MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

Factors Associated with Asthma Management in Massachusetts

CONTENTS

INTRODUCTION

Asthma is a chronic disease that affects the lungs and is marked by chronic inflammation of 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 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.

Although there is no cure, asthma exacerbations and deaths are preventable.

People with asthma can control their disease and live healthy active lives. The Expert Panel Report 3 (EPR-3) was developed as a guideline for asthma diagnosis and management, based on the most current asthma knowledge and research. EPR-3 is centered on four components that have been found to be essential to effective asthma management: measures of assessment and monitoring; education for a partnership in asthma care; control of environmental factors and comorbid conditions that affect asthma; and pharmacologic therapy.[1] Regardless of severity, asthma should be well controlled. The goal of effective asthma management in adults and children is to increase their quality of life and allow them to function with minimal restrictions. (https://www.nhlbi.nih.gov/resources/expert-panel-report-3-epr-3-guidelines-diagnosis-and)

This report presents self-report data from the Asthma Call-back Survey (ACBS) on a variety of factors associated with management and classifications for asthma control among adults and children in Massachusetts reporting current asthma in the Behavioral Risk Factor Surveillance System (BRFSS). While the focus herein is on asthma management and control, a companion report describing asthma prevalence in Massachusetts is available on mass.gov. (https://www.mass.gov/asthma-prevention-and-control). This report presented data for adults and children respectively due to the fact that CDC conducted ACBS for adults and children separately. Moreover, risk factors may vary by age.

DATA SOURCES

The BRFSS is a state-based system of health surveys established by the Centers for Disease Control and Prevention (CDC) in 1984.

It is a continuous multimode telephone survey of adults ages 18 years and older residing in a private residence or college housing and is conducted in all states as a collaboration between the federal CDC and state departments of health. The landline telephone portion of the survey has been conducted in Massachusetts since 1986; a cell phone component was added in 2011. The BRFSS collects data on a variety of health risk factors, preventive behaviors, chronic conditions, and emerging public health issues. Additional information about the Massachusetts BRFSS methods can be found at the end of this report and at https://www.mass.gov/behavioral-risk-factor-surveillance.

The Massachusetts Department of Public Health collects information regarding asthma management through a follow-up survey to the BRFSS, called the Asthma Call-back Survey (ACBS).

Topics include: History of asthma symptoms, health care utilization, asthma education, modifications to the environment, medications, cost of care, school, daycare, co-morbid conditions, and complementary and alternative therapy. 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: https://www.cdc.gov/asthma/brfss/default.htm#2010.

The limited sample size of the ACBS for adults and children is due to low response rate to BRFSS or ACBS, especially, restricted the subgroup analysis in this section. Data for multiple years (2011–2014 data for adult ACBS and 2006–2010 data for child ACBS) were combined to derive more stable estimates.

TABLE 1. *Adult* Asthma Call-Back Survey Massachusetts Sample Size/ Response Rates and U.S. Medians, 2011–2014

	MASSACHUSETTS		UNITED STATES
YEAR	SAMPLE SIZE	RESPONSE RATE (%)	MEDIAN RESPONSE RATE (%)
2011	317	50.64	66.75
2012	275	47.99	62.92
2013	186	47.45	60.10
2014	189	42.19	61.23

Data Source: *2011–2014 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 Child Asthma Call-back Survey*
https://www.cdc.gov/asthma/acbs.htm

FACTORS ASSOCIATED WITH ASTHMA MANAGEMENT IN ADULTS

This section presents data on adults who currently have asthma and self-reported asthma symptoms, healthcare utilization, medication, and environmental triggers at home. Asthma control among adults was assessed based on the NHLBI Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma by considering daily asthma symptoms, nighttime awakenings due to asthma, frequency of use of "rescue" medications, lung function, interference with normal activity and exacerbations requiring oral corticosteroids.

The ultimate goal of asthma management is for individuals to have "Well Controlled"* asthma. Among adults with current asthma:

36% were classified as having "Well Controlled" asthma

64% were classified as having either "Not Well Controlled" or "Very Poorly Controlled" asthma

** See appendix on page 42*

Measures of Asthma Management

FIGURE 1. Level of Asthma Control among Massachusetts Adults with Current Asthma, 2011–2014

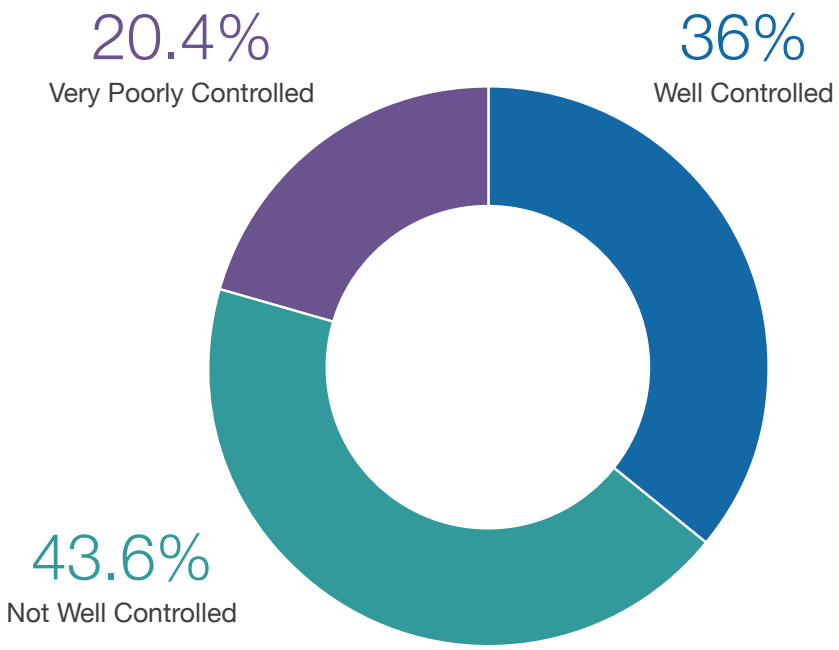

TABLE. Level of Asthma Control among Massachusetts Adults with Current Asthma, 2011–2014

LEVEL OF ASTHMA CONTROL	N[1]	%[2]	95% CI[3]
Well Controlled		36.0	28.3 – 45.5
Not Well Controlled		43.6	34.7 – 50.2
Very Poorly Controlled		20.4	13.6 – 27.7
TOTAL	677		

[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: *2011–2014 MA BRFSS Adult Asthma Call-back Survey*

TABLE 3. Demographic and Socioeconomic Factors of Massachusetts Adults with Current Asthma by Level of Control, 2011–2014

		WELL CONTROLLED		NOT WELL CONTROLLED		VERY POORLY CONTROLLED	
	N[1]	%[2]	95% CI[3]	%[2]	95% CI[3]	%[2]	95% CI[3]
Sex	677						
Male		41.6	28.8 – 54.5	43.9	31.0 – 56.7	14.5	6.8 – 22.1
Female		33.5	22.7 – 44.3	43.4	33.9 – 52.5	23.1	14.4 – 31.8
Race/Ethnicity	677						
White, Non-Hispanic		38.0	28.4 – 47.5	42.1	33.5 – 50.8	19.9	12.0 – 27.8
All Other		34.2	14.4 – 54.0	37.3	19.7 – 54.8	28.5	13.4 – 43.7
Age Group	676						
18–34		47.0	26.9 – 67.1	36.4	19.0 – 53.7	16.6*	1.7 – 31.5
35–64		32.1	24.5 – 39.6	45.9	37.6 – 54.3	22.0	14.4 – 29.6
65+		25.4	16.6 – 34.2	51.2	40.1 – 62.3	23.4	13.9 – 32.9
Income	594						
< $25,000		27.5	7.1 – 48.0	42.4	26.2 – 58.6	**30.1**	**15.4 – 44.7**
$25–75,000		34.4	23.5 – 45.4	45.2	33.5 – 56.9	20.4	9.8 – 31.0
$75,000+		52.1	39.4 – 64.8	39.7	27.3 – 52.1	8.2	2.6 – 13.9
Education	675						
Less than high school		—**	NA	61.6	40.5 – 82.6	28.5	9.4 – 47.6
High school		25.3	11.2 – 39.3	33.5	18.8 – 48.2	**41.2**	**22.6 – 59.9**
At least some college		44.1	33.9 – 54.2	43.8	34.5 – 53.0	12.2	7.5 – 16.9
Smoking Status	673						
Current smoker		23.2*	7.4 – 39.0	40.8	23.4 – 58.2	36.1	18.7 – 53.4
Former smoker		24.9	15.3 – 34.6	49.4	35.8 – 63.1	25.6	11.3 – 39.5
Never smoker		44.0	32.3 – 55.7	42.3	31.8 – 52.8	13.7	6.2 – 21.1
Cost as a Barrier to Care[4]	677						
Cost is a barrier to care		—**	NA	46.9	19.5 – 74.4	21.6*	6.2 – 37.1
Cost is not a barrier to care		36.9	29.1 – 44.7	43.0	35.2 – 50.7	20.2	13.0 – 27.3

[1] N is the number of respondents who had current asthma that answered the corresponding question(s).

[2] Percent is weighted to population characteristics by sex, age, race/ethnicity, marital status, education, and owner/renter status.

[3] 95% confidence interval.

[4] "Yes" to any of the following: a.) "Was there a time in the past 12 months when you needed to see your primary care doctor for your asthma but could not because of the cost?", b.)"Was there a time in the past 12 months when you were referred to a specialist for asthma but could not go because of the cost?", or c.)"Was there time in the past 12 months when you needed to buy medication for your asthma but could not because of the cost?"

** Relative Standard Error is > 30%. Results should be interpreted with caution due to instability of the estimate.*

*** Sample size is too small, cannot be reported.*

***Notes:** Percentages do not add up to 100% due to rounding. Bolded percents mean statistically significant.*

***Data Source:** 2011–2014 MA BRFSS Adult Asthma Call-back Survey*

Levels of Asthma Control

Among adults with current asthma:

females were more likely to be classified as “Not Well Controlled” or “Very Poorly Controlled,” but the difference was not statistically significant

as age increased, the likelihood of being classified as “Not Well Controlled” or “Very Poorly Controlled” increased, but the increase was not statistically significant

those in the ‘all other’ race/ethnicity category were more likely to be classified as “Not Well Controlled” or “Very Poorly Controlled,” compared to White, non-Hispanics. However, the difference was not statistically significant because of insufficient sample size

those experiencing cost barriers to asthma care in the last year were more likely to have “Very Poorly Controlled” asthma than individuals who did not report experiencing these same cost barriers. However, the difference was not statistically significant

TABLE 4. Measures of Impairment among Massachusetts Adults with Current Asthma, 2011–2014

MEASURES OF IMPAIRMENT	N[1]	%[2]	95% CI[3]
Had symptoms of asthma, past 30 days[4]	703		
0 days		34.1	26.1 – 42.2
1–8 days		28.2	21.6 – 34.8
9–29 days		24.5	17.5 – 31.5
30 days		13.2	9.2 – 17.2
Sleep disrupted by asthma, past 30 days[5]	705		
0 days		72.3	65.1 – 79.0
1–2 days		8.5	4.4 – 12.5
3–12 days		10.6	6.3 – 14.9
13–30 days		8.6	4.2 – 13.1
Completely symptom-free, past 2 weeks[6]	695		
0 days		22.5	16.3 – 28.6
1–10 days		25.6	19.0 – 32.3
11–14 days		51.9	43.9 – 59.9
Asthma attack or episode, past 12 months[7]	12		
Yes		46.7	38.8 – 54.6
Limited usual activities due to asthma, past 12 months[8]	234		
Not at all		32.7	20.6 – 44.7
A little		44.9	32.0 – 57.8
A moderate amount or A lot		22.4	10.0 – 34.8
Unable to work or carry out usual activities due to asthma, past 12 months[9]	692		
0 days		68.4	60.5 – 76.4
1–10 days		23.6	16.1 – 31.1
≥11 days		8.0	3.4 – 12.6
Had emergency department visits or other urgent care for asthma, past 12 months[10]	718		
None		88.4	84.1 – 92.7
1 Visit		5.7	3.1 – 8.3
2+ Visits		5.9	2.4 – 9.4
Overnight hospital stay, past 12 months[11]	719		
Yes		4.9	1.6 – 8.1

[1] N is the number of respondents who had current asthma that answered the corresponding question(s).

[2] Percent is weighted to population characteristics by sex, age, race/ethnicity, marital status, education, and owner/renter status.

[3] 95% confidence interval.

[4] "During the past 30 days, on how many days did you have symptoms of asthma?"

[5] "During the past 30 days, on how many days did symptoms of asthma make it difficult to stay asleep?"

[6] "During the past 14 days, on how many days were you completely symptom-free that is no coughing, wheezing or other symptoms of asthma?"

[7] "During the past 12 months, have you had an episode or an asthma attack?"

[8] "During the past 12 months, would you say you limited your usual activities due to asthma not at all, a little, a moderate amount, or a lot?"

[9] "During the past 12 months, how many days were you unable to work or carry out your usual activities because of your asthma?"

[10] "During the past 12 months, how many times did you visit an emergency room or urgent care center because of your asthma?"

[11] "During the past 12 months, that is since [one year ago today], have you had to stay overnight in a hospital because of your asthma? Do not include an overnight stay in the emergency room."

Data Source: *2011–2014 MA BRFSS Adult Asthma Call-back Survey*

Measures of Asthma Impairment

Among adults with current asthma, 2011-2014:

65.9% experienced symptoms at least one day in the past 30 days

67.3% reported having some limitations in their usual activities

23.6% could not work 1–10 days due to asthma, while 8.0% could not work ≥11 days

22.5% experienced symptoms every day over the last two weeks

44.9% reported “a little” to “a moderate amount” of limitations in activities

the average number of days of work lost due to asthma is 7 days annually

nearly half had an asthma attack or episode in the last year

31.6% could not work or carryout usual activities on at least one day in the past year due to asthma

11.6% visited the ER or urgent care during the past 12 months due to asthma

27.7% reported difficulty sleeping at least one night in the past 30 days

4.9% stayed overnight at the hospital during the past 12 months due to asthma

FIGURE 2. Asthma Self-Management Education among Massachusetts Adults with Current Asthma, 2011–2014

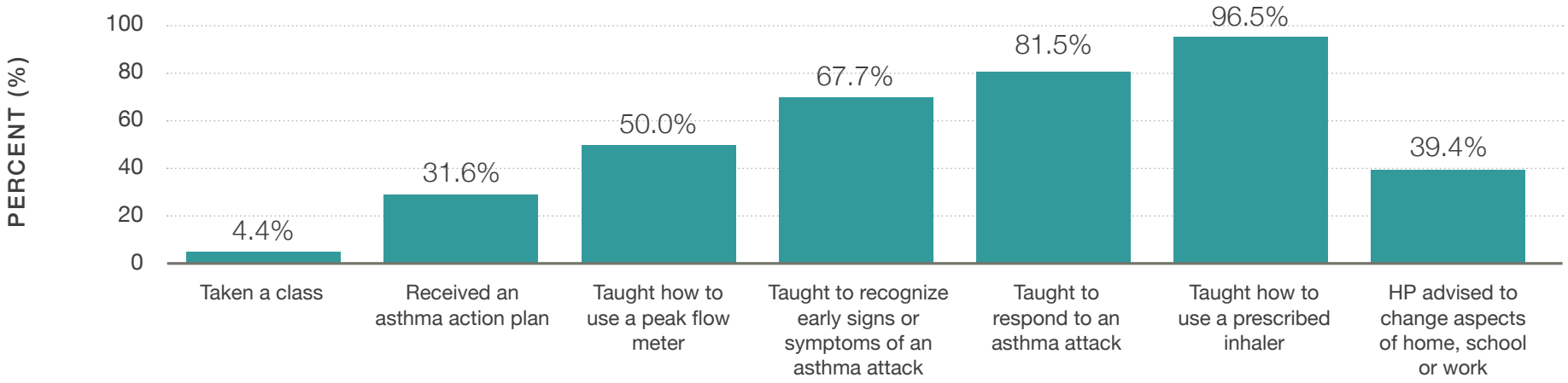

TABLE. Asthma Self-Management Education among Massachusetts Adults with Current Asthma, 2011–2014

SELF-MANAGEMENT EDUCATION	N[1]	%[2]	95% CI[3]
Taken a class on asthma management[4]	722	4.4	2.5 – 6.4
Received an asthma action plan[5]	722	31.6	23.6 – 39.7
Taught how to use a peak flow meter[6]	722	50.0	42.2 – 58.7
Taught to recognize early signs or symptoms of an asthma attack[7]	722	67.7	60.7 – 74.7
Taught to respond to an asthma attack[8]	722	81.5	76.7 – 86.2
Taught how to use a prescribed inhaler[9]	692	96.5	94.5 – 98.5
Health professional advised to change aspects of home, school or work[10]	719	39.4	31.9 – 46.8

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

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

[3] *95% Confidence Interval.*

[4] *"Have you ever taken a course or class on how to manage your asthma?"*

[5] *"Has a doctor or other health professional ever given you an asthma action plan?"*

[6] *"Has a doctor or other health professional ever taught you how to use a peak flow meter to adjust your daily medications?"*

[7] *"Has a doctor or other health professional ever taught you how to recognize early signs or symptoms of an asthma episode?"*

[8] *"Has a doctor or other health professional ever taught you what to do during an asthma episode or attack?"*

[9] *"Did a doctor or other health professional show you how to use the inhaler?"*

[10] *"Has a health professional ever advised you to change things in your home, school, or work to improve your asthma?"*

Note: *Percentage of items should not add up to 100% because they were all independent questions*

Data Source: *2011–2014 MA BRFSS Adult Asthma Call-back Survey*

Asthma Self-Management Education

Among adults with current asthma:

31.6% had ever received an asthma action plan

50.0% had been taught how to use a peak flow meter to adjust daily medications

67.7% had been taught how to detect early signs and symptoms of an asthma episode

81.5% had been taught how to respond to an asthma episode

96.5% had been taught by a health care professional to use an inhaler

Preventative Health Care Utilization

Infrequent use of routine health care services is a risk factor in asthma exacerbations. Health care utilization in adults with current asthma is measured by the frequency of routine checkups for asthma and whether the individual has received a flu shot in the past year.

Routine visits with a health care professional about a person's asthma provide a platform for open and unrestricted communication between the clinician, the patient and, when appropriate, the patient's family. Through routine checkups, clinicians are able to better assess a number of factors, such as the patient's attitude toward the management regimen, adherence to medications, and any overall concerns.

Flu vaccinations are recommended for everyone over 6 months of age, but the CDC also highly recommends them for certain subsets of the population, including people with asthma, and older adults. Although asthma does not increase one's risk of contracting influenza, the flu can be more severe in this subset of people, regardless of their level of asthma control.[2]

TABLE 5. Preventative Healthcare Utilization among Massachusetts Adults with Current Asthma, 2011–2014

PREVENTATIVE HEALTHCARE UTILIZATION	N[1]	%[2]	95% CI[3]
Had routine checkup for asthma, past 12 months[4]	708		
None		39.7	32.0 – 47.4
1 Visit		24.7	18.7 – 30.8
2+ Visits		35.5	27.7 – 43.4
Received flu vaccine, past 12 months[5]			
18–64 Years of Age	317	55.6	45.6 – 65.5
65+ Years of Age	123	67.7	55.5 – 79.9

[1] N is the number of respondents who had current asthma that answered the corresponding question(s).

[2] Percent is weighted to population characteristics by sex, age, race/ethnicity, marital status, education, and owner/renter status.

[3] 95% confidence interval.

[4] "During the past 12 months how many times did you see a doctor or health professional for a routine checkup for your asthma?"

[5] "Yes" to "During the past 12 months, have you had a flu shot?" or "During the past 12 months, have you had a flu vaccine that was sprayed in your nose?"

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

***Data Source:** 2011–2014 MA BRFSS Adult Asthma Call-back Survey*

Preventative Healthcare Utilization

Among adults with current asthma:

60.3% reported one or more checkups with their health care provider annually

12.1% more adults age 65+ received a flu vaccination than younger adults

67.7% of adults aged 65 years and older reported receiving a flu vaccination within the past 12 months, while 55.6% of younger adults did. The prevalence were higher than general population (57.8% and 42.1%, respectively).

Medication Use

There are two major classes of asthma medications: long-term control medications and quick-relief medications.

Long-term control medications, or simply “control medications,” are used to achieve and maintain control of persistent asthma. Examples include corticosteroids, long-acting beta2-agonists and leukotriene modifiers. Quick-relief medications, also known as “rescue medications,” are used to treat acute symptoms and episodes of marked increases in asthma symptoms, and reduction in lung function or asthma exacerbations. Examples include short-acting beta2-agonists and anticholinergics. Figures below depict the proportions of adults with current asthma using either control or rescue medications.

FIGURE 3. Medication Use in the Past 3 Months among Massachusetts Adults with Current Asthma, 2011–2014

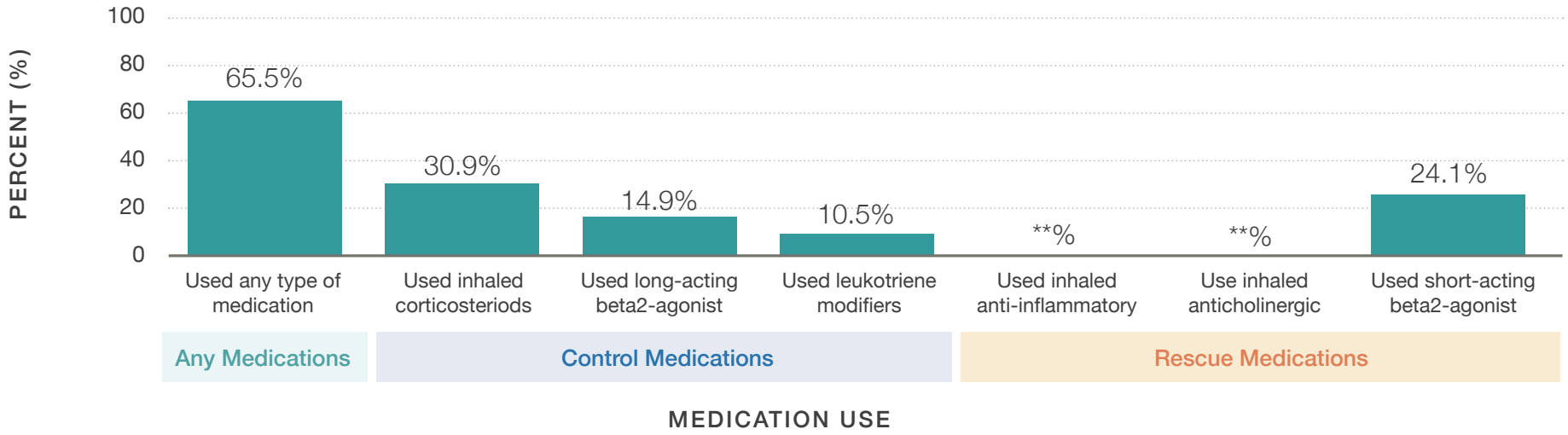

TABLE. Medication Use in the Past 3 Months among Massachusetts Adults with Current Asthma, 2011–2014

TYPE OF MEDICATION USED IN PAST 3 MONTHS	N[1]	%[2]	95% CI[3]
Used any prescription asthma medication[4]	722	65.5	57.0 – 74.0
Control Medications			
Used inhaled corticosteroid[5]	722	30.9	24.4 – 37.3
Used inhaled long-acting beta2-agonist[6]	722	14.9	10.0 – 19.8
Used leukotriene modifier[7]	722	10.5	6.1 – 14.9
Rescue Medications			
Used inhaled anti-inflammatory[8]	722	—**	NA
Used inhaled anticholinergic[9]	722	—**	NA
Used inhaled short-acting beta2-agonist[10]	722	24.1	18.3 – 29.9

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

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

[3] *95% Confidence Interval.*

[4] *"Yes" to "In the past 3 months, _____" to any of the following: Have you taken prescription asthma medicine using an inhaler?"; Have you taken prescription asthma medication in pill form?"; Have you taken prescription asthma medication in syrup form?"; Were any of your asthma medicines used with a nebulizer?"*

[5] *"One or more" inhaled corticosteroid in the past three months*

[6] *"One or more" inhaled long-acting beta2-agonists in the past three months*

[7] *"One or more" leukotriene modifier in the past three months*

[8] *"One or more" inhaled anti-inflammatory in the past three months*

[9] *"One or more" inhaled anticholinergic in the past three months*

[10] *"One or more" inhaled short-acting beta2-agonists in the past three months*

** *Sample size is too small, cannot be reported.*

Data Source: *2011-2014 MA BRFSS Adult Asthma Call-back Survey*

Asthma Medication Use in the Past 3 Months

Among adults with current asthma:

65.5% reported using a prescription asthma medication

30.9% reported using an inhaled corticosteriod

14.9% reported using an inhaled long-acting beta2-agonist

10.5% reported using a leukotriene modifier (a control medication)

24.1% reported using short acting beta2-agonist

FIGURE 4. Comorbidities among Massachusetts Adults with Current Asthma, 2011–2014

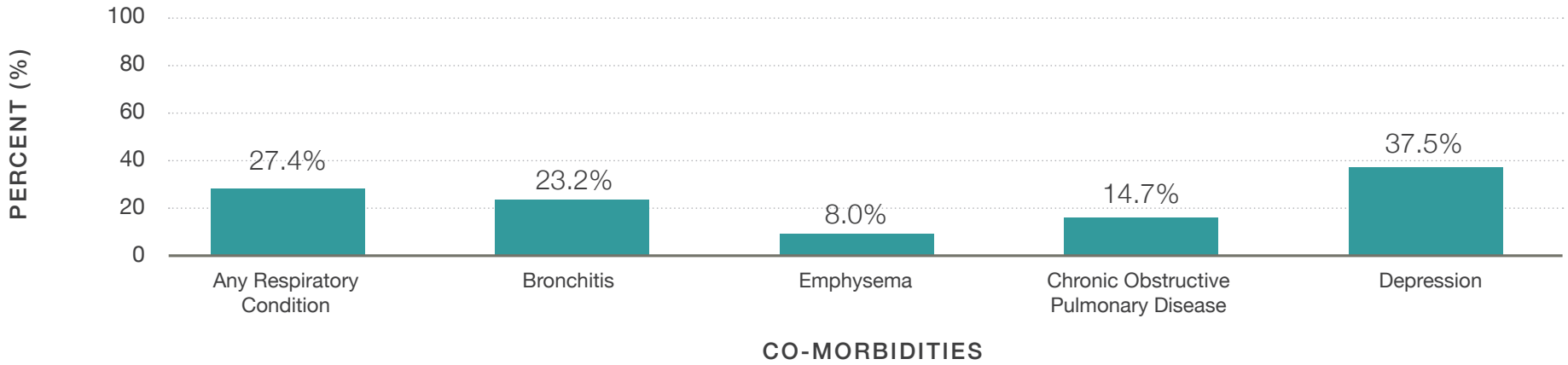

TABLE. Comorbidities among Massachusetts Adults with Current Asthma, 2011-2014

CO-MORBIDITY	N[1]	%[2]	95% CI[3]
Any Respiratory Disorder[7]	722	27.4	21.5 – 33.4
Chronic Bronchitis[4]	715	23.2	17.6 – 28.9
Emphysema[5]	715	8.0	4.7 – 11.3
Chronic Obstructive Pulmonary Disease (COPD)[6]	711	14.7	10.6 – 18.9
Depression[8]	717	37.5	30.0 – 45.0

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

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

[3] *95% Confidence Interval.*

[4] *"Yes" to "Have you been told by a doctor or health professional that you have chronic bronchitis?"*

[5] *"Yes" to "Have you been told by a doctor or health professional that you have emphysema?"*

[6] *"Yes" to "Have you been told by a doctor or health professional that you have chronic obstructive pulmonary disease also known as COPD?"*

[7] *"Yes" to any of the following: 1) "Have you ever been told by a doctor or health professional that you have chronic obstructive pulmonary disease also known as COPD?", 2)"Have you ever been told by a doctor or health professional that you have emphysema?", or 3) Have you ever been told by a doctor or health professional that you have chronic bronchitis?"*

[8] *"Yes" to "Have you ever been told by a doctor or health professional that you were depressed?"*

Data Source: *2011–2014 MA BRFSS Adult Asthma Call-back Survey*

Comorbidities

Among adults with current asthma:

27.4%

reported being told by a health professional that they also had another respiratory disorder (chronic bronchitis, emphysema, or COPD).

37.5%

received a diagnosis of depression from a health care professional with depression being the most prevalent comorbidity

Environmental Triggers in Homes

Asthma triggers are allergens or irritants that can cause asthma or make one's asthma symptoms, episodes, or asthma attacks worse.

Reducing exposure to known asthma triggers is imperative for effective asthma control. Common asthma triggers include any chemical, pollutant, smoke, pets, pests, mold, and dust mites.

Methods for reducing asthma trigger exposure include: preventing exposure to tobacco smoke indoors, using mattress and pillow covers, and washing sheets and bed covers in hot water to reduce exposure to dust mite.

FIGURE 5. Environmental Asthma Triggers in Homes of Massachusetts Adults with Current Asthma, 2011–2014

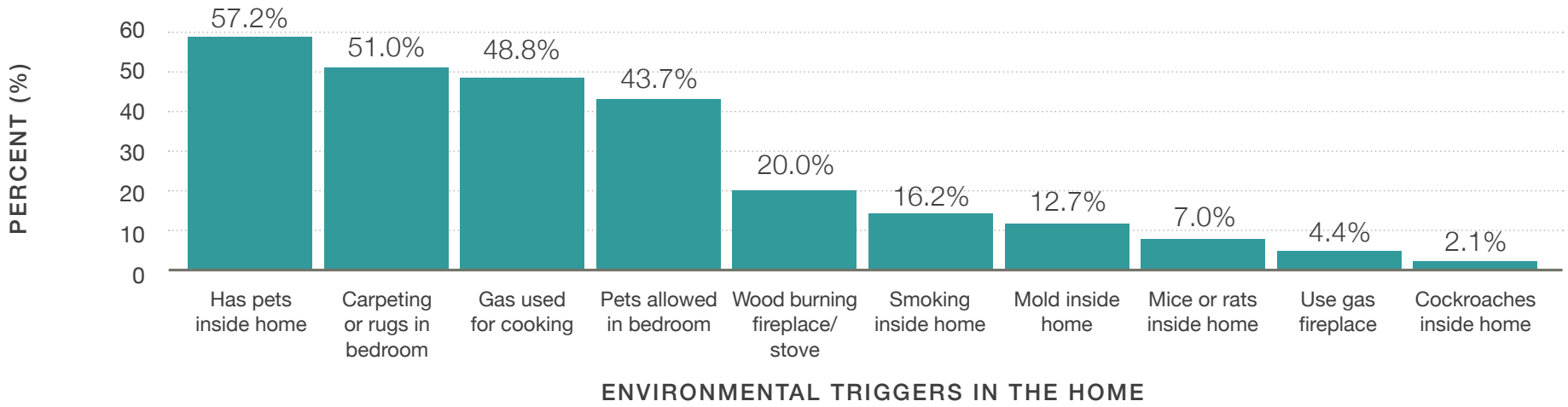

TABLE. Environmental Asthma Triggers in the Homes of Massachusetts Adults with Current Asthma, 2011-2014

ENVIRONMENTAL TRIGGERS IN THE HOME	N[1]	%[2]	95% CI[3]
Has pets inside home[4]	722	57.2	49.5 – 65.0
Carpeting or rugs in bedroom[5]	721	51.0	43.3 – 58.8
Gas used for cooking[6]	721	48.8	41.1 – 56.6
Pets allowed in bedroom[7]	722	43.7	36.1 – 51.3
Wood burning fireplace/stove[8]	722	20.0	13.4 – 26.6
Smoking inside the home, past week[9]	722	16.2	11.1 – 21.3
Mold inside the home, past 30 days[10]	722	12.7	8.2 – 17.3
Mice or rats inside the home, past 30 days[11]	722	7.0	4.1 – 9.8
Gas fireplace or unvented gas stove[12]	719	4.4	2.3 – 6.4
Cockroaches inside the home, past 30 days[13]	721	2.1*	0.3 – 3.9

[1] N is the number of respondents who had current asthma that answered the corresponding question(s).

[2] Percent is weighted to population characteristics by sex, age, race/ethnicity, marital status, education, and owner/renter status.

[3] 95% Confidence Interval.

[4] "Yes" to Does your household have pets such as dogs, cats, hamsters, birds or other feathered or furry pets that spend time indoors?

[5] "Yes" to "Do you have carpeting or rugs in your bedroom?"

[6] "Yes" to "Is gas used for cooking?"

[7] "Yes" to " Are pets allowed in your bedroom?"

[8] "Yes" to "Is a wood burning fireplace or wood burning stove used in your home?"

[9] "Yes" to "In the past week, has anyone smoked inside your home?"

[10] "Yes" to "In the past 30 days, has anyone seen or smelled mold or a musty odor inside your home?"

[11] "Yes" to "In the past 30 days, has anyone seen mice or rats inside your home?"

[12] "Yes" to "Are unvented gas logs, unvented gas fireplaces, or unvented gas stoves used in your home?"

[13] "Yes" to "In the past 30 days, has anyone seen a cockroach inside your home?"

** Relative Standard Error is > 30%. Results should be interpreted with caution due to instability of the estimate.*

***Data Source:** 2011–2014 MA BRFSS Adult Asthma Call-back Survey*

Environmental Triggers

Among adults with current asthma:

The most commonly reported environmental exposures in the home were

57.2% pets and

51.0% carpets/rugs in the bedroom

Less commonly reported were

4.4% gas fireplaces

7.0% rodent exposure

FIGURE 6. Home Modifications among Massachusetts Adults with Current Asthma, 2011–2014

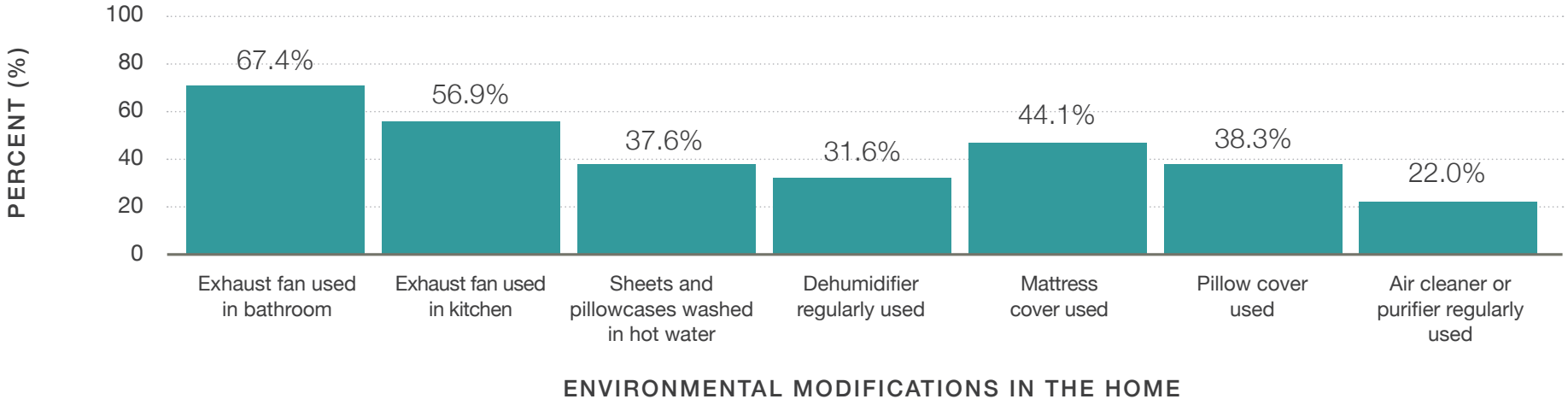

TABLE. Home Modifications among Massachusetts Adults with Current Asthma, 2011-2014

MODIFICATIONS	N[1]	%[2]	95% CI[3]
Exhaust fan used in bathroom[4]	713	67.4	60.5 – 74.4
Exhaust fan regularly used in kitchen[5]	712	56.9	49.3 – 64.6
Sheets and pillowcases washed in hot water[6]	703	37.6	30.5 – 47.7
Mattress cover used[7]	701	44.1	36.5 – 51.8
Dehumidifier regularly used[8]	721	31.6	25.0 – 38.2
Pillow cover used[9]	712	38.3	30.7 – 45.8
Air cleaner or purifier regularly used[10]	716	22.0	16.1 – 27.9

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

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

[3] *95% Confidence Interval.*

[4] *"Yes" to "In your bathroom, do you regularly use an exhaust fan that vents to the outside?"*

[5] *"Yes" to "Is an exhaust fan that vents to the outside used regularly when cooking in your kitchen?"*

[6] *"Hot" to "Are your sheets and pillowcases washed in cold, warm or hot water?"*

[7] *"Yes" to "Do you use a mattress cover that is made especially for controlling dust mites?"*

[8] *"Yes" to "Is a dehumidifier regularly used to reduce moisture inside your home?"*

[9] *"Yes" to "Do you use a pillow cover that is made especially for controlling dust mites?"*

[10] *"Yes" to "Is an air cleaner or purifier regularly used inside your home?"*

Data Source: *2011–2014 MA BRFSS Adult Asthma Call-back Survey*

Environmental Modifications

Among adults with current asthma:

The most commonly reported environmental modifications in the home used were:

67.4% bath exhaust fan

56.9% kitchen exhaust fan

Less commonly reported modification used was:

22.0% air cleaners/purifiers

FACTORS ASSOCIATED WITH ASTHMA MANAGEMENT IN CHILDREN

This section presents the data on a variety of factors of associated with asthma management and classification for asthma control among children with current asthma. The limited sample sizes for children restricted the subgroup analysis and therefore the analyses among children are not as extensive as those among adults.

Among children with current asthma:

33.8% were classified as having "Well Controlled" asthma

18.2% were classified as having "Very Poorly Controlled" asthma

48.0% were classified as having "Not Well Controlled" asthma

General Asthma Management

FIGURE 7. Level of Control among Massachusetts Children with Current Asthma, 2006–2010

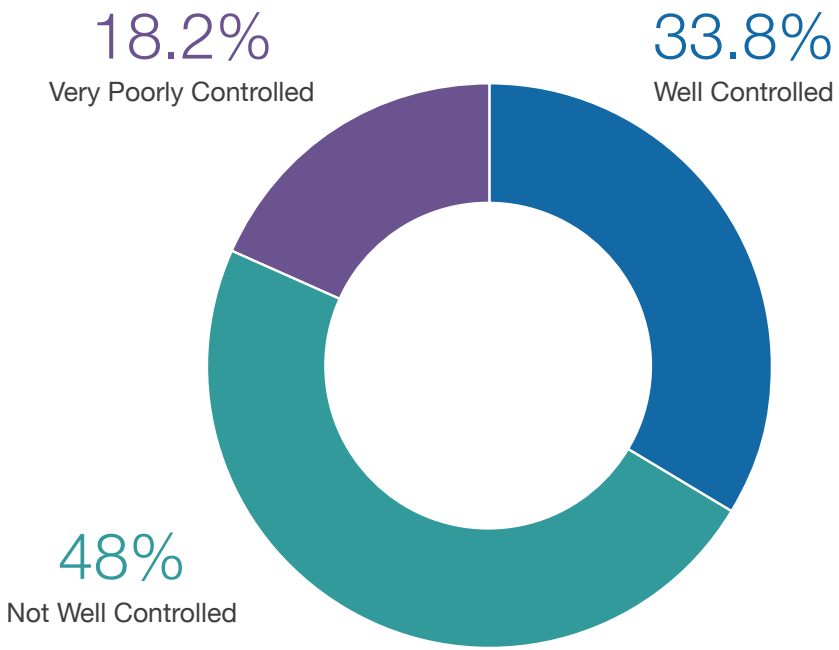

TABLE. Level of Control among Massachusetts Children with Current Asthma, 2006-2010

LEVEL OF ASTHMA CONTROL	N[1]	%[2]	95% CI[3]
Well Controlled		33.8	24.8 – 42.8
Not Well Controlled		48.0	38.8 – 57.2
Very Poorly Controlled		18.2	10.9 – 25.5
TOTAL	254		

[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*

Note: *Due to small sample size in the pediatric population, a table displaying demographic and socioeconomic factors of Massachusetts children with current asthma by level of control could not be produced.*

TABLE 6. Measures of Impairment among Massachusetts Children with Current Asthma, 2006–2010

MEASURES OF IMPAIRMENT	N[1]	%[2]	95% CI[3]
Had symptoms of asthma, past 30 days[4]			
1+ Days	268	45.0	36.2 – 53.9
Nighttime awakenings, past 2 weeks[5]	270		
0–10 days		29.3	21.1 – 37.5
11–14 days		70.7	62.5 – 78.9
Symptom-free days, past 2 weeks[6]	273		
0–10 days		29.3	21.1 – 37.5
11–14 days		70.7	62.5 – 78.9
Asthma attack or episode, past 12 months[7]	273	52.3	43.4 – 61.2
Limited activity, past 12 months[8]	272		
Not at all		44.8	35.9 – 53.7
A little		39.2	30.6 – 47.8
A moderate amount or A lot		16.0	9.2 – 22.8
Missed school or daycare due to asthma, past 12 months[9]	247	41.1	32.2 – 50.0
Had emergency department visits or other urgent care for asthma, past 12 months[10]	274	18.5	11.3 – 25.6
Overnight hospital stay, past 12 months[11]	276	6.5*	1.2 – 11.7

[1] N is the number of respondents who had current asthma that answered the corresponding question(s).

[2] Percent is weighted to population characteristics by sex, age, race/ethnicity, marital status, education, and owner/renter status.

[3] 95% confidence interval.

[4] "During the past 30 days, how many days did [child] have symptoms of asthma?"

[5] "During the past 30 days, how many days did asthma make it difficult for [child] to sleep?"

[6] "During the past 2 weeks, how many days was [child] completely symptom free, that is no coughing, wheezing, or other symptoms of asthma?"

[7] "During the past 12 months, how many times did [child] have an episode of asthma or an asthma attack?"

[8] "During the past 12 months, would you say [child] limited [his/her] usual activities due to asthma not at all, a little, a moderate amount, or a lot?"

[9] "During the past 12 months, about how many days or school did [child] miss because of his/her asthma?" or "During the past 12 months, about how many days of daycare did [child] miss because of his/her asthma?"

[10] "During the past 12 months, has [child] had to visit an emergency room or urgent care center because of his/her asthma?" and "During the past 12 months how many times did [child] visit an emergency room or urgent care center because of his/her asthma?"

[11] "During the past 12 months, has [child] had to stay overnight in a hospital because of his/her asthma?" and "During the past 12 months how many different times did [child] stay overnight in a hospital because of his/her asthma?"

***Note:** Subcategories were selected to correspond to the EPR-3 Guidelines when possible. Subcategories were collapsed to derive more stable estimates when possible.*

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

Measures of Asthma Impairment

Among children with current asthma, from 2006-2010:

45.0% experienced symptoms of asthma at least once within the past 30 days

41.1% missed school or daycare in the past 12 months due to asthma (for an average of approximately 2.1 days)

70.7% were completely symptom-free for more than 10 days in the last two weeks

18.5% visited the emergency room or urgent care centers in the past year due to their asthma

52.3% reported having at least one asthma attack in the last 12 months

TABLE 7. Asthma Self-Management Education among Massachusetts Children or Caretakers with Current Asthma, 2006–2010

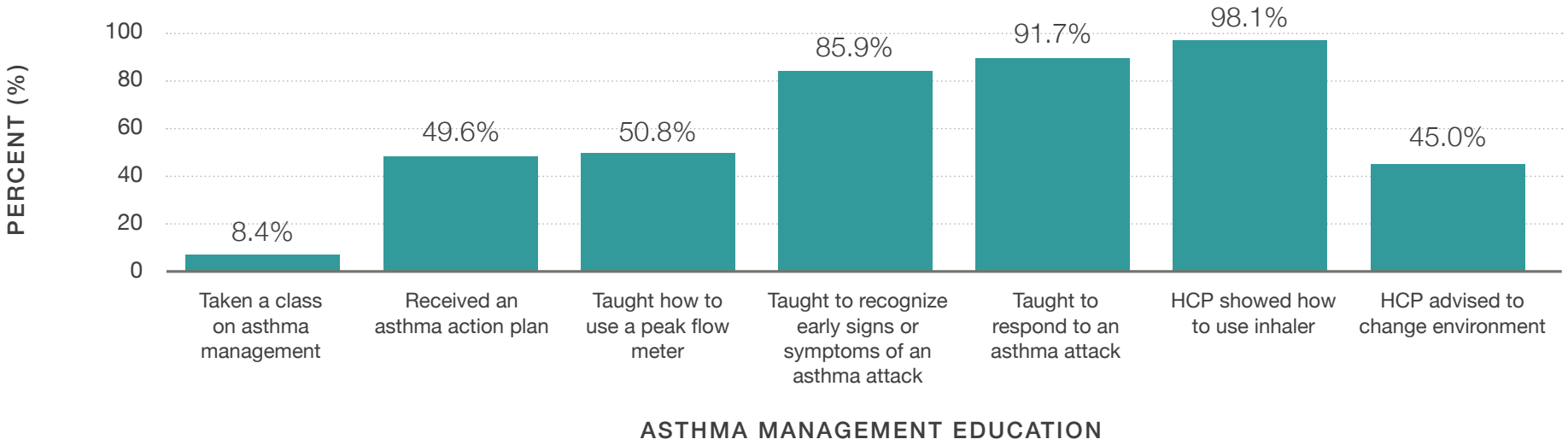

TABLE. Asthma Self-Management Education among Massachusetts Children or Caretakers with Current Asthma, 2006-2010

SELF-MANAGEMENT EDUCATION	N[1]	%[2]	95% CI[3]
Taken a class on asthma management	275	8.4	4.6 – 12.1
Received an asthma action plan[5]	269	49.6	40.7 – 58.4
Taught how to use a peak flow meter[6]	272	50.8	41.8 – 59.7
Taught to recognize early signs or symptoms of an asthma attack[7]	275	85.9	79.3 – 92.5
Taught to respond to an asthma attack[8]	274	91.7	87.7 – 95.8
HCP showed how to use inhaler[9]	242	98.1	95.9 – 100.0
HCP advised to change environment (such as aspects of home, school or work)[10]	272	45.0	36.1 – 53.8

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

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

[3] *95% Confidence Interval.*

[4] *"Have you [or child] ever taken a course or class on how to manage your asthma?"*

[5] *"Has a doctor or other health professional ever given you [or child] an asthma action plan?"*

[6] *"Has a doctor or other health professional ever taught you [or child] how to use a peak flow meter to adjust your daily medications?"*

[7] *"Has a doctor or other health professional ever taught you [or child] how to recognize early signs or symptoms of an asthma episode?"*

[8] *"Has a doctor or other health professional ever taught you [or child] what to do during an asthma attack or episode?"*

[9] *"Did a doctor or other health professional show [child] how to use the inhaler?" or "Did a doctor or health professional watch [child] use the inhaler?"*

[10] *"Has a health professional ever advised you to change things in [child's] home, school, or work to improve his/her asthma?"*

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

Asthma Self-Management Education

Among children with current asthma:

The five-year average annual percentage of asthma self-management education varied by educational components.

85.9+%

A majority of children or caretakers were taught to recognize early signs and symptoms of an asthma episode, taught what to do during an asthma attack and shown how to use an inhaler (85.9%, 91.7%, and 98.1% respectively).

8.4%

Approximately 8.4% of children or caretakers with current asthma had taken a class on how to manage their asthma; the least commonly reported method of self-management education.

Preventative Health Care Utilization

Lack use of routine health care services is a risk factor in asthma exacerbations and flu vaccinations are recommended for all patients over 6 months of age.

Among children with current asthma:

79.3% reported having routine visits with their health provider in the past 12 months

61.9% have received a flu vaccination in the past 12 months

TABLE 8. Preventative Healthcare Utilization among Massachusetts Children with Current Asthma, 2006–2010

PREVENTATIVE HEALTHCARE UTILIZATION	N[1]	%[2]	95% CI[3]
Had routine checkup for asthma, past 12 months[4]	271	79.3	72.8 – 85.9
Received flu vaccine, past 12 months[5]	275	61.9	53.1 – 70.6

[1] N is the number of respondents who had current asthma that answered the corresponding question(s).

[2] Percent is weighted to population characteristics by sex, age, race/ethnicity, marital status, education, and owner/renter status.

[3] 95% confidence interval.

[4] "During the past 12 months how many times did [child] see a doctor or health professional for a routine checkup for your asthma?"

[5] "During the past 12 months, has [child] had a flu shot?" or "During the past 12 months, has [child] had a flu vaccine that was sprayed in his/her nose?"

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

Medication Use

The use of a spacer or holding chamber with an inhaler can decrease oral bioavilability and thus enhance safety and efficacy for children.

66.3%

of children with current asthma that used an inhaled prescription asthma medication used a spacer in the past 3 months

68.8%

of children with current asthma used any prescription medication in the past 3 months

TABLE 9. Medication Use in the Past 3 Months among Massachusetts Children with Current Asthma, 2006–2010

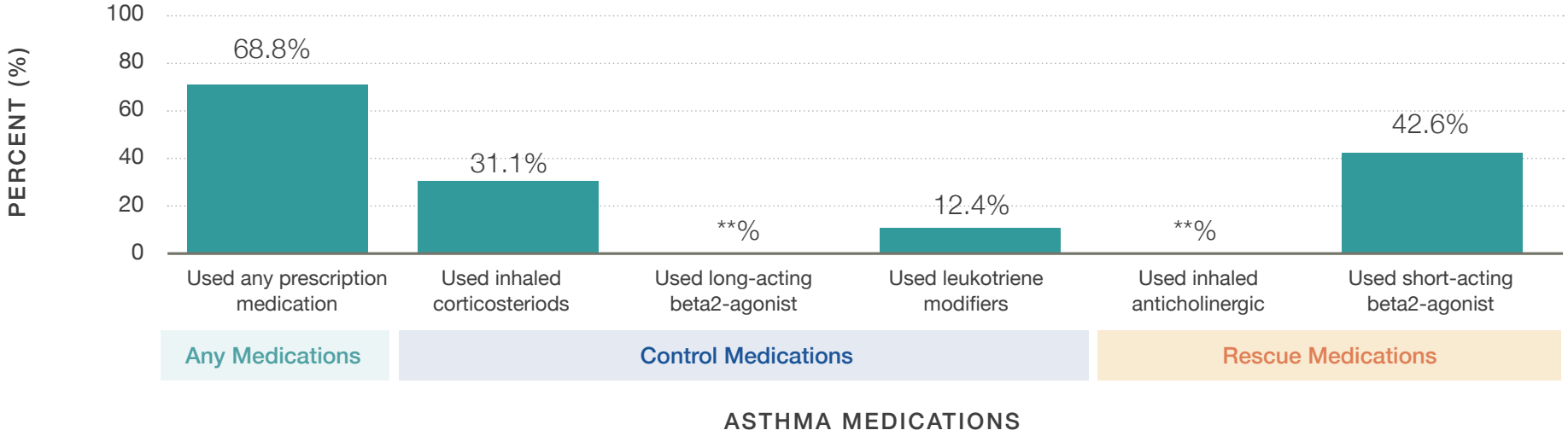

TABLE. Medication Use in the Past 3 Months among Massachusetts Children with Current Asthma, 2006-2010

TYPE OF MEDICATION USE, PAST 3 MONTHS	N[1]	%[2]	95% CI[3]
Used any prescription asthma medication[4]	275	68.8	60.2 – 77.3
Control Medications			
Used inhaled corticosteroid[5]	276	31.1	23.0 – 39.2
Used inhaled long-acting beta2-agonist[6]	276	—*	—
Used leukotriene modifier[7]	276	12.4	7.4 – 17.4
Rescue Medications			
Used inhaled anti-inflammatory[8]	276	—*	—
Used inhaled anticholinergic[9]	276	42.6	34.1 – 51.2
Used inhaled short-acting beta2-agonist[10]	272	56.1	47.2 – 64.9
Used spacers[11]	162	66.3	56.2 – 76.5

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

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

[3] *95% Confidence Interval.*

[4] *"Yes" to "In the past three months, _____" to any of the following:*
Has [child] taken prescription asthma medicine using an inhaler?"
Has [child] taken prescription asthma medication in pill form?"
Has [child] taken prescription asthma medication in syrup form?"
Were any of [child's] asthma medicines used with a nebulizer?"

[5] *"One or more" inhaled corticosteroid in the past three months*

[6] *"One or more" inhaled long-acting beta2-agonists in the past three months*

[7] *"One or more" leukotriene modifier in the past three months*

[8] *"One or more" inhaled anticholinergic in the past three months*

[9] *"One or more" inhaled short-acting beta2-agonists in the past three months*

[10] *"One or more" inhaled prescription asthma medications in the past three months*

[11] *"Yes" to "Does [child] use a spacer with [list of medications taken with an inhaler]?"*

** Sample size is too small, cannot be reported.*

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

Environmental Triggers in Homes

Asthma triggers are allergens or irritants that can cause asthma or make one's asthma symptoms, episodes, or asthma attacks worse.

53.3% of children with current asthma reported having pets in the home

53.0% of children with current asthma reported having carpeting or rugs in the bedroom

54.3% of children with current asthma reported using gas for cooking

TABLE 10. Environmental Asthma Triggers in Home among Massachusetts Children with Current Asthma, 2006–2010

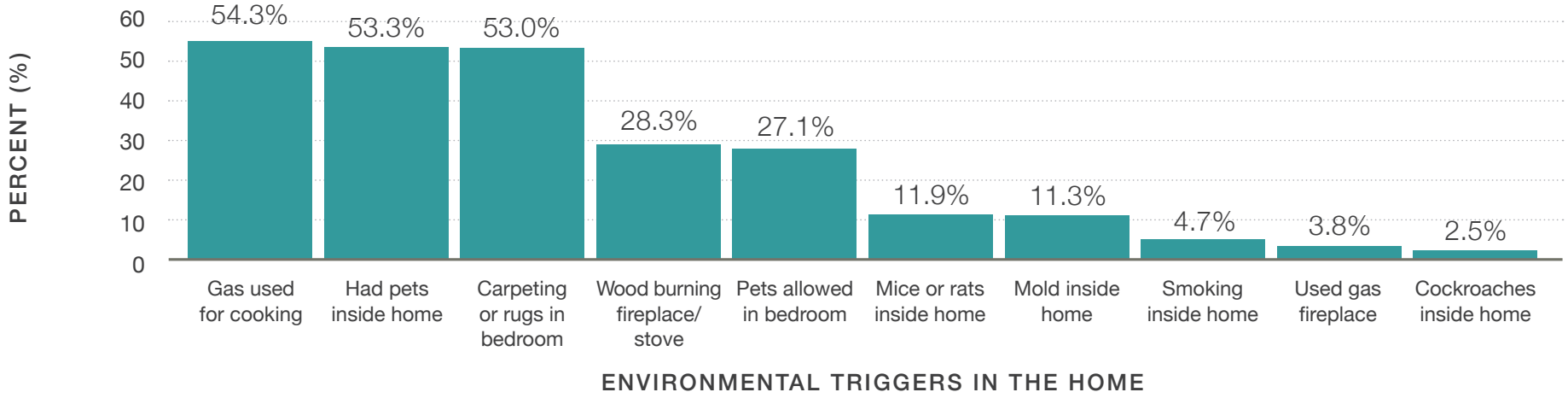

TABLE. Environmental Asthma Triggers in Home among Massachusetts Children with Current Asthma, 2006–2010

ENVIRONMENTAL TRIGGERS IN THE HOME	N[1]	%[2]	95% CI[3]
Gas used for cooking [4]	274	54.3	45.4 – 63.1
Had pets inside home[5]	274	53.3	44.5 – 62.1
Carpeting or rugs in bedroom[6]	274	53.0	44.2 – 61.9
Wood burning fireplace/stove[7]	274	28.4	19.8 – 36.9
Pets allowed in bedroom[8]	274	27.1	19.2 – 35.0
Mice or rats inside the home, past 30 days[9]	274	11.9	6.4 – 17.5
Mold inside the home, past 30 days[10]	274	11.3	6.0 – 16.6
Smoking inside the home, past week[11]	274	4.7	2.3 – 7.2
Gas fireplace or unvented gas stove[12]	271	3.8*	1.0 – 6.7
Cockroaches inside the home, past 30 days[13]	274	2.5*	0.5 – 4.4

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

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

[3] *95% Confidence Interval.*

[4] *"Yes" to "Is gas used for cooking?"*

[5] *"Yes" to Does your household have pets such as dogs, cats, hamsters, birds or other feathered or furry pets that spend time indoors?*

[6] *"Yes" to "Do you have carpeting or rugs in your bedroom?"*

[7] *"Yes" to "Is a wood-burning fireplace or wood burning stove used in your home?"*

[8] *"Yes" to " Are pets allowed in your bedroom?"*

[9] *"Yes" to "In the past 30 days, has anyone seen mice or rats inside your home?"*

[10] *"Yes" to "In the past 30 days, has anyone seen or smelled mold or a musty odor inside your home?"*

[11] *"Yes" to "In the past week, has anyone smoked inside your home?"*

[12] *"Yes" to "Are unvented gas logs, unvented gas fireplaces, or unvented gas stoves used in your home?"*

[13] *"Yes" to "In the past 30 days, has anyone seen a cockroach inside your home?"*

** Relative Standard Error is > 30%. Results should be interpreted with caution due to instability of the estimate.*

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

Environmental Modifications

Among children with current asthma:

The most commonly reported environmental modifications in the home used were:

60.5% bath exhaust fan

62.7% kitchen exhaust fan

Less commonly reported modifications used were:

38.1% pillow covers

28.8% air cleaners/purifiers

TABLE 11. Modifications in Homes among Massachusetts Children with Current Asthma, 2006–2010

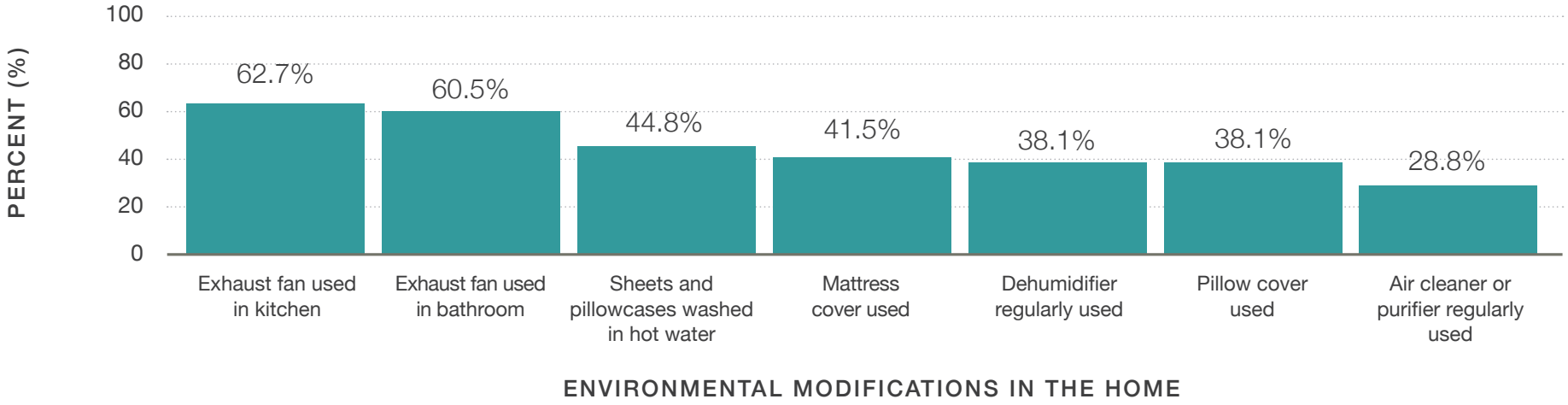

TABLE. Modifications in Homes among Massachusetts Children with Current Asthma, 2006-2010

MODIFICATIONS	N[1]	%[2]	95% CI[3]
Exhaust fan regularly used in kitchen[4]	274	62.7	54.4 – 70.9
Exhaust fan used in bathroom[5]	274	60.5	51.6 – 69.4
Sheets and pillowcases washed in hot water[6]	269	44.8	35.9 – 53.6
Mattress cover used[7]	271	41.5	32.9 – 50.0
Dehumidifier regularly used[8]	274	38.1	29.7 – 46.5
Pillow cover used[9]	272	38.1	29.6 – 46.5
Air cleaner or purifier regularly used[10]	273	28.8	20.9 – 36.7

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

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

[3] *95% Confidence Interval.*

[4] *"Yes" to "Is an exhaust fan that vents to the outside used regularly when cooking in your kitchen?"*

[5] *"Yes" to "In your bathroom, do you regularly use an exhaust fan that vents to the outside?"*

[6] *"Hot" to "Are your sheets and pillowcases washed in cold, warm or hot water?"*

[7] *"Yes" to "Do you use a mattress cover that is made especially for controlling dust mites?"*

[8] *"Yes" to "Is a dehumidifier regularly used to reduce moisture inside your home?"*

[9] *"Yes" to "Do you use a pillow cover that is made especially for controlling dust mites?"*

[10] *"Yes" to "Is an air cleaner or purifier regularly used inside your home?"*

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

APPENDIX

Data Sources

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 affect the 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, have 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 guardians, grandparents, adult siblings, other relatives, and 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
- Complementary and alternative therapy

To view the complete survey for both children and adults, visit the CDC's website.

A combined total of 967 adults (ages 18 years and older) participated in the 2011–2014 adults call-back, and 419 adult proxies of children with asthma (ages 0–17 years), participated in the 2006–2010 call-back. Among them, 677 adults and 254 children were classified as having current asthma. Because of the relatively small number of children included in this survey, the 95% confidence intervals for the reported percentages are wide (i.e., the estimates are not as precise as those for the adults). The underlying sample size (Sample Size) in the presented tables is the number of people with current asthma who answered the corresponding questions or whose response was assumed based on an answer to a previous question. 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 designed to be representative of all Massachusetts adults and children with asthma.

Call-back data are based on self-reported information from respondents, and therefore may be subject to error for several reasons: individuals may have difficultly remembering past events; individuals may respond differently to questions depending on what they perceive to be the socially desirable answer; and individuals may also respond to survey questions differently due to their respective cultural and linguistic backgrounds. The call-back survey is administered only to individuals with landline telephones, and can be conducted in English or Spanish only. Therefore, individuals who do not speak one of these two languages and individuals living in households without landline telephones are not included in the sample, and BRFSS results may not be generalizable to these populations.

For all data set, percentages were not generated on counts less than 10.

Definition of Asthma Control for Adults and Children with Current Asthma (all ages)

Several questions are used to measure the impairment construct of asthma control from the ACS (see footnotes below table). These questions are summarized into four main categories based on the EPR-3 Guidelines: symptoms (frequency and duration), nighttime awakenings, use of short-acting beta agonists (SABA), and interference with normal activities. Control status was based on the most severe level across the three categories. It is important to note that lung function measures (FEV1 and PEF), are not available from the ACS and therefore, are not included in the classification of asthma control in this report.

Cut points were derived by assuming "the past 30 days" refers to one month with four weeks, and were modified to meet the EPR-3 Guidelines where possible. For example, the ACS measures the number of days the respondent had symptoms in the past 30 days. Using the EPR-3 Guidelines, symptoms are classified as "Well Controlled" if they occur ≤2 days per week. Using the ACS, ≤2 days per week * four weeks is approximately eight days/month (x/7 = 8/30, x=1.86). Therefore, the cut point for "Well Controlled" symptoms includes symptoms reported occurring on eight days or less in the past 30 days.

The EPR-3 Guidelines for assessing asthma control are slightly different for children ages 0–4 years and 5–11 years. For the purpose of this report, the classification of asthma control for patients ages 12 years and older (see grid below) were also applied for children ages 0–4 and 5–11 years.

Asthma Control Categories

Among children and adults with current asthma:

TABLE. EPR-3 Guidelines for Assessing Asthma Control

VARIABLE	WELL CONTROLLED	NOT WELL CONTROLLED	VERY POORLY CONTROLLED
Symptoms[1]	0 ≤ x ≤ 8 days in the past 30 days	9 ≤ x ≤ 29 days in the past 30 days, or x= 30 days in the past 30 days but not throughout the day	= 30 days in the past 30 days, and throughout the day
Nighttime Awakenings[2]	0 ≤ x ≤ 2 nights in the past 30 days	3 ≤ x ≤ 12 nights in the past 30 days	13 ≤ x ≤ 30 nights in the past 30 days
Inhaled SABA Use (uses per day)[3]	No prescription asthma medication with an inhaler use in the past three months, or no inhaled SABA medication use in the past three months, or total inhaled SABA medication use ≤ 0.29x per day.	0.29 ≤Total inhaled SABA medication use ≤ 1.00x per day	Total inhaled SABA medication use ≥ 1.00x per day
Interference with Normal Activity[4]	Not at all, or no symptoms past year	A little, or a moderate amount	A lot

[1] *"During the past 30 days, on how many days did you have any symptoms of asthma?", "Do you have symptoms all the time?"*

[2] *"During the past 30 days, on how many days did symptoms of asthma make it difficult for you to stay asleep?"*

[3] *"In the past three months, have you taken prescription asthma medications using an inhaler?", "In the past three months, what prescription asthma medications did you take by inhaler?", "How many times per day or per week do you use [list of medications]?"*

[4] *During the past 12 months, would you say you limited your usual activities due to asthma not at all, a little, a moderate amount, or a lot?*

Note: *The EPR-3 Guidelines for assessing asthma control are slightly different for children ages 0-4 years and 5-11 years. For the purpose of this report, the classification of asthma control for patients ages 12 years and older (see table above) were also applied for children ages 0-4 and 5-11 years.*

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[1] National Heart, Lung, and Blood Institute. 2007. Expert Panel Report 3 (EPR3): Guidelines for the diagnosis and management of asthma. National Institutes of Health, Bethesda, MD.

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[3] Centers for Disease Control and Prevention (CDC), National Center for Environmental Health. Behavioral Risk Factor Surveillance Systems Call-back Surveys. Available at http://www.cdc.gov/asthma/questions.htm#callback

[4] National Heart, Lung, and Blood Institute. 2007. Expert Panel Report 3 (EPR3): Guidelines for the diagnosis and management of asthma. National Institutes of Health, Bethesda, MD.

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC HEALTH