The Burden of Asthma in Vermont

March 13, 2013

VERMONT
DEPARTMENT OF HEALTH

A special thanks to:

The Vermont Asthma Advisory Panel
Richard Wasserman, MD, the Vermont Lung Center, University of Vermont
Charles Irvin, PhD, the Vermont Lung Center, University of Vermont

Issued 03.13.2013, r.04.23.2013

Executive Summary

Asthma is a chronic disease affecting the lungs. The Vermont Department of Health Division of Health Surveillance set out to compile a comprehensive report describing the burden of asthma using data that was currently available. At the time this report was written, the most current year of survey data was 2010 and the most current hospital discharge data was from 2009. We chose to focus on describing who had asthma and how those with asthma coped with their condition in terms of overall health and their ability to manage their disease.

Prevalence of asthma in Vermont has been significantly higher than that of the U.S. since 2007. However, asthma prevalence in Vermont did not increase between 2006 and 2010. In 2010, the prevalence of current asthma was 11% among adult Vermonters and 10% among children in Vermont. In adults, asthma was more prevalent among females, those with household incomes below 125% of the federal poverty level, those who did not graduate from high school, those who reported they were unable to work, and those who reported they were unemployed.

Both asthma severity and asthma control were examined in order to better gauge the impact of risk factors and how those with asthma manage their condition. Of those with asthma, nearly half of adults and more than half of children had a persistent form of the disease. Nearly 60% of adults and children with asthma in Vermont had well controlled asthma. One in five children had either 'not well' or 'poorly controlled' asthma. Slightly more than a quarter of adults did not have their asthma well controlled and 14% had poorly controlled asthma. As the severity of an individual's asthma worsened the level of asthma control also declined.

Sociodemographic Risk Factors

Among adults, we identified some key sociodemographic risk factors affecting adult Vermonters, including education, household income, and employment status. While there were some slight variations among children with asthma by age and school level, these differences were not significantly different.

Adults with lower levels of education were more likely to have more severe and less controlled forms of asthma. Nearly half of those with a high school education or less had moderate to severe persistent asthma. This is significantly higher than the proportion seen among college graduates. Furthermore, a significantly higher proportion of those with at least a high school education had 'poorly' controlled asthma.

Adult Vermonters with asthma who reported a household income below 125% of the federal poverty level (FPL) were significantly more likely to have severe and poorly controlled asthma compared to those in the highest household income group (greater than 350% of the FPL).

However, as household income increases, the severity of asthma does not necessarily decline nor does the ability to control one's asthma improve. Rather, those reporting household incomes below 125% of the FPL and those with household incomes between 250% and 349% of the FPL are more similar to one another in regards to asthma severity and control than to the groups adjacent to them—these two groups (below 125% FPL and 250% to 349% FPL) had a significantly higher proportion of individuals with poorly controlled asthma compared to those with household incomes above 350% FPL.

Adult Vermonters with asthma who reported they were unable to work were significantly more likely to have severe persistent asthma and poorly controlled asthma than their employed counterparts.

Biological Risk Factors

The main biologic risk factor among adult Vermonters with asthma was the existence of co-occurring chronic conditions. We also examined recommended immunizations among all Vermonters with asthma.

Among adults, we assessed a variety of chronic conditions in addition to asthma, including arthritis, depression, diabetes, cardiovascular disease, cancer, arthritis, and chronic obstructive pulmonary disease. Adults with current asthma were significantly more likely to report having multiple chronic conditions than those without asthma. A third of those with three or more co-existing chronic conditions had severe persistent asthma. This is significantly higher than the proportion seen among those with one or less co-occurring chronic conditions. Nearly half of those with asthma and three other coexisting chronic conditions had poorly controlled asthma. This is significantly higher than the proportion seen among those with one or less co-occurring chronic conditions.

In 2010, half of adults with current asthma received an influenza vaccine, significantly higher than the proportion of adults without asthma. There was better guideline adherence, with regard to influenza and pneumonia vaccinations, among adults over the age of 65 years compared to adults between 18-64 years of age. Three-quarters of children with asthma received an influenza vaccine in 2010. However, only 6% of Vermont's youth with asthma have ever had a pneumonia vaccine as recommended by the Centers for Disease Control & Prevention.

Environmental Triggers

Using survey data, we were able to analyze various environmental triggers among those with asthma. The most common environmental trigger for both adults and children at home was

the presence of an indoor pet. Other common indoor triggers for Vermonters included carpeting in the bedroom and pets allowed in the bedroom. Most Vermonters with asthma (85% of both children and adults) had two or more indoor environmental triggers. The number of environmental triggers did not have a significant association with asthma severity or control among adult asthmatics in Vermont.

In addition to looking at the proportion of Vermonters exposed to secondhand smoke (SHS), we also examined how smoking in combination with smoke exposure affected asthma severity and control among adults. The proportion of adult Vermonters with current asthma who smoke was significantly higher than the proportion of those without asthma. Furthermore, those with asthma were significantly more likely to be current smokers and report smoking on 'most days' than those without asthma. Current smokers with asthma were significantly more likely to have been exposed to SHS than former smokers and those that never smoked. Ever smokers exposed to SHS were significantly more likely to have severe persistent asthma and poorly controlled asthma than those who never smoked and were not exposed to SHS.

Among adults, another interesting environmental trigger was work-related asthma. A quarter of adults with current asthma reported a current or previous job aggravated their asthma. A third of adult Vermonters with current asthma reported quitting a job due to their asthma. The presence of work related asthma factors had a significant negative association with asthma severity and control.

Asthma Self-Management

A key indicator of successfully addressing the burden of asthma is an individual's ability to self-manage their condition. We examined this looking at self-reported information on self-management techniques and by examining how individuals utilized medications for the treatment of their asthma.

More than half of adults and children with current asthma had been taught what to do during an asthma attack and how to recognize early signs of an asthma episode. However, other self-management techniques were less common. Half of adults and children were taught to use a peak flow meter. Only 30% of adults and half of children had ever received a written asthma action plan. Few Vermonters, 8% of adults and 4% of children, attended an asthma management class.

Approximately 4 out of 5 adults and children with asthma had been advised by a health professional to modify their environment in order to reduce exposure to environmental triggers. Most adults and youth utilized multiple methods for preventing environmental triggers in their home. Among adults with asthma, severity and control did not significantly differ by the number of preventive measures utilized.

Most adults (96%) and all children with asthma had used some sort of medication (inhaler, pills, nebulizers, or over-the-counter treatment) for their asthma throughout the course of the disease. Three-quarters of adults and children used a medication in the preceding three months. A quarter of adults and children used both a controller and a rescue inhaler in the last three months. A quarter of adults and one in five children reported only using a rescue inhaler in the previous three months. One in ten adults and 7% of children only used a controller medication the last three months. Approximately a third of adults (36%) and slightly less than half of children (43%) did not use either a controller or a rescue medication in the previous month. One in ten Vermonters with current asthma reported a cost barrier to accessing the medication need for treating their asthma.

Service Utilization

Most Vermonters, including those with asthma, have some type of health insurance. In addition to being significantly more likely to report an annual check-up than adults without asthma, adults with current asthma were significantly more likely to report being unable to see a physician due to cost than those without asthma. EPR-3 guidelines suggest that individuals with well controlled asthma see their physician for a routine asthma visit every six months (twice a year). Half of adults and a quarter of children in Vermont with current asthma did not see their health care provider at all in the previous year for a routine asthma visit. Half of adults with one routine asthma visit had well controlled asthma and a third of adults with two or more routine asthma visits had well controlled asthma in the last year.

By examining both emergency and hospital discharge rates of Vermont residents we can gauge level of asthma control and learn more about how asthmatics are utilizing health services. The rate of discharge from the emergency department (ED) and from the hospital with a primary diagnosis of asthma did not significantly change between 2005 and 2009. According to 2009 data, young males (<15 years) and young to middle-age women (15-44 years and 45-64 years) had significantly higher rates of ED and hospital discharges with a primary diagnosis of asthma than their counterparts of the opposite sex. Certain geographic areas, including the Rutland and the Springfield hospital service areas, had significantly higher discharge rates with a primary diagnosis of asthma, from both the ED and the hospital, than that of the state overall.

The mean charge of an ED visit and a hospital visit with a primary diagnosis of asthma has significantly increased since 2005. Total charges related to a primary diagnosis of asthma in the ED and in the hospital were over $7 million in 2009 for Vermont residents.

Target Populations

Based on the various analyses completed for this document we chose a variety of target populations that could be more closely examined. We suggested conducting more detailed analysis and continued observations of:
- Those with low levels of education,
- Those with a household income below 125% of the FPL,
- Those with co-occurring chronic conditions,
- Smokers and those exposed to secondhand smoke,
- Those with work-related asthma,
- Those living in the Springfield and Rutland hospital service areas.

In addition to a higher proportion of individuals reporting these individual factors having severe and poorly controlled asthma, there was also an increased odds of moderate to severe and uncontrolled asthma. We highlighted some of the crude odds ratios and suggested that using more complex models to examine these factors among asthmatics should be a prominent part of future asthma surveillance activities.

Conclusions

There is significant work to be done to help those with asthma in Vermont gain better control of their chronic condition. We have identified some key areas to target and areas where surveillance can continue to work to help inform decision making with the Vermont Asthma Program.

Table of Contents

Introduction

Asthma is a chronic disease of the lungs. The National Heart Lung and Blood Institute defines asthma as a disease of the airways that inflames and narrows the airways. Asthma is characterized by variable recurring periods of wheezing, chest tightness, shortness of breath, and coughing.[1] However an individual with asthma can complete normal activities when they are equipped with proper self-management tools and an appropriate method for treating the disease.

In the U.S., the percent of people ever diagnosed with asthma significantly increased from 7% in 2001 to 8% 2010. In 2010, 7 million children and nearly 19 million adults had asthma. Certain groups, including women, families with household incomes below the federal poverty level, and certain races have a significantly higher prevalence of asthma. Black, Alaskan Native, and American Indian individuals had significantly higher prevalence of asthma compared to white individuals. Individuals of Puerto Rican and Mexican decent had a higher prevalence of asthma compared non-Hispanic individuals.[2]

The prevalence of asthma in adults has been significantly higher in Vermont than the U.S. since 2007. While the prevalence of asthma within Vermont has not significantly increased in the past 5 years, it impacts the lives of one in ten Vermonters. Like the U.S., asthma was more prevalent in certain sub groups in Vermont, including women and those with lower annual household incomes.

In 2000, asthma became a routine aspect of health surveillance at the Vermont Department of Health with funding from the CDC. Asthma surveillance routinely monitors the prevalence of asthma, as well as other asthma-related information including various risk factors, utilization of health services, and the ability to self-manage the disease. On an annual basis, the asthma surveillance team analyzes and compiles current information on asthma into an annual data report. In addition to routine asthma updates, the asthma surveillance team assists the Vermont Asthma Program by providing relevant information and assisting with data driven tasks such as the development of a State Asthma Plan.

The first Vermont State Asthma Plan was published in 2003 and was later revised in 2008. The 2008 plan focused on addressing populations within the state who were experiencing a disproportionate burden of asthma compared to the general population with asthma. Two priority populations, persons living below 125% of the federal poverty level or with less than a high school education, and residents of the Rutland region were identified as target populations. The Asthma Program is working with stakeholders from around the state to develop a new State Plan that is scheduled to be published in early 2013.

This report is meant to serve as an in-depth description of Vermont's asthma data as of 2010. The main focus is the burden of disease within Vermont. Areas where Vermont significantly

differs from national statistics are noted, however, they are not discussed in detail in this report. This document is meant to serve as a detailed, descriptive epidemiology of asthma and its associated risk factors.

The first chapter describes asthma prevalence in the state as a whole and of various subgroups. From prevalence we move to examining quality of life factors and broadly examine asthma severity and control. In chapter 3, we look at sociodemographic risk factors associated with asthma. We not only look at differences in asthma prevalence, but also at how each risk factor is associated with asthma severity and control. We continue examining risk factors in chapter 4, focusing on various environmental exposures that can affect one's asthma. In chapter 5 our focus changes to self-management and medication use among those with asthma before looking at health service utilization in chapter 6. Chapter 7 provides an update on the Healthy Vermonters 2010 initiative and describes the goals for the current Healthy Vermonters 2020 initiative. Finally in chapter 8 we use a different approach, the use of crude odds ratios, to take a closer look at populations that may be targeted by the Vermont Asthma Program in the future.

Chapter 1- Asthma Prevalence

The first step in understanding the burden of asthma is to examine how many Vermonters have asthma. In addition, we can examine more specific population to get a better sense of who is affected by asthma and where interventions may be targeted.

Asthma Prevalence

Prevalence measures the number of people in a given population with a particular health condition or disease at a given time. Asthma is a chronic disease that may be diagnosed at any age, but the symptoms of asthma may not persist throughout one's lifetime. For this reason, asthma prevalence is often defined as 'lifetime' asthma prevalence or 'current' asthma prevalence. *Lifetime asthma prevalence* specifies the proportion of individuals in a population who reported ever being told by a doctor or health professional they had asthma. *Current asthma prevalence* is the proportion of individuals in a population who reported they had been diagnosed by a health professional with asthma <u>and</u> currently has asthma.

Asthma Prevalence in the U.S.

Nearly one in ten adults in the U.S. (9%) had current asthma and 14% of the population had been diagnosed with asthma at some point in their life according to data from 2010 [3]. In 2010, among youth, those under the age of 18, the lifetime asthma prevalence in the U.S. was 13% and the prevalence of current asthma was 8% [4].

National surveillance data and research literature give insight into key demographic factors that should be considered when examining asthma prevalence. In national data from 2008-2010, youth (ages 0 to 17 years), females, black persons, persons of multiple races, Puerto Ricans, and persons with an income level below the federal poverty level were noted as having a higher prevalence of asthma [2]. Other research literature suggests that those with lower levels of education [2, 5-7], smokers and those exposed to smoke [8-11], obese individuals [6, 7], and those living in urban areas have a higher prevalence of asthma [11, 12]. Table 1.1 summarizes significant differences seen in current asthma prevalence by various factors, according to 2010 data from the Behavioral Risk Factor Surveillance System (BRFSS).

Table 1.1. Key statistically significant differences for current asthma prevalence among adults in the U.S., BRFSS 2010 [3, 4]		
DEMOGRAPHIC FACTOR	**ADULTS** (≥18 YEARS)	**YOUTH** (<18 YEARS)
Age	Adults, aged 18-24, had a higher prevalence compared to all other adult age groups with the exception of 55-64 year olds.	Those under the age of 4 had a lower prevalence compared to all other age groups.
Sex	Females had higher prevalence than males.	Males had a higher prevalence than females.
Annual household income with Regard to the Federal Poverty Level (FPL)	The two lowest annual household income categories, less than 125% of the FPL and 125-249% of the FPL, had a higher prevalence compared to other income brackets.	*(not measured)*
Education Status	U.S. adults that graduated from college had a lower prevalence compared to those with lower levels of education.	*(not measured)*
Race and Ethnicity	Black non-Hispanic adults and multiracial non-Hispanic adults had a higher prevalence than non-Hispanic whites. Hispanic adults had a lower prevalence compared to white non-Hispanic individuals.	Black non-Hispanic and multiracial non-Hispanic youth had a higher prevalence than white non-Hispanic youth.

Prevalence among Adult Vermonters

In 2010, the lifetime prevalence of asthma among adult Vermonters was 17% and the current prevalence of asthma was 11%. This equates to approximately 85,000 Vermonters that have ever received an asthma diagnosis and 54,000 Vermonters that currently have asthma. The

prevalence of current asthma among Vermonters has been significantly higher than that of the nation since 2007 (figure 1.1). However, it is important to note that Vermont's prevalence has not significantly increased from year-to-year.

Figure 1.1. Current adult asthma prevalence in VT and U.S, 2006-2010*

*Data from BRFSS 2006-2010
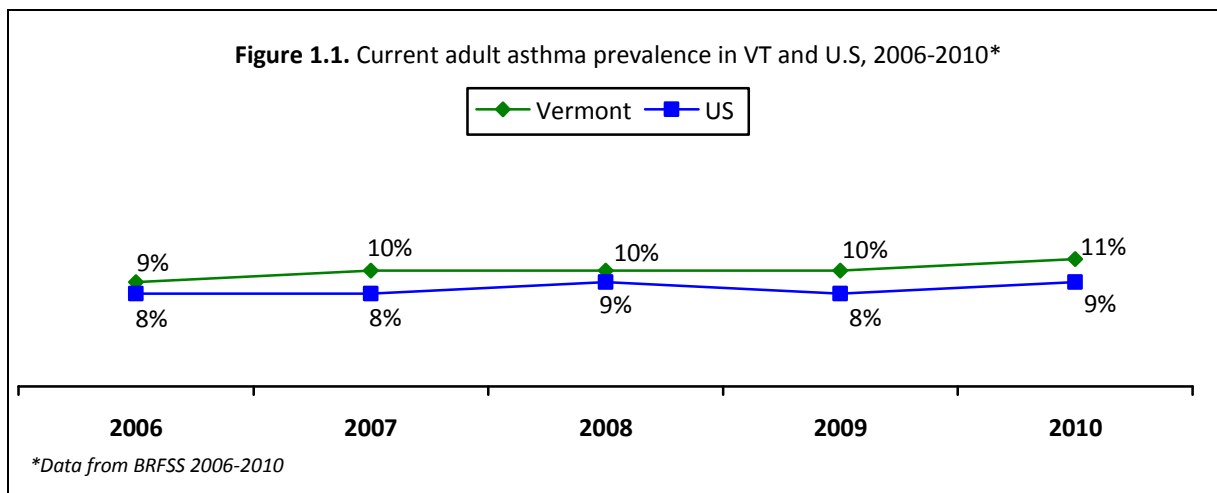
Adult Asthma Prevalence among Sociodemographic Groups

In Vermont, as in the U.S., females, individuals of lower socioeconomic status, including those with low levels of income and educational attainment, have a higher prevalence of asthma. Also similar to national data, there were not any significant differences in asthma prevalence by race and ethnicity in Vermont. Other demographic factors, such as age and employment status, showed significant variations in prevalence among adult Vermonters

Age

Prevalence of asthma by age group among adult Vermonters is presented in figure 1.2.
In Vermont, the prevalence of current asthma was slightly higher among adults 18-24 years old and those 25-34 years old compared to other age groups, but these differences were not statistically significant. Prevalence of current asthma in adults over the age of 65 years was significantly lower than Vermont's statewide prevalence.

Figure 1.2. Current asthma prevalence among adult Vermonters by age group, 2010*

Age group	Prevalence
18-24	15%
25-34	15%
35-44	11%
45-54	10%
55-64	10%
>65	9%

Age (years)

*Data from BRFSS 2010
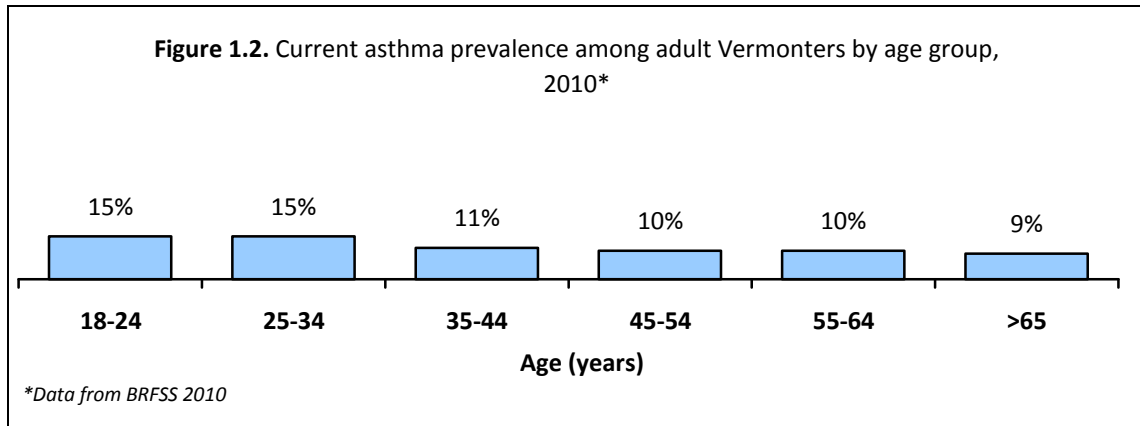
When compared to the prevalence of asthma in the U.S., adult Vermonters age 25-34 years and those age 35-44 years had a significantly higher prevalence of asthma. Vermont's surveillance data shows 18-24 year olds have a similar prevalence to other age categories as opposed to a significantly higher prevalence of asthma, which was seen in the U.S. surveillance data.

Sex

The prevalence of current asthma among adults was significantly higher in female Vermonters than their male counterparts (figure 1.3). This pattern, higher prevalence among females, was also seen in national data.

Figure 1.3. Current asthma prevalence among adult Vermonters by sex, 2010*

Sex	Prevalence
Male	8%
Female	14%

*Data from BRFSS 2010
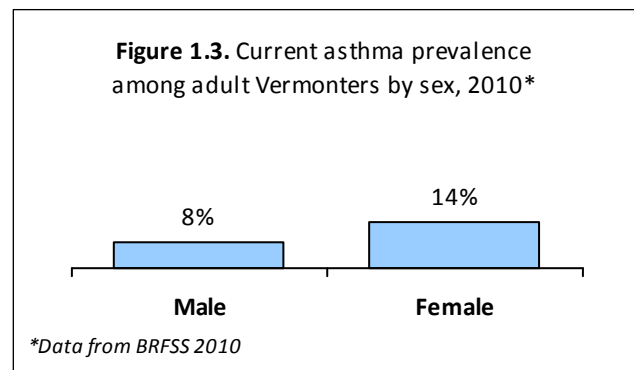
Annual household income

The proximity of an individual's annual household income to the Federal Poverty Level (FPL) is used as a proxy for income. FPL takes into account wages earned and the number of individuals living in a household. In Vermont, as the proximity to the FPL decreased, current asthma became less prevalent (figure 1.4). Those with an annual household income exceeding 350% of the FPL had a significantly lower prevalence of current asthma when compared to those below 250% of the FPL. This is similar to the national trend of current asthma prevalence.

Figure 1.4. Current asthma prevalence among adult Vermonters by annual household income proximity to FPL, 2010*

15%   13%   10%   9%

| <125% | 125-249 | 250-349% | >350% |

Annual household income (% of FPL)

Data from BRFSS 2010
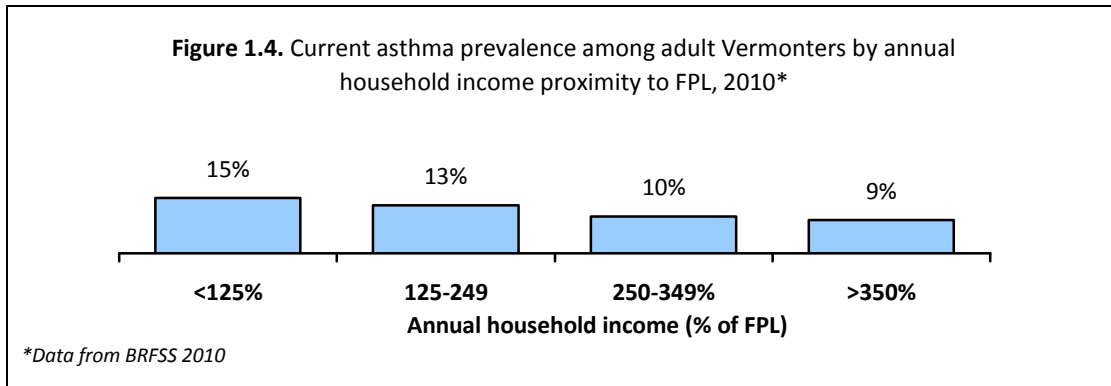
While the overall pattern of asthma prevalence by annual household income categories was similar in Vermont and the U.S., it should be noted that the overall prevalence in the three lowest annual household income categories were significantly higher in Vermont than in national data. Current asthma prevalence was 2 to 4 percentage points higher among Vermonters reporting annual household incomes in the three lowest categories than prevalence in the same respective income categories in the U.S.

Level of Education

Adult Vermonters that did not graduate from high school had a significantly higher prevalence of current asthma than Vermonters that graduated from college. This was the only statistically significant difference in regards to educational attainment. An emerging suggests that asthma prevalence decreases as the level of education increases (figure 1.5). However, this pattern is not statistically significant.

Figure 1.5. Current asthma prevalence among adult Vermonters (≥18 years) by education status, 2010*

16%   12%   12%   10%

| <High school | High school graduate | Some college | College graduate |

Data from BRFSS 2010
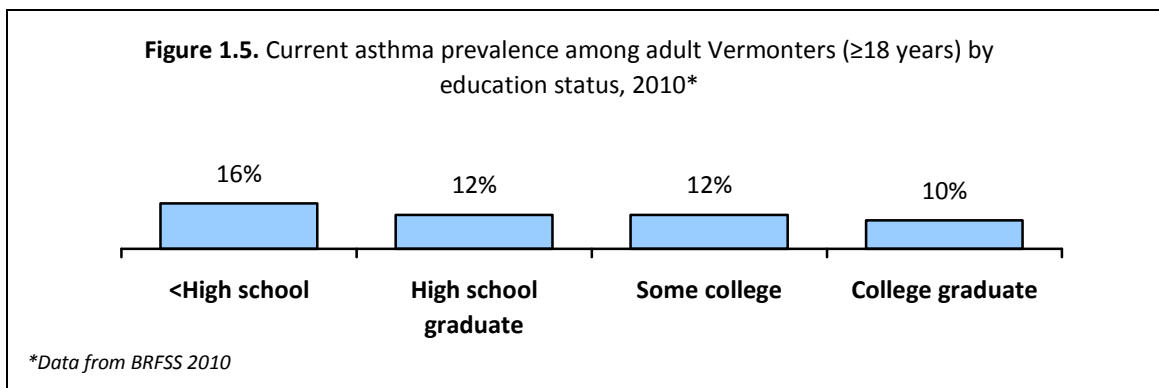
The pattern of prevalence seen among Vermonters by education status is similar to that of the nation as a whole. However, the burden of asthma among Vermonters with higher levels of education significantly differs when compared to the U.S. (figure 1.6). Vermonters that graduated from high school and those that graduated from college both have significantly higher prevalence of asthma than the prevalence reported for the U.S. (*NOTE:* Vermont's prevalence did not significantly differ from the U.S. prevalence for those who reported they did not graduate from high school and those who attended some college).

Figure 1.6. Current asthma prevalence among Vermont and U.S. adults by level of education, 2010*

■ U.S. ☐ Vermont

	<High school	High school graduate	Some college	College graduate
U.S.	10%	9%	10%	7%
Vermont	16%	12%	12%	10%

Data from BRFSS 2010
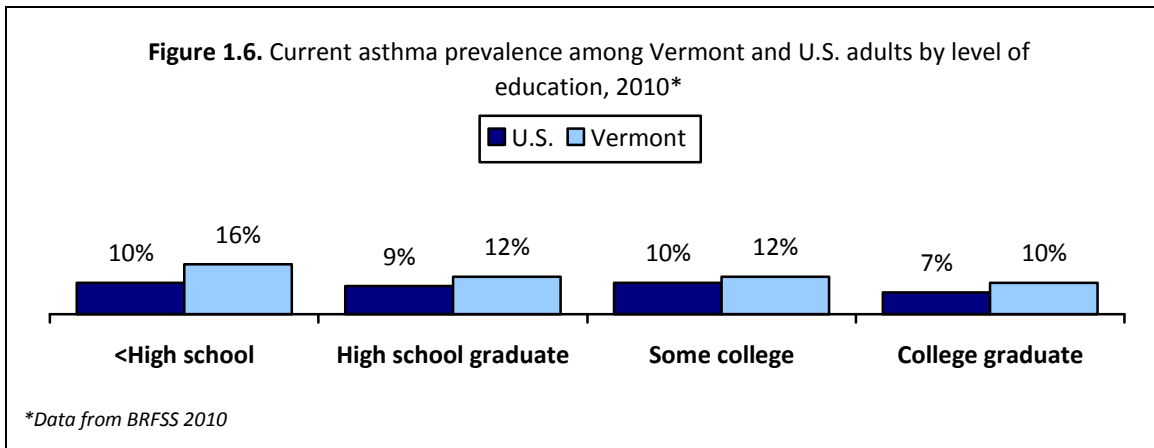
Employment Status

The prevalence of current asthma differed significantly by employment status among adult Vermonters (figure 1.7). There was no significant difference between those that were employed and those who chose not to work—students, homemakers, and retired individuals. However, there were significant differences between these two groups and those who were unemployed and those who reported being unable to work. The prevalence of current asthma among unemployed Vermonters was nearly twice that of currently employed Vermonters. Current asthma prevalence among Vermonters that reported they were unable to work was more than double the current asthma prevalence of those that reported they were currently employed.

Figure 1.7. Current asthma prevalence among adult Vermonters by employment status, 2010*

Employed	Not working	Unemployed	Unable to work
10%	10%	19%	23%

Data from BRFSS 2010
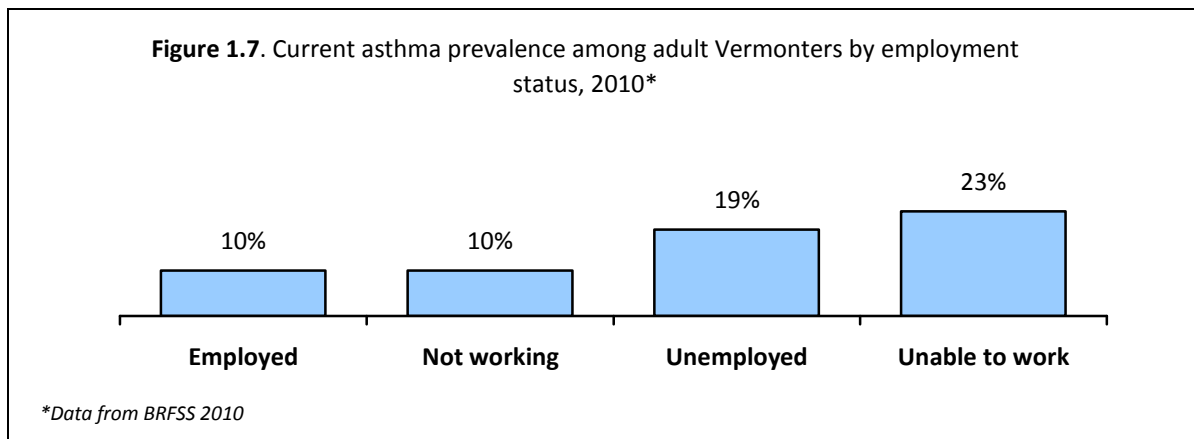
Race and Ethnicity

In Vermont, the small number of individuals of racial and ethnic minorities makes it difficult to perform extensive analyses. Thus, it is necessary to combine racial and ethnic minority categories into a single category that can be compared to white non-Hispanic Vermonters. While Vermonters that belonged to an ethnic or racial minority appeared to have slightly higher

prevalence of current asthma when compared to white non-Hispanic Vermonters, the difference was not statistically significant (figure 1.8).

In the U.S., certain minorities, black and multiracial individuals, have a significantly higher prevalence of current asthma compared to white non-Hispanic adults. Unlike the U.S., Vermont did not have a significant difference in asthma prevalence between non-Hispanic white residents and residents who were racial or ethnic minorities.

Figure 1.8. Prevalence of asthma among Adult Vermonters by Race/Ethnic Minority Status, 2010*

11%   15%

White non-Hispanic   **Ethnic/racial minority**

Data from BRFSS 2010
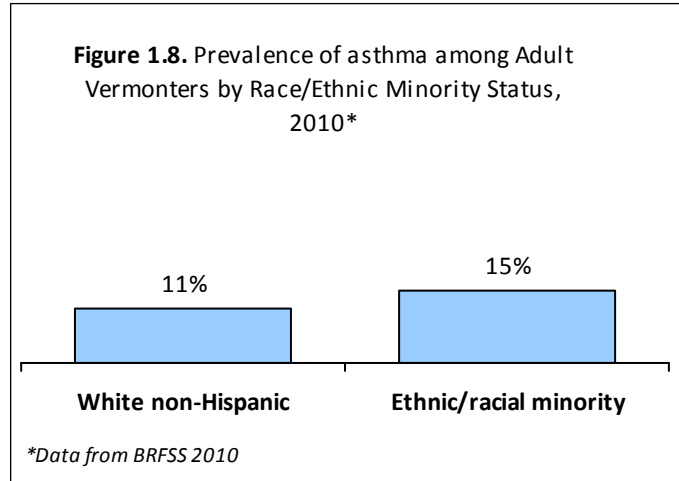
Geographic Regions

Vermont can be regionally divided into 14 counties, 13 Hospital Service Areas, and 12 Health Districts. Hospital Service Areas (HSAs) are defined according to where the majority of people in a given town seek a specific set of hospital services. Hospitals used in the designation of HSAs only include hospitals in Vermont. Hospitals in nearby states are not considered in the creation of the regional designation.

Since Vermont is a mostly rural state, data from 2008, 2009, and 2010 were combined to assure there were enough people in each area for reporting. The following sections only show data on county and HSA.

Figure 1.9. Current asthma prevalence among adults by county, 2008-2010*

Grand Isle 12%
Franklin 10%
Orleans 13%
Essex 15%
Lamoille 9%
Chittenden 9%
Caledonia 12%
Washington 8%
Addison 9%
Orange 10%
Rutland 12%
Windsor 11%
Bennington 13%
Windham 11%

Data from BRFSS 2008-2010
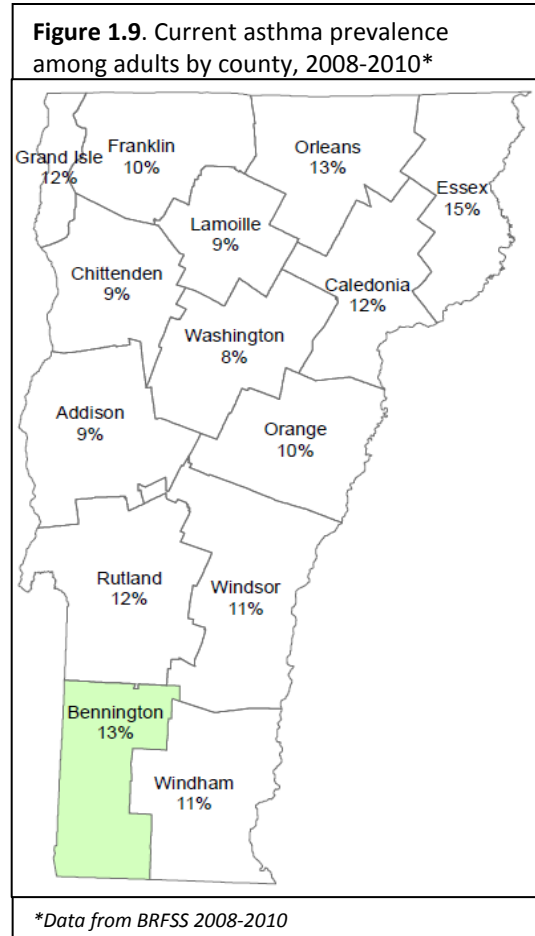
Vermont Counties

Figure 9 shows the prevalence of asthma in Vermont's 14 counties. Current asthma prevalence varied throughout the state, ranging from 8% in Washington County to 15% in Essex County. The only county with a significantly higher prevalence than the state overall was Bennington County.

Vermont Hospital Service Areas

Current asthma prevalence ranged from 8% in the Barre HSA to 14% in the Bennington and St. Johnsbury HSAs (figure 1.10). The only HSA to significantly differ from the current asthma prevalence for the state overall was the Bennington HSA.

Figure 1.10. Current asthma prevalence among adults by HSA, 2008-2010*

*Data from BRFSS 2008-2010
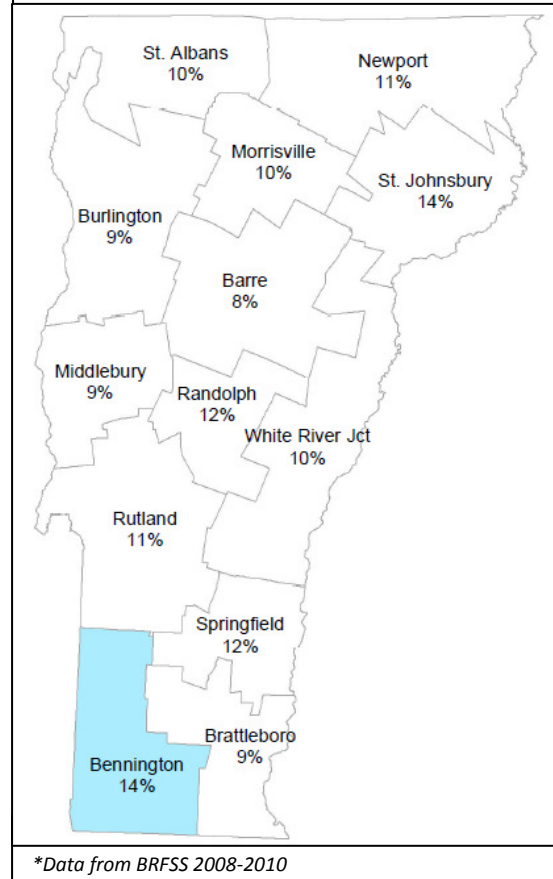
Vermont District Office Regions

Vermont can be divided into 12 regions based on the towns served by each district office. Since district office regions share similar geographic borders with both counties and HSAs, prevalence figures are similar. However, since there are fewer district offices, we detect significantly higher prevalence of current asthma among adults in Bennington and St. Johnsbury (14% of adults with current asthma in both regions according to 2010 BRFSS data).

Asthma among Young Vermonters

Prevalence in Youth

In Vermont, 14% of youth, those less than 18 years of age, had been diagnosed with asthma at some point in their lifetime and 10% of youth had current asthma according to 2010 data (figure 1.11). Current and lifetime asthma prevalence among youth in Vermont did not significantly differ from national figures.

Figure 1.11. Asthma prevalence among youth (<18 years) in Vermont, 2010*

14%   10%

Lifetime asthma   **Current asthma**

Data from BRFSS 2010
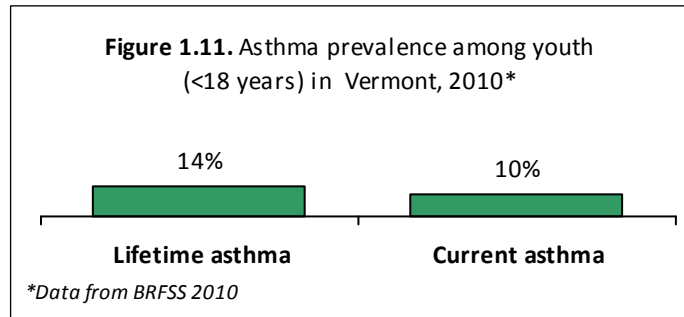
Demographic Factors among Youth

The number of demographic factors available for analysis among youth is limited compared to adults, although we have presented those that are available. The main demographic factors that can be examined in youth are sex and age.

The prevalence of current asthma in male and female youth was identical at 10% in each category. Current asthma prevalence ranged from 8% in those less than 10 years of age to 13% in youth age 10 to 14 years of age. However, current asthma did not significantly differ by age group (figure 1.12).

Figure 1.12. Current asthma prevalence among youth (<18 years) in Vermont by age, 2010*

8%   8%   13%   11%

<5   **5-9**   **10-14**   **15-17**

Age (years)

Data from BRFSS 2010
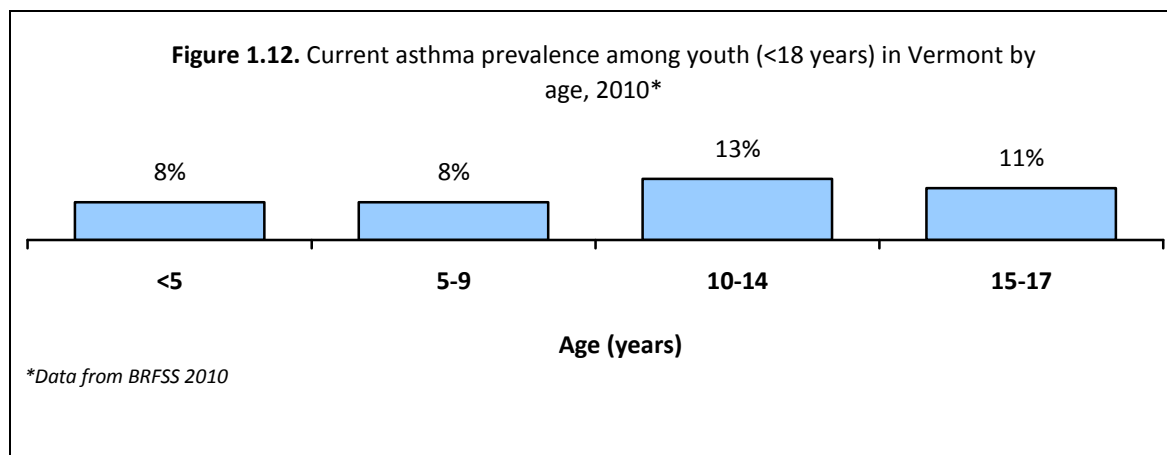
Vermont did not differ significantly from the U.S. in regards to prevalence by age or sex among youth.

Grade Level

In addition to BRFSS, the School Nurses' Report can be used to gauge prevalence of asthma in youth.[†] However, the School Nurses' Report is a passive reporting system and does not parse students into those that have ever received an asthma diagnosis and those that currently have asthma. The most recent School Nurses' Report data suggest that 9% of students enrolled in school have asthma. This is slightly lower than the current asthma estimate from BRFSS.

We can aggregate data by school level for both the School Nurses' Report and BRFSS data on current asthma to examine the prevalence in elementary, middle, and high school students as shown in figure 1.13. Both BRFSS (9%) and the School Nurses' Report (9%) estimate a similar prevalence of asthma among elementary school students. For middle and high school students, the School Nurses' Report predicts a slightly lower prevalence of asthma when compared to those with current asthma in BRFSS data. Though it is unknown whether the School Nurses' Report refers to those ever diagnosed with asthma or only those with current asthma, we believe that the School Nurses' Report most likely underestimates the prevalence of asthma among school age children.

Figure 1.13. Asthma prevalence a by school level of Vermont's youth (<18 years), 2010*

☐ BRFSS-Lifetime asthma ☐ BRFSS-Current asthma ☐ School Nurses' Report asthma

	Elementary school	Middle school	High school
BRFSS-Lifetime asthma	12%	16%	17%
BRFSS-Current asthma	9%	12%	11%
School Nurses' Report asthma	9%	9%	9%

Data from BRFSS 2010 and School Nurses' Report 2010-2011
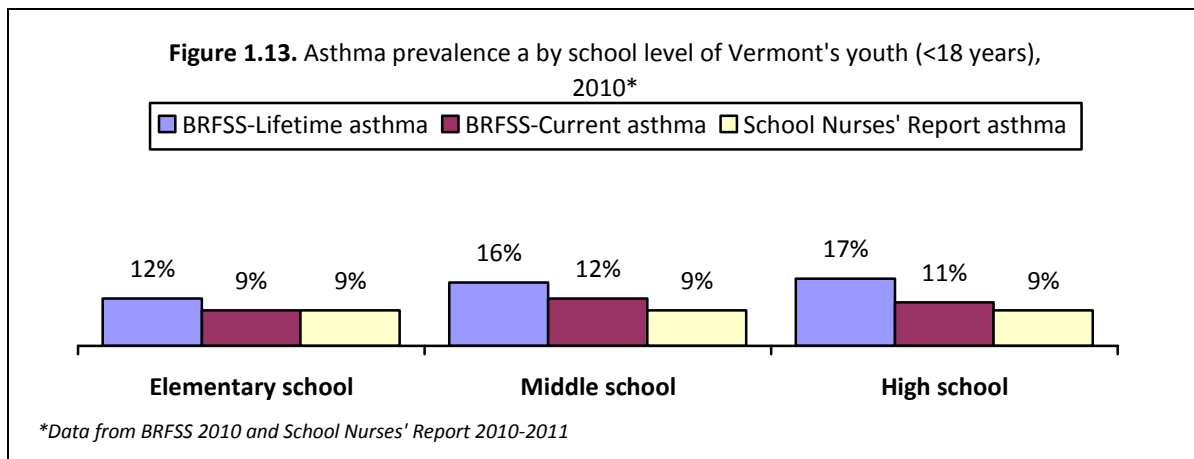
District Office Regions

Both BRFSS and the School Nurses' Report provide data by district office. In most district office regions, asthma prevalence according to the BRFSS and School Nurses' Report among elementary school age youth was fairly similar (figure 1.14.A). There were a few exceptions where large discrepancies were seen, including an almost three-fold difference between the data sources in Bennington.

[†.] *It is important to remember that the School Nurses' Report can only report prevalence for youth whose parents responded to the nurse's request for health information. In other words, prevalence is not based on the entire school population; rather it is based on those parents or guardians that provide the health information to the school nurse in a given year.*

Figure 1.14.A. Asthma prevalence of elementary school age youth (<18 years), 2010*

□ BRFSS ■ School Nurses' Report

*Data from BRFSS 2010 and School Nurses' Report 2010-2011
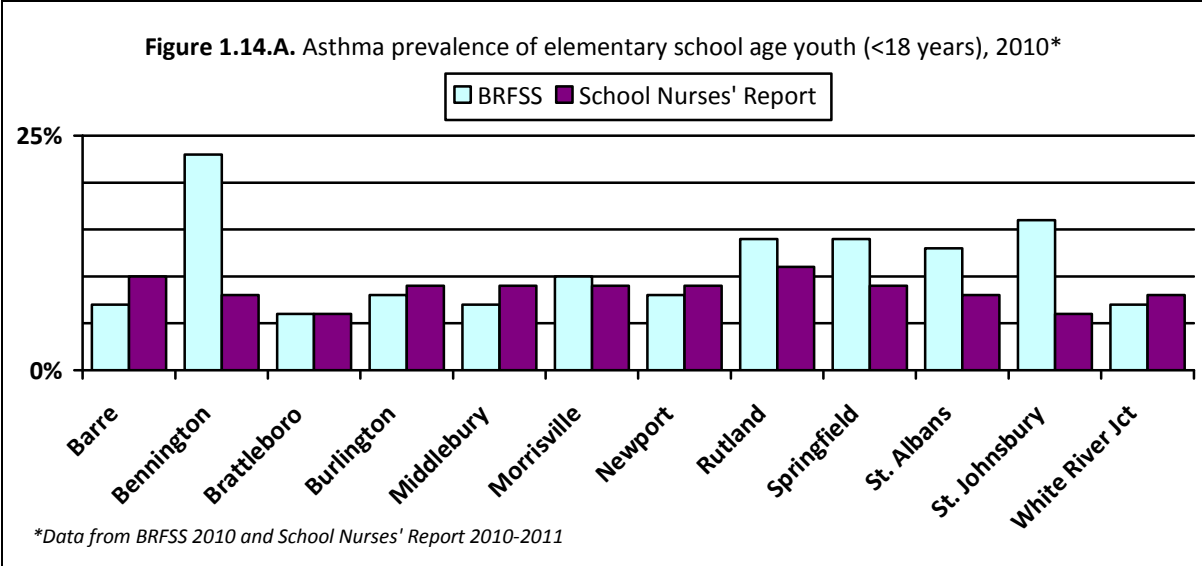
Discordance between BRFSS and the School Nurses' Report prevalence figures continues when we examine youth in middle school (figure 1.14.B). Bennington, Burlington, and Morrisville all had fairly concordant prevalence values of asthma. Brattleboro, Springfield, St. Johnsbury, and White River Junction all had at least a five percentage point discrepancy between the two data sources.

Figure 1.14.B. Asthma prevalence of middle school age youth (<18 years), 2010*

□ BRFSS ■ School Nurses' Report

*Data from BRFSS 2010 and School Nurses' Report 2010-2011
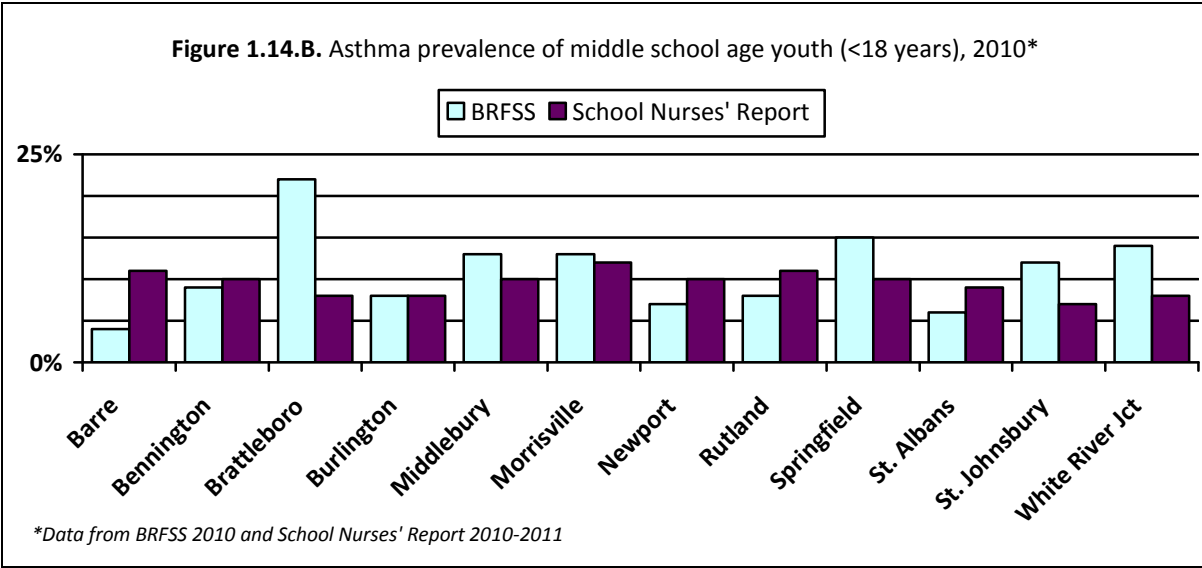
We see that for youth in high school, there were more regions that show discordance between the prevalence of current asthma in BRFSS and the prevalence of asthma according to the School Nurses' Report (figure 1.14.C). The largest discrepancies were seen in Bennington, Morrisville, Springfield, and White River Junction.

Figure 1.14.C. Asthma prevalence of high school age youth (<18 years), 2010*

□ BRFSS ■ School Nurses' Report

Data from BRFSS 2010 and School Nurses' Report 2010-2011
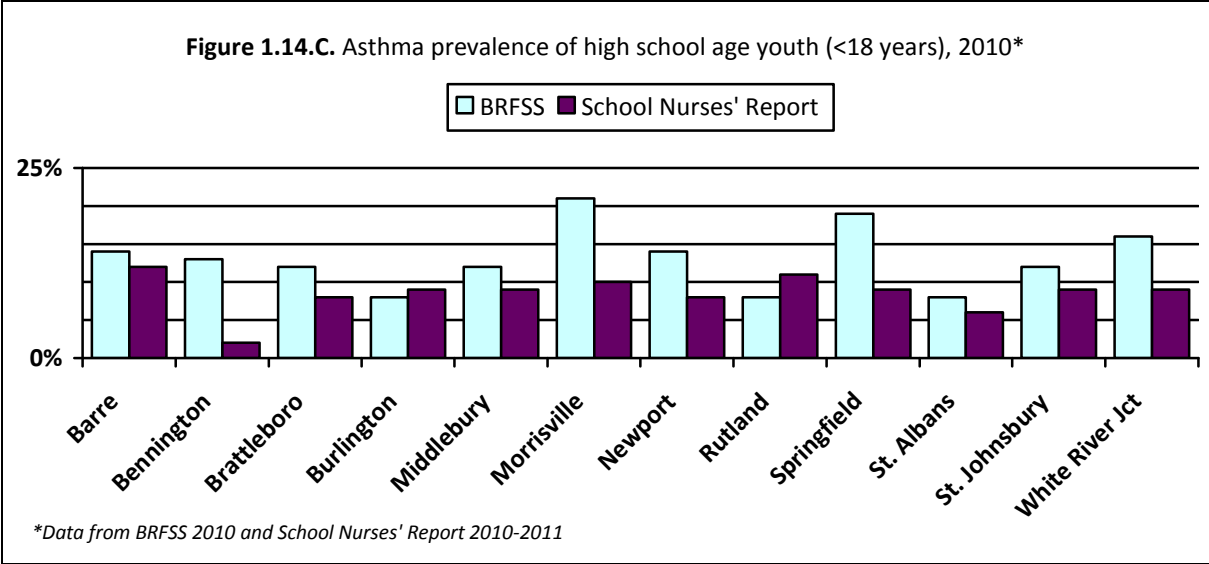
Again, the data leads us to believe that the School Nurses' Report underestimates the burden of asthma compared to the BRFSS data on current asthma by District Office region. However, this discrepancy may give some insight into the awareness schools have regarding the chronic conditions of their students and suggests areas where more communication between providers, parents, and schools could be beneficial.

Chapter 2—Quality of Life, Asthma Severity, and Asthma Control

In order to better understand the burden of asthma we must examine how asthma impacts the quality of an individual's life. Based on a variety of different questions from the Asthma Call Back Survey (ACBS), a follow-up phone survey conducted among those who report asthma on BRFSS, we can also classify Vermonters into more specific groups based on the severity and control of one's asthma. In this chapter we introduce how severity and control are assessed. In subsequent chapters of this document we discuss how various risk factors and exposures are associated with various levels of asthma control and severity.

Quality of Life Status

As a chronic respiratory condition, asthma is often associated with a number of physical limitations and can significantly affect one's overall quality of life. In this section we examine how those with asthma evaluate their overall health and describe day-to-day activity limitations.

General Health Status and Life Satisfaction

BRFSS respondents are asked how they would rank their general health and about their overall life satisfaction. There are some significant differences in one's general health status and life satisfaction among adult Vermonters with current asthma and those without asthma.

Adult Vermonters with current asthma were significantly more likely to rank their general health as poor or fair compared to those without asthma (figure 2.1). In addition, Vermont adults with current asthma were less likely to report that their general health was excellent compared to adult Vermonters without asthma.

Figure 2.1. General health status of adult Vermonters with and without current asthma, 2010*

Legend: ■ Current asthma ☐ No asthma

Category	Current asthma	No asthma
Excellent	14%	26%
Very good	33%	39%
Fair	15%	7%
Poor	7%	3%

*Data from BRFSS 2010

Figure 2.2. Life satisfaction of adult Vermonters with and without current asthma, 2010*

■ Current asthma □ No Asthma

6%   4%   3%   1%

Dissatisfied   **Very dissatisfied**

Data from BRFSS 2010

Nearly half of adult Vermonters that did not have current asthma reported that they were very satisfied with their life. Adult Vermonters with current asthma were significantly less likely to be very satisfied with their life. Furthermore, those with asthma were significantly more likely to be either dissatisfied or very dissatisfied with their life than those without asthma (figure 2.2).

Limitations due to Asthma

In 2010, the ACBS data showed that a third of adults with current asthma and more than half of youth with current asthma have their daily activity at least a little limited by their asthma (figure 2.3). Most importantly, these data show that fewer than half of adults and less than third of youth cannot carry out normal activity, as they wish, because of their asthma.

Figure 2.3. Self-reported activity limitations among Vermonters with current asthma, 2010*

□ Not limited   □ Limited a little   ■ Limited

	Adults	Youth
Limited	18%	11%
Limited a little	38%	60%
Not limited	44%	29%

Data from ACBS 2010
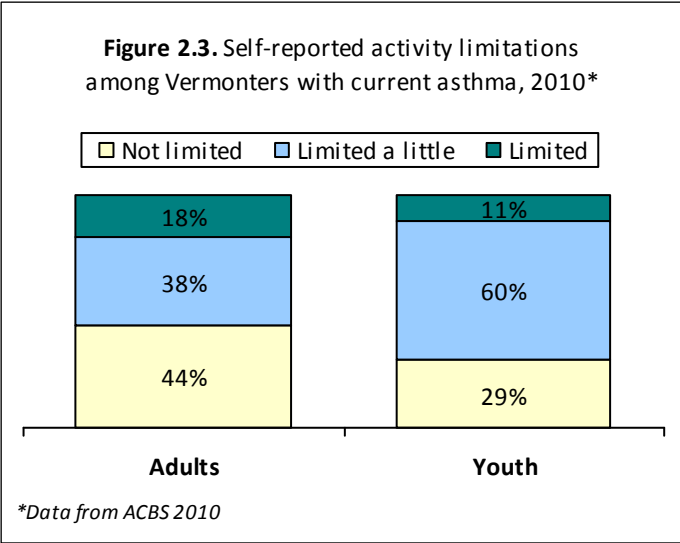
Mortality

Between 2000 and 2009, 74 Vermonters have died due to asthma. Asthma deaths were significantly more likely among females, 1.6 female deaths per 100,000, and among those over the age of 65, 5.5 deaths per 100,000. Between 2005 and 2009 the number of deaths caused by asthma has ranged from 7 to 9 individuals.

Asthma Severity

Indicators of Asthma Severity

According to Expert Panel Report 3 (EPR-3) guidelines from the National Heart, Lung, and Blood Institute (NHLBI), asthma severity should be clinically assessed at the initial diagnosis, prior to the initiation of any controller medications [1]. Data gathered from the following questions on the ACBS coincide with the NHLBI guidelines and may be used to assess asthma severity:

- Self-reported visits to the Emergency Room or an Urgent Care Center in the previous year,
- Number of days an individual had to miss school, work, or day care or could not carry out usual activities in the previous year,
- The number of days an individual experienced asthma symptoms in the last month, and
- The number of nights that asthma symptoms made it difficult to sleep in the previous month.

Adults

In 2010, one out of ten adults in Vermont with current asthma reported they visited an emergency room or an urgent care center at least once in the previous year for their asthma. A quarter of adults with current asthma reported they could not go to work or could not carry out their normal activities because of asthma symptoms on at least one day in the previous year. More than half of adult Vermonters with current asthma reported that they had experienced at least one day with asthma symptoms in the previous month; 14% of these individuals reported experiencing asthma symptoms at least once a day. One out of five adults with current asthma reported their asthma made it difficult for them to sleep on at least one night in the previous month.

Youth

Based on parent-reported data, one out of ten young Vermonters with current asthma required at least one emergency room or urgent care visit for treatment of asthma symptoms in the previous year. Slightly less than half of youth missed at least one day of school due to asthma symptoms in the previous year. Less than half of youth with current asthma experienced at least one day with asthma symptoms in the previous month and only one in five experienced asthma symptoms that disrupted their sleep.

Method for Assessing Asthma Severity

Asthma severity is calculated by stratifying each indicator into four levels of severity—mild intermittent, mild persistent, moderate persistent, and severe persistent. Table 2.1 shows how the four individual indicators from the ACBS are classified to assess asthma severity.[‡] The most severely classified indicator determines the overall severity for an individual. For example, if an individual has asthma that classifies as mild intermittent for three of the four indicators and has one indicator that classifies as moderate persistent, the individual's overall severity status will be considered moderate persistent.

Table 2.1. Classification of asthma severity from the Asthma Call Back Survey 2010 according to NHLBI guidelines

Indicators	Mild Intermittent	Mild Persistent	Moderate Persistent	Severe Persistent
	% Vermont adults with Asthma*			
Self-reported visits to the emergency department or urgent care center	*None*	*1-2 visits*	*3-6 visits*	*7 or more visits*
	90	*9*	*1*	*0*
Number of days one had to miss/school/day care/work or could not carry out usual activities	*None*	*1-5 days*	*6 to 75 days*	*75 days or more*
	74	*17*	*8*	*1*
Days with asthma symptoms in the last month	*8 days or less*	*9-29 days*	*Every day BUT not all day*	*Every day AND All day*
	67	*19*	*6*	*8*
Number of nights that asthma symptoms made it difficult to sleep in the last month	*0-2 nights*	*3-4 nights*	*5-10 nights*	*More than 11 nights*
	83	*7*	*5*	*5*
*Only adult numbers can be listed due to limited number of youth in stratified categories				

The individual indicators of asthma severity for adult Vermonters with current asthma are presented according to their severity classification in Table 2.1. (Due to small samples sizes in the stratified categories, this information cannot be presented for youth with asthma in Vermont). Each individual indicator's contribution to the final prediction of severity gives us some perspective on what is causing people to appear in the most severe classifications of asthma. The factor that most heavily contributed to cases of severe persistent asthma in adult Vermonters was the number of days with asthma symptoms in the last month. In other words, 8% of adults with current asthma experienced asthma symptoms all day and every day during the previous month, which means their asthma would be classified as severe persistent.

[‡] It is important to note that the methods used for determining severity with the ACBS do not take into account the use of long term controller medications. Thus, the assessment of impairment and risk using this method may underestimate the true level of asthma severity.

Emergency department (ED) and urgent care visits did not contribute to any cases of severe persistent asthma. Based on just ER data, 90% of adult Vermonters with current asthma meet the classification for mild intermittent asthma.

Asthma Severity Estimation

Asthma severity can be estimated by combining individual indicators introduced in the previous section. About half of adult Vermonters with asthma had cases that were classified as having mild intermittent asthma in 2010 (figure 2.4). Nearly a quarter of adults had asthma classified as mild persistent. Another quarter of Vermonters were classified as having either moderate persistent or severe persistent asthma.

Figure 2.4. Asthma severity among Vermonters with current asthma, 2009-2010*,**

Mild intermittent | Mild persistent
Moderate persistent | Severe persistent

Adults *
10%
13%
24%
53%

Youth**
16%
31%
49%

* Data from ACBS 2010
** Data from ACBS 2009 and ACBS 2010
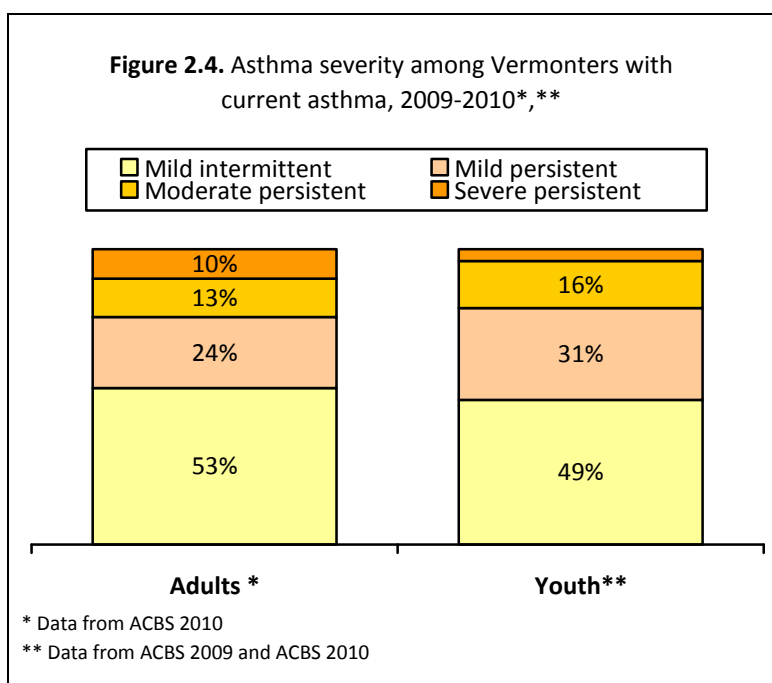
Based on ACBS data from 2009 and 2010 approximately half of young Vermonters with current asthma had mild intermittent asthma and nearly a third had mild persistent asthma. One out of five young Vermonters with current asthma had either moderate persistent or severe persistent asthma.

In table 2.1, where we presented the percent of adults reporting the levels of severity according to each independent indicator of severity, more than two-thirds of adults typically appeared in the mild intermittent category. However, when we account for all four indicators combined, about half of individuals had asthma classified as mild intermittent asthma. This reinforces the robust nature of analyzing indicators independently and supports our method of using a combined measure for the examination of asthma severity.

Asthma Control

Indicators of Asthma Control

Similar to asthma severity, the NHLBI has made recommendations on how to assess asthma control and management in the based on the degree to which symptoms, functional impairments, and asthma risks are minimized and the goals of asthma therapy are met [1]. Using the ACBS, asthma control is assessed using information from the following questions:

- The number of days an individual experienced asthma symptoms in the last month,
- The number of nights that asthma symptoms made it difficult to sleep in the previous month, and
- Short-acting Beta Agonist (SABA) inhaler use in the previous three months.

Adults

Two of the three indicators used to assess control are also used in the severity assessment. When severity was discussed in the previous section, we noted that more than half of adult Vermonters with current asthma reported that they had experienced at least one day with asthma symptoms in the previous month and more than one in ten of them reported experiencing asthma symptoms at least once a day. One out of five adults with current asthma reported that on at least one night in the previous month their asthma made it difficult for them to sleep. Approximately two-thirds of those with current asthma reported using some type of SABA inhaler as a rescue medication in the last three months.

Youth

Earlier, when daytime and nighttime symptoms among young Vermonters with current asthma were discussed in regards to severity, we noted that fewer than half experienced symptoms on one day in the previous month and only one in five experienced asthma symptoms that disrupted their sleep. Nearly three-quarters of youth have used a SABA inhaler as a rescue inhaler for the treatment of asthma symptoms in the previous three months.

Methods for Assessing Asthma Control

With the data provided by the ACBS we can assess symptoms, function impairments, and risks of unwanted events related to asthma. Unlike severity, age is a consideration when assessing how to classify nighttime symptoms for asthma control. Also, the use of a SABA inhaler is limited to those that use the SABA inhaler as a rescue medication. Thus, use of a SABA inhaler prior to exercise, which is not also used in the case of an asthma attack, does not contribute to

the overall SABA usage for an individual. Table 2.2 lists the aspects from the ACBS used for assessing control. As with severity, the least controlled indicator predicts the overall control for each individual. Thus, if an individual reports that they have had one day and one night of asthma symptoms, but they use their SABA inhaler twice a day, they will be noted as having poorly controlled asthma.[§]

Table 2.2. Classification of asthma control from the Asthma Call Back Survey 2010 according to NHLBI guidelines				
Indicator		**Well controlled**	**Not well controlled**	**Poorly controlled**
		% Adult Vermonters with Asthma*		
Asthma symptoms in the last month		*8 or fewer days with asthma symptoms*	*9 to less than 30 days with symptoms* *OR* *30 days of symptoms, but symptoms were not all day*	*Symptoms every day in last month that lasted throughout the day*
		67	25	8
Asthma making it difficult to sleep in the last month	0-4 years	*0-1 nights*	*2-4 nights*	*5 or more nights*
	5-11 years	*0-1 nights*	*2-8 nights*	*9 or more nights*
	≥ 12 years	*0-2 nights*	*3-12 nights*	*13 or more nights*
		86	10	4
SABA Inhaler usage (times per day)**		*Less than 0.29 times per day* *(≈ twice a week)*	*0.29< times <2 per day*	*2 or more times per day*
		82	10	8
*Only adult numbers can be listed due to number of individuals in stratified categories ***SABA inhaler usage is limited to use as a rescue inhaler only, use prior to exercise is not included in this calculation*				

Table 2.2 also shows that the three indicators used to assess control each contribute to the overall level of control in a slightly different way. (Due to the small numbers in these stratified categories, this data cannot be presented for youth). About two-thirds of Vermonters with current asthma experienced fewer than eight symptom days in the previous month. Nearly a quarter of those with current asthma experienced symptoms on at least nine days in the previous month, classifying many adults with asthma as 'not well controlled'. If asthma control was solely classified on asthma symptoms making it difficult to sleep, most adult Vermonters (86%) would have asthma that is classified as well controlled and fewer would have asthma

[§] The method for assessing control has recently changed to better reflect the current EPR-3 guidelines. This is the first publication showing the new method for assessing control. Previous methods for assessing control do not account for SABA use prior to exercise and tended to underestimate the number of individuals with well controlled asthma.

classified as either 'not well' or 'poorly' controlled. Nearly one in five adults reported using their SABA inhaler at least twice a week, and 8% reported needing it at least twice a day.

Asthma Control Estimation

We can estimate asthma control by accounting for all three individual asthma control indicators introduced in the previous section. Slightly more than half of young and adult Vermonters with current asthma had well controlled asthma according to 2010 data (figure 2.5). Approximately a quarter of adult Vermonter had asthma classified as 'not well' controlled and 14% had asthma that was classified as 'poorly' controlled. Based on parent responses, one in five youth had asthma that was classified as 'not well' controlled and another one in five classified as 'poorly' controlled.

Figure 2.5. Asthma control among Vermonterss with current asthma, 2010*

Legend: Well controlled | Not well controlled | Poorly controlled

Adults: 13% Poorly controlled, 29% Not well controlled, 58% Well controlled

Youths (<18 years): 19% Poorly controlled, 23% Not well controlled, 59% Well controlled

*Data from ACBS 2010
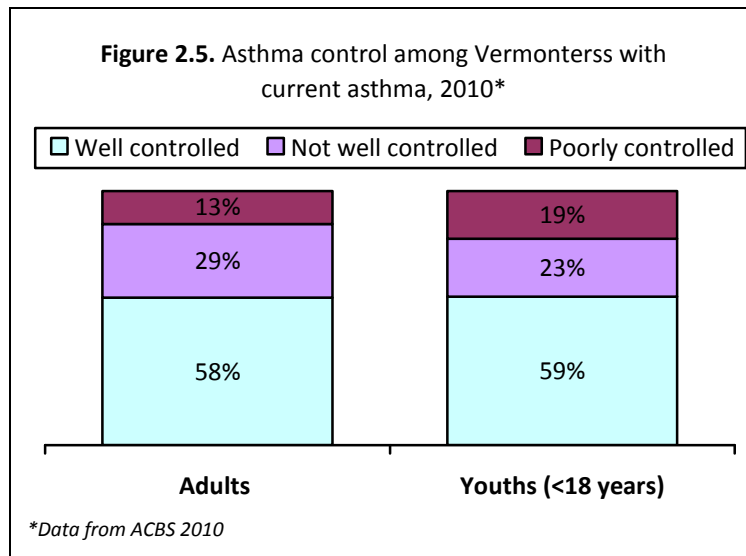
As presented in table 2.2, at least two-thirds of adults have asthma that is considered well controlled according to each independent indicator. However, when we take all three indicators into consideration we find that only 58% of adults have well controlled asthma. Thus, while individuals may have one indicator well controlled, it is not correct to assume this will carry over to the other two equally critical indicators. This verifies the need to use a combined measure when assessing asthma control.

Asthma Control by Level of Asthma Severity

One would assume that the more severe one's asthma the less likely one would be able to keep their asthma well controlled (figure 2.6). There are some dramatic changes as we move across the spectrum of severity from mild intermittent asthma toward severe persistent asthma. Nine out of ten adults in Vermont with mild intermittent asthma have well controlled asthma. This is significantly better than any other level of severity. One a third of these individuals with mild persistent asthma have well controlled asthma. One in ten individuals with moderate to severe asthma have well controlled asthma. Very few individuals with severe persistent asthma have well controlled asthma and they are significantly more likely than any other level of asthma severity to have poorly controlled asthma. Unfortunately, the number of individuals in each stratum is too small to perform this analysis among Vermonters less than 18 years of age.

Figure 2.6. Level of asthma control by level of asthma severity among adult Vermonters with current asthma, 2008-2010*

Legend: ■ Well controlled □ Not well controlled ■ Poorly controlled

Mild intermittent: 89% (Well controlled)
Mild persistent: 29% (Well controlled), 58% (Not well controlled), 13% (Poorly controlled)
Moderate persistent: 11% (Well controlled), 75% (Not well controlled), 14% (Poorly controlled)
Severe persistent: 91% (Poorly controlled)

Data from ACBS 2008-2010

Chapter 3- Demographic and Biological Risk Factors

Asthma can be affected by a variety of demographic and biological risk factors. In addition to examining the association between common risk factors and the prevalence of current asthma, we also chose to look at how various risk factors affect asthma severity and the ability to control one's asthma. Throughout this chapter the frequencies of risk factors are examined among all of those with current asthma and stratified by asthma severity and control.

Demographic Risk Factors

As noted in Chapter 1, current asthma is more prevalent among those with lower annual household incomes, lower levels of education, and those who are unemployed or unable to work. Research has suggested that these demographic factors be considered risk factors for asthma and in some cases more severe asthma [5, 7, 11, 13-16].

Level of Education

The level of education attained by an adult did not significantly differ between adult Vermonters with current asthma and those without asthma (figure 3.1). Though it is noted as being a demographic risk factor for current asthma in the literature [5], our most recent BRFSS data does not show a similar trend among Vermonters.

However, more severe levels of asthma are seen among those with less education (figure 3.2). Mild intermittent asthma was significantly more likely among adult Vermonters who attended college and among those who graduated from college. Adult Vermonters who have no more than a high school diploma were significantly more likely to have severe persistent asthma compared to all other education levels.

Figure 3.1. Level of education attained among adult Vermonters with and without current asthma, 2010*

■ Current asthma □ No asthma

- ≤HS diploma: 41% (Current asthma), 36% (No asthma)
- Some college: 25% (Current asthma), 24% (No asthma)
- College graduate: 34% (Current asthma), 40% (No asthma)

*Data from BRFSS 2010

Figure 3.2. Asthma severity by level of education among adult Vermonters with current asthma, 2008-2010*

Legend:
- Mild intermittent
- Mild persistent
- Moderate persistent
- Severe persistent

	≤HS diploma	Some college	College graduate
Severe persistent	23%	10%	
Moderate persistent	23%	13%	10%
Mild persistent	17%	23%	23%
Mild intermittent	37%	54%	62%

* Data from ACBS and BRFSS 2008-2010

Consistent with existing research [5], lower levels of education were associated with less controlled asthma. In general, as an individual's level of education increases so does asthma control (figure 3.3). Those with no more than a high school diploma were significantly more likely to have poorly controlled asthma compared to those who attended college and those who graduated from college.
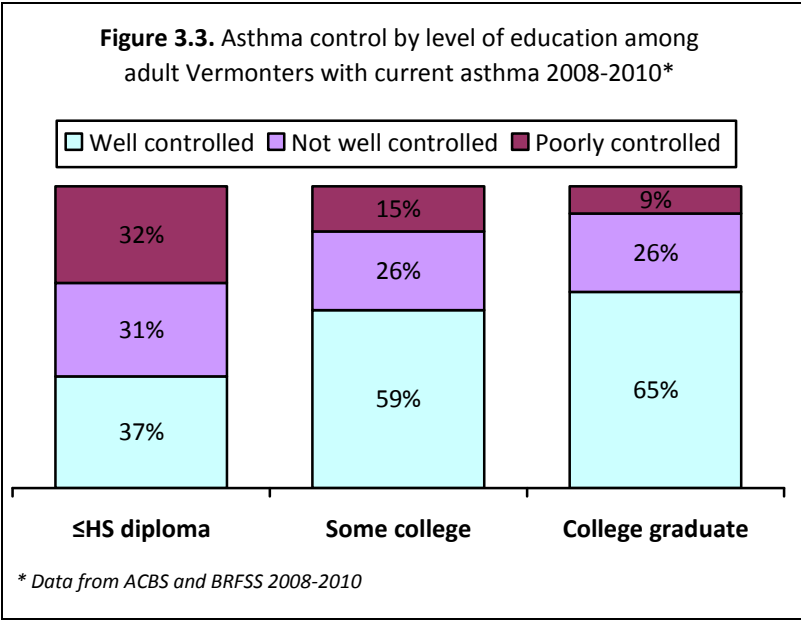
Figure 3.3. Asthma control by level of education among adult Vermonters with current asthma 2008-2010*

Legend:
- Well controlled
- Not well controlled
- Poorly controlled

	≤HS diploma	Some college	College graduate
Poorly controlled	32%	15%	9%
Not well controlled	31%	26%	26%
Well controlled	37%	59%	65%

* Data from ACBS and BRFSS 2008-2010

Adult Vermonters with current asthma were significantly more likely to report an annual household income below 125% of the FPL in 2010 than those without asthma (figure 3.4). Furthermore, those with current asthma were significantly less likely to report an income greater than 350% of the FPL when compared to those without asthma. According to our most recent data, it appears that annual household income with respect to FPL is a risk factor for current asthma among Vermonters.

Figure 3.4. Annual household income of adult Vermonters with and without current asthma, 2010*

Data from BRFSS 2010
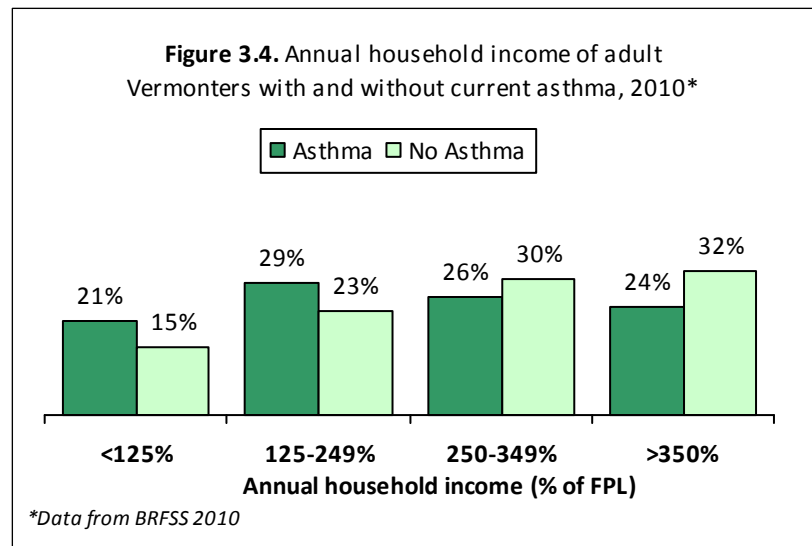
The burden of asthma within each income group can be more closely examined after we stratify by the four levels of severity. Those with current asthma reporting an annual household income less than 125% of the FPL were significantly more likely to have more severe asthma compared to those with annual household incomes between 125% and 249% and those with annual household incomes above 350% of the FPL (figure 3.5). Those who reported annual household incomes in the three brackets above 125% were significantly more likely to report mild intermittent asthma than those below 125% of the FPL.

Figure 3.5. Asthma severity by annual household income among adult Vermonters with current asthma, 2008-2010*

Data from ACBS and BRFSS 2008-2010
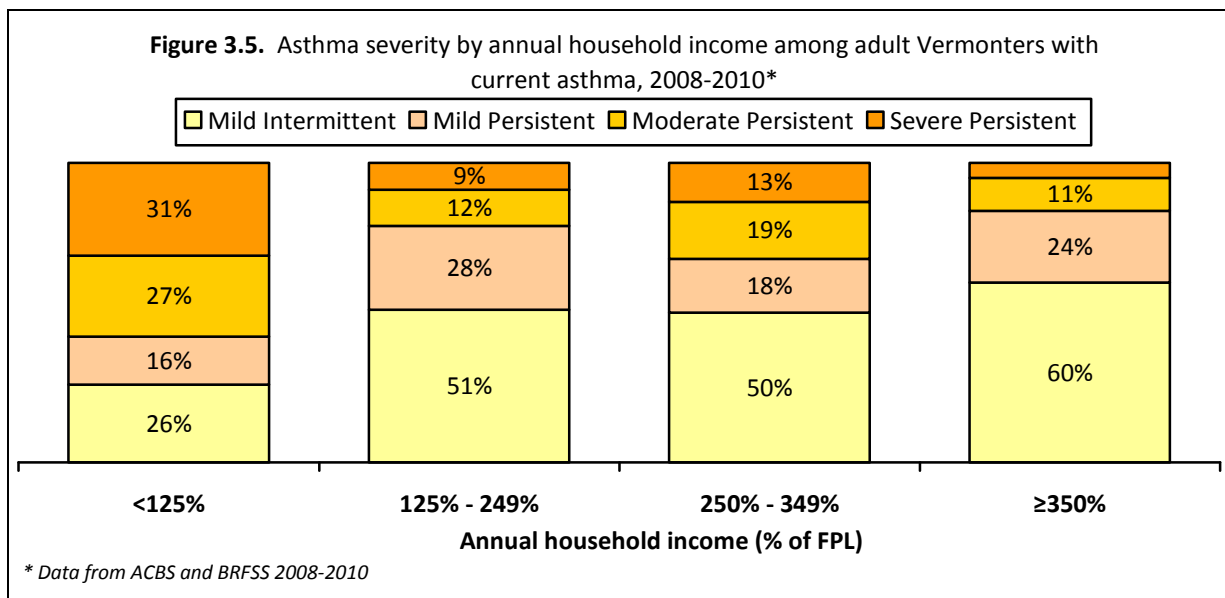
We can also assess the overall impact of asthma by examining asthma control by household proximity to the FPL. The trend in asthma control, based on one's proximity to the FPL, is complicated as the similarities in asthma seem to skip over certain FPL brackets (figure 3.6). A third of those reporting an annual household income below 125% of the FPL have well controlled asthma, and another two out of five adults in this annual household income group have poorly controlled asthma.

This differs significantly from all other income brackets except for those with annual household incomes between 250% and 349% of the FPL. Surprisingly, those between 125% and 249% of the FPL and those with annual household income above 350% of the FPL look more similar to each other than the income bracket they encompass. In fact, those making less than 125% of the FPL and those making 250% to 349% of the FPL are significantly more likely to have poorly controlled asthma than those making more than 350% of the FPL.

Figure 3.6. Asthma control by annual household income among adult Vermonters with current asthma, 2008-2010*

Legend: Well Controlled, Not Well Controlled, Poorly Controlled

Annual household income (% of FPL)	Well Controlled	Not Well Controlled	Poorly Controlled
<125%	32%	29%	39%
125%-249%	57%	30%	13%
250%-349%	50%	25%	25%
>350%	60%	30%	10%

Data from ACBS and BRFSS 2008-2010
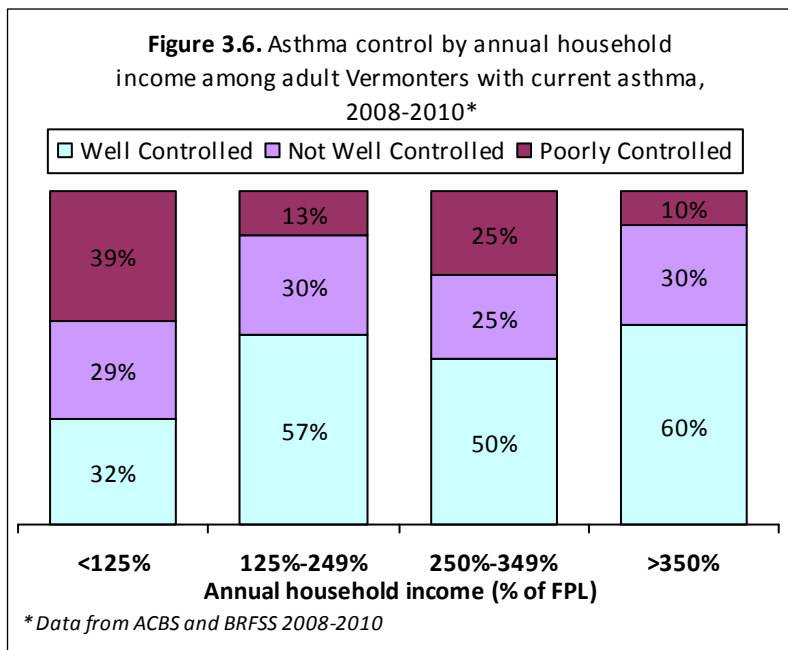
It is not entirely clear why we are seeing this pattern of asthma control. However, we speculate that some of the individuals in the 250% to 349% income bracket have annual household incomes that fall short of the Medicaid requirement and they may not be able to access the care they need on a consistent basis to improve their asthma control.

Employment Status

More than half of adult Vermonters with current asthma reported that they were currently employed. However, they were significantly more likely to report being unemployed or unable to work than those without asthma (figure 3.7). Those with asthma were also significantly less likely to be employed. One in ten adult

Figure 3.7. Employment status among adult Vermonters with and without current asthma, 2010*

Legend: Current asthma, No asthma

	Current asthma	No asthma
Employed	58%	64%
Not working*	24%	27%
Unemployed	9%	5%
Unable to work	9%	4%

Data from BRFSS 2010
**Not Working includes homemakers, students, and retired*
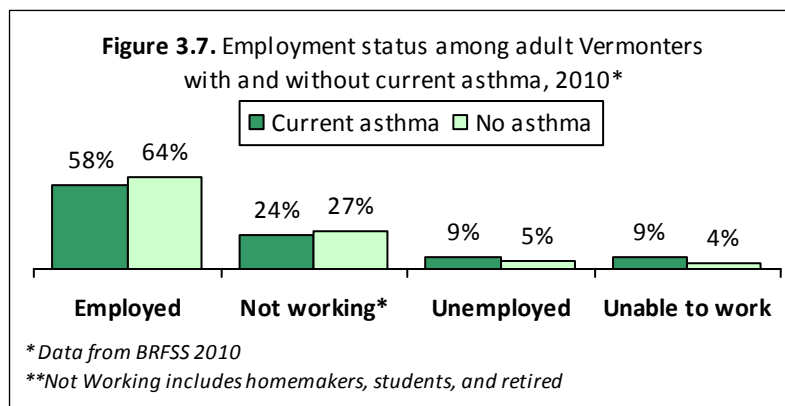
Vermonters with current asthma were unemployed or unable to work in 2010. It is not clear whether asthma or another condition prohibited them from working.

More than half of employed Vermonters with current asthma had mild intermittent asthma and less than one in ten had severe and persistent asthma (figure 3.8). Those that report they are unable to work were significantly more likely to asthma classified as severe persistent and less likely to have asthma classified as mild intermittent compared to those with current asthma who were employed. More than half of the adults that reported they were unable to work had asthma that was classified as moderate to severe persistent. This suggests that asthma may likely serve as a barrier to gaining or maintaining employment for some individuals. Individuals that currently choose not to work and those that are unemployed did not significantly differ from any of the other employment statuses.

Figure 3.8. Asthma severity by employemnt status of adult Vermonters with current asthma, 2008-2010*

Legend: Mild intermittent, Mild persistent, Moderate persistent, Severe persistent

Employed: 55%, 21%, 15%, 9%
Not working**: 43%, 15%, 18%, 24%
Unemployed: 49%, 22%, 16%, 13%
Unable to work: 21%, 20%, 24%, 35%

*Data from ACBS and BRFSS 2008-2010
**Not Working includes homemakers, students, and retired

Figure 3.9. Asthma control by employment status of adult Vermonters with current asthma, 2008-2010*

Legend: Well controlled, Not well controlled, Poorly controlled

Employed: 59%, 27%, 14%
Not working**: 42%, 29%, 29%
Unemployed: 47%, 31%, 22%
Unable to work: 34%, 21%, 45%

*Data from ACBS and BRFSS 2008-2010
**Not Working includes homemakers, students, and retired

Among Vermonters with current asthma, those who were employed and those that were unable to work significantly differed in regards to asthma control (figure 3.9). More than half of employed Vermonters had well controlled asthma compared to one third of those with asthma who reported being unable work. Almost half of those unable to work have poorly controlled asthma, which is significantly higher than the 14% of those that are employed.

Those who are unable to work were more likely to have asthma that is classified as severe and were also more likely to have asthma that is poorly or not well controlled. The exact barriers to asthma control among those unable to work needs to be investigated further.

Adverse Childhood Experiences (ACE)

Based on emerging literature [14, 15, 17, 18], there is evidence to suggest adverse childhood experiences (ACE) can influence disease later in life. In 2010, there were several questions on the BRFSS that asked about the following ACE:

- Living with someone who was depressed, mentally ill, or suicidal;
- Living with anyone who was a problem drinker or alcoholic;
- Living with anyone who used illegal street drugs or who abused prescription medications;
- Living with anyone who served time or was sentenced to time in a prison, jail, or other correctional facility;
- Living in a home where adults physically abused one another;
- Having parents who are divorced;
- Being physically abused by one's parent or an adult in one's home;
- Being verbally abused by one's parent or an adult in one's home; and
- Experiencing some form of sexual abuse.

There were some significant differences between those with asthma and those without asthma in regards to how many ACE an individual reported (figure 3.10). In general, those with current asthma were more likely to report ACE, the only statistically significant difference was among those who reported four or more ACE.

Figure 3.10. Adverse childhood experiences (ACE) among adult Vermonters with and without current asthma, 2010*

*Data from BRFSS 2010
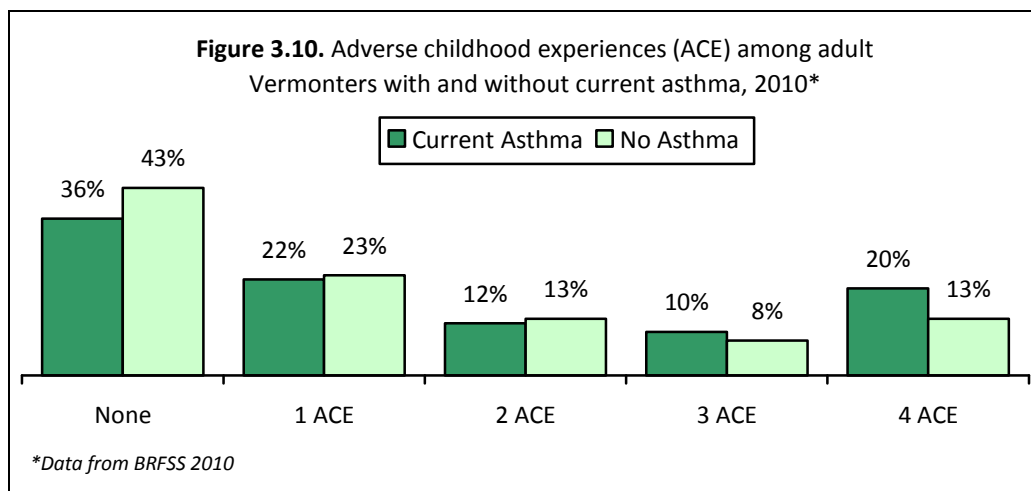
When asthma was further stratified into levels of severity and control there were no significant differences in the proportions in each level by the number of ACE (data available in appendix).

However, this analysis is bases on only one year of data on ACE. In the future, when we can accumulate more years of data, we plan to complete more analyses with ACE data and look for emergent patterns in asthma severity and asthma control.

Co-occurring Chronic Conditions as Biological Risk Factors

Recommendations from the National Heart, Lung and Blood Institute (NHLBI) state that patients who do not have well controlled asthma should be evaluated for other chronic comorbid conditions [1]. Though we cannot assess all chronic conditions outlined in the EPR-3 guidelines, we can assess some conditions and can examine this concept more broadly by evaluating how many chronic conditions are present in addition to asthma.

Individual Chronic Conditions and Current Asthma

Figure 3.11 shows the prevalence of specific chronic health conditions among those with current asthma and those who did not have asthma. Vermonters with current asthma were nearly three times as likely to report having depression and five times more likely to report chronic obstructive pulmonary disease (COPD) than Vermonters without asthma. Adult Vermonters with current asthma were also significantly more likely to report arthritis, obesity, and diabetes.

Figure 3.11. Co-occuring chronic conditions among adults with and without current asthma in Vermont, 2010*

Current asthma   No Asthma

Condition	Current asthma	No Asthma
Arthritis	41%	27%
Obese	35%	23%
Depression	17%	6%
COPD	10%	2%
Diabetes	10%	6%
CVD	8%	7%
Cancer	7%	6%

*Data from BRFSS 2010
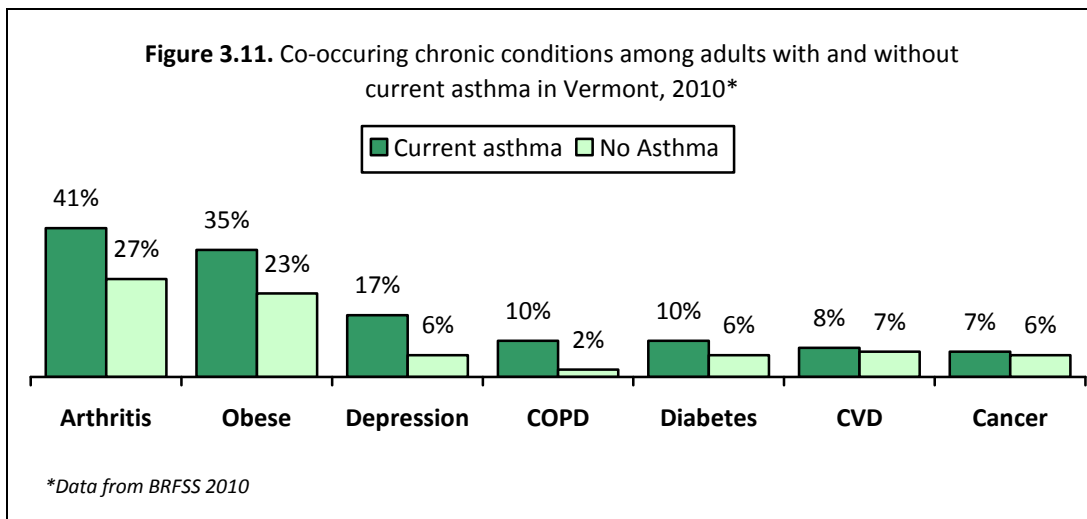
Presence of Multiple Chronic Conditions

A number of chronic health conditions can be analyzed using the BRFSS.[**] It is important to take into account the total number of chronic conditions present when examining other individual chronic conditions in addition to asthma. In a clinical setting, a number of indexes including the Charlson Index, takes into account various chronic conditions in calculating overall morbidity [19].

While we cannot assess all of the relevant information needed to fully utilize these indexes, we are able to take the preliminary step of identifying those with numerous chronic conditions (figure 3.12). Adult Vermonters who did not currently have asthma were significantly more likely to report that they did not have any other chronic conditions. More than half of those that did not have asthma also did not have any other chronic condition measured on BRFSS. In contrast, adults with asthma were significantly more likely to have one, two and even three or more co-occurring chronic conditions than those that did not have asthma.

Figure 3.12. Co-occuring conditions among adults with and without current asthma in Vermont, 2010*

Legend: Current asthma / No asthma

None: 49%, 62%
One: 32%, 28%
Two: 14%, 8%
Three or more: 6%, 2%

Number of co-occuring chronic conditions, in addition to current asthma

*Data from BRFSS 2010

As the number of chronic conditions present increases so does the likelihood of having severe persistent asthma (figure 3.13). More than half of adult Vermonters with current asthma and no other chronic conditions had mild intermittent asthma. Adult Vermonters with current asthma and two or more additional chronic conditions were significantly less likely to
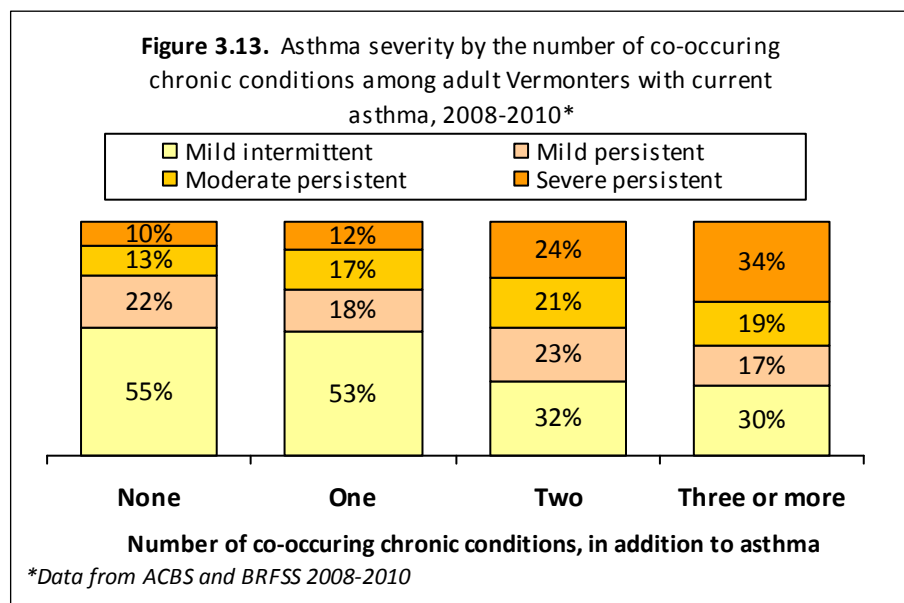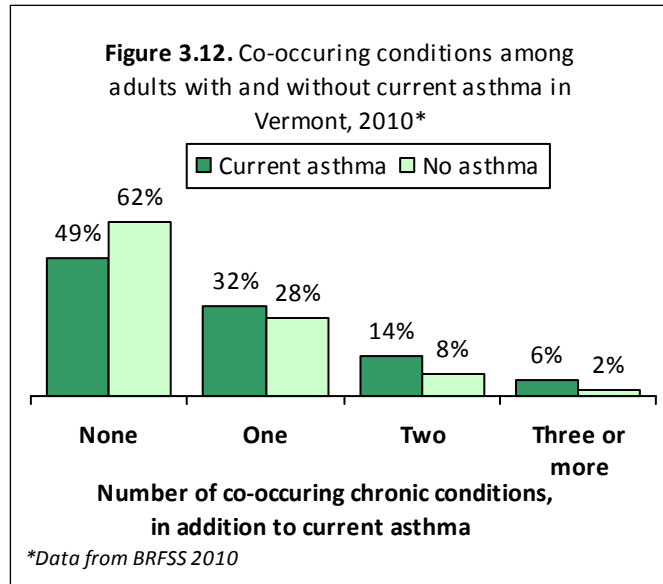
Figure 3.13. Asthma severity by the number of co-occuring chronic conditions among adult Vermonters with current asthma, 2008-2010*

Legend: Mild intermittent / Mild persistent / Moderate persistent / Severe persistent

None: 55%, 22%, 13%, 10%
One: 53%, 18%, 17%, 12%
Two: 32%, 23%, 21%, 24%
Three or more: 30%, 17%, 19%, 34%

Number of co-occuring chronic conditions, in addition to asthma

*Data from ACBS and BRFSS 2008-2010

[**] *Chronic conditions measured include: moderate to severe depression, cardiovascular disease, obesity, diabetes, and cancer in 2010. Arthritis was measured in 2009 and COPD was measured in 2008.*

have mild intermittent asthma than those with one or less chronic conditions. Those with current asthma and three or more additional chronic conditions were significantly more likely to have severe persistent asthma than those with one or less co-occurring chronic conditions.

The likelihood of well controlled asthma decreased as the number of co-occurring chronic conditions in addition to asthma increased (figure 3.14). Adult Vermonters with current asthma and two or more co-occurring chronic conditions were significantly less likely to have well

controlled asthma than those without any co-occurring chronic conditions. In fact, close to half of those with three or more co-occurring chronic conditions had poorly controlled asthma. The likelihood of well controlled asthma begins a dramatic decline to less than half with well controlled asthma with the addition of one co-occurring chronic condition; though these two groups did not significantly differ from one another. At the point that an individual with asthma had more than two chronic conditions, only a third had well controlled asthma.

Figure 3.14. Asthma Control by the number of co-occuring chronic conditions among adult Vermonters with current asthma, 2008-2010*

☐ Well controlled ☐ Not well controlled ■ Poorly controlled

Number of co-occuring chronic conditions, in addition to asthma

Data from ACBS and BRFSS 2008-2010
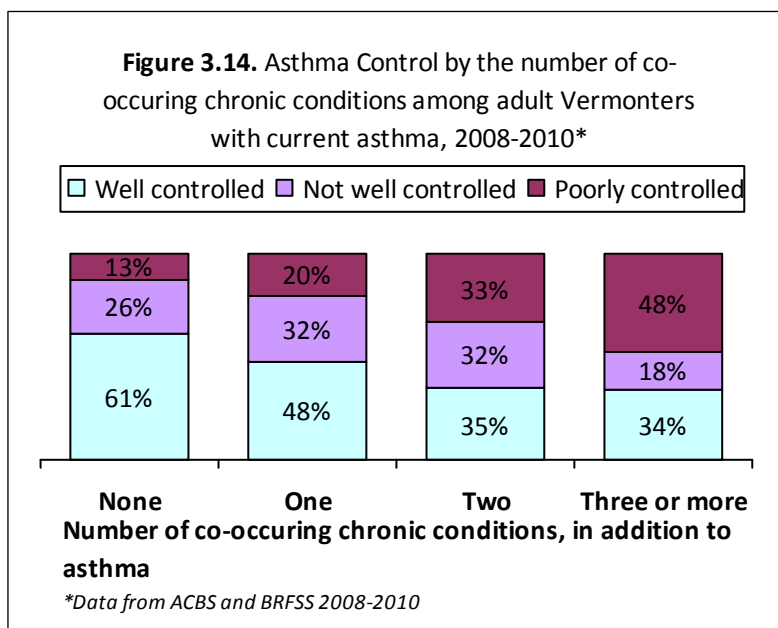
While these analyses are simplistic and do not account for all of the specific co-occurring chronic conditions mentioned in the EPR-3, the NHLBI recommendation to evaluate those with uncontrolled asthma is well supported by Vermont's data.

Influenza and Pneumonia Immunizations

Adults

It is recommended that all individuals with current asthma receive an annual influenza vaccine [1]. Between 2006 and 2010, Vermont adults with current asthma were significantly more likely to be vaccinated for influenza than those without asthma (figure 3.15). The proportion of individuals with an annual influenza vaccination and the proportion of those who have ever received a pneumonia vaccination *(data not shown)* among adult Vermonters with current asthma remained relatively unchanged since 2007.

In 2010, more than half (54%) of all adults with current asthma were vaccinated for influenza (figure 3.16). However, when adults were stratified into two age categories, those age 18 to 64 years and those age of 65 years and over, there were some significant differences in the proportion of individuals who received recommended vaccinations. Adults between the ages of 18 and 64 with current asthma were significantly more likely to receive an influenza vaccine than those without asthma in the same age group. Influenza vaccination did not significantly differ between adults age of 65 years and older with current asthma and those without asthma.

The Centers for Disease Control recommends that both children [21] and adults [20] with asthma receive a vaccine for pneumonia. Nearly half, 42%, of all adults with current asthma reported receiving a vaccine for pneumonia (figure 3.17). While only about a third of adults 18 to 64 years of age with current asthma received the pneumonia vaccine, nearly nine out of ten Vermonters over age 65 years and older with current asthma were vaccinated for pneumonia in

Figure 3.15. Influenza vaccination among adult Vermonters with and without current asthma, 2006-2010*

Current asthma: 43% (2006), 54% (2007), 50% (2008), 54% (2009), 54% (2010)
No asthma: 32% (2006), 38% (2007), 39% (2008), 40% (2009), 42% (2010)
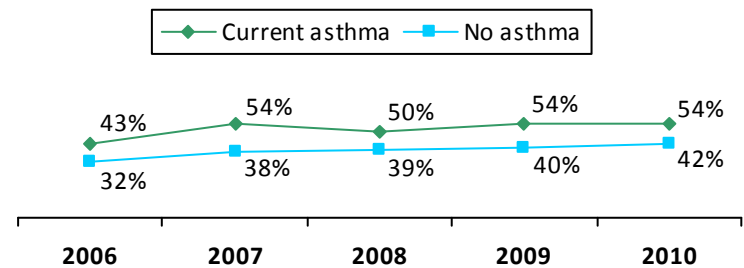
Data from BRFSS 2006-2010

Figure 3.16. Influenza vaccination in the previous year among adult Vermonters with and without current asthma, 2010*

Current asthma / No asthma:
All Adults: 54% / 43%
18-64 yrs: 50% / 36%
≥65 yrs: 76% / 71%
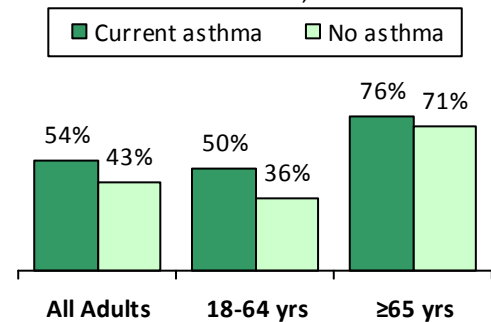
Data from BRFSS 2010

Figure 3.17. Pneumonia vaccination in adult Vermonters with and without current asthma, BRFSS 2010*

Current asthma / No asthma:
All Adults: 42% / 26%
18-64 yrs: 34% / 14%
≥65 yrs: 87% / 72%
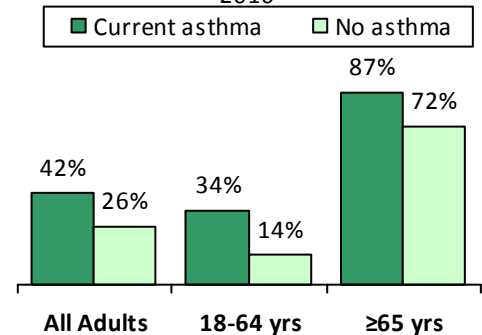
Data from BRFSS 2010

2010. Pneumonia vaccinations were significantly more likely among those with current asthma in both age categories. However, only a third of those with current asthma between the ages of 18-64 years received a pneumonia vaccine. This suggests that statewide guideline adherence to immunization recommendations could improve, especially for adults between the ages of 18 and 64.

Youth

Approximately three-quarters of young Vermonters, 17 years of age or younger, with current asthma were vaccinated for influenza in 2010. Though the number of young Vermonters with current asthma who receive an influenza vaccination has increased over the last several years, the upward trend is not statistically significant (figure 3.18). Unfortunately, we do not have information on pneumonia vaccinations among children with asthma.

Figure 3.18. Influenza Vaccination among young Vermonters (<18 years) with current asthma, 2006-2010*

45%   46%   56%   54%   73%

2006   2007   2008   2009   2010

Data from ACBS 2006-2010
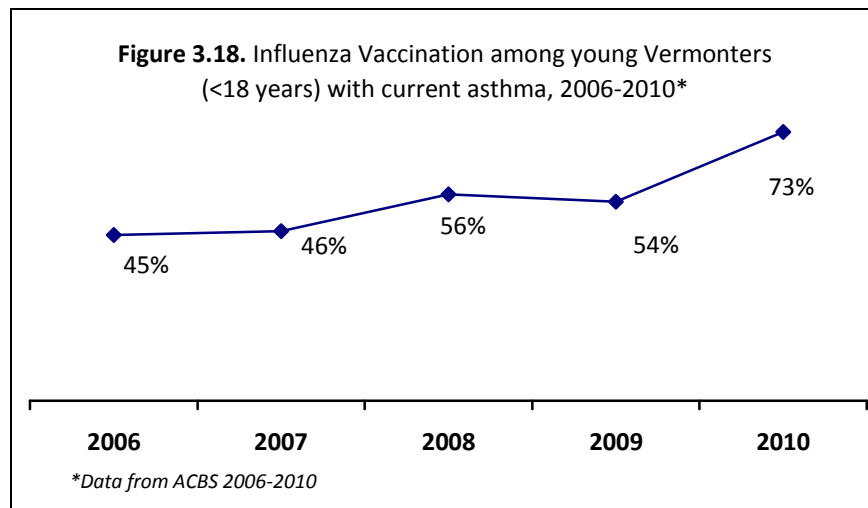
Chapter 4—Environmental Risk Factors

In Chapter 3, demographic factors and co-occurring chronic conditions were examined as risk factors for current asthma. The current NHLBI guidelines also recommend evaluating environmental triggers, allergens, and irritants for all asthma patients [1]. This includes assessing exposure to smoke (both personal use and exposure associated with others smoking in the same area), dust mites, animal dander, indoor pests (cockroaches and rodents), mold, and pollen. In this chapter, we look at how various environmental exposures impact Vermonters with current asthma. For this analysis tobacco smoke is broken into two categories—current smoking status and exposure to secondhand smoke (SHS). We examine how environmental triggers at home impact asthma. Lastly, we will examine the role of the work environment among adult Vermonters with current asthma.

Smoking Status and Exposure

Tobacco smoke can be examined as a personal risk factor by looking at an individual's current and past smoking status. It can also be examined as an environmental risk factor by looking at tobacco smoke exposure in one's home. We start by looking at current smoking status and then broaden our scope by looking at environmental exposure to smoke in the home while still considering the individual's smoking status.

Current Smoking Status

Since 2007, adult Vermonters with current asthma were significantly more likely to report being a current smoker than those without asthma (figure 4.1). However, the prevalence of smoking has not significantly changed since 2006 among those with current asthma or among those without asthma.

Figure 4.1. Smoking prevalence in adult Vermonters with and without current asthma, 2006-2010*

Current asthma — No asthma

21%   24%   24%   25%   22%
18%   18%   16%   17%   15%

2006   2007   2008   2009   2010

* Data from BRFSS 2006-2010; all years of data are age-adjusted
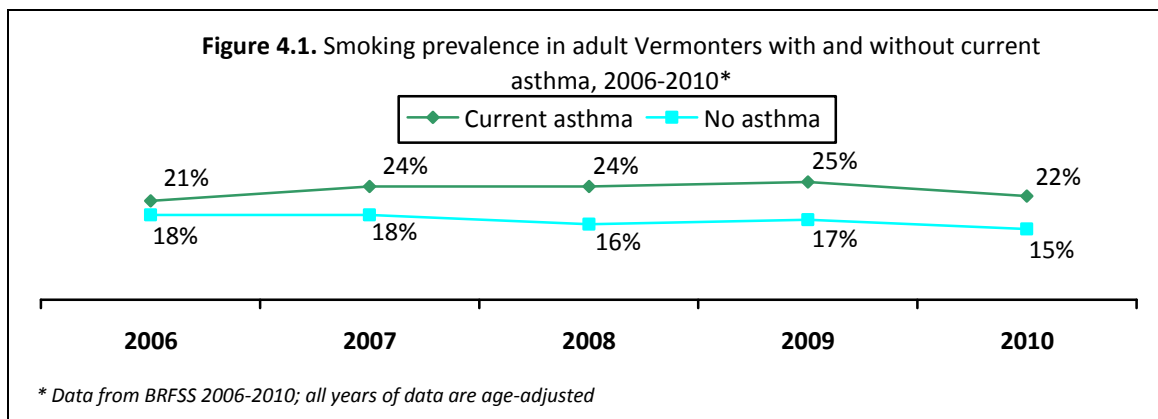
In 2010, half of adult Vermonters with current asthma reported they had never smoked. Of adults with current asthma that reported they had ever smoked (smoked 100 cigarettes or more over their lifetime), one out of five adults were current smokers and slightly more than a quarter were former smokers (figure 4.2). Adult Vermonters without current asthma were significantly less likely to report they were current smokers than those with asthma. There were no significant differences between those with and without asthma in regards to being a former smoker or a never smoker.

Figure 4.2. Smoking status of adult Vermonters with and without current asthma, 2010*

Legend: Current asthma, No asthma

Current smoker: 21% (Current asthma), 15% (No asthma)
Former smoker: 29% (Current asthma), 29% (No asthma)
Never smoker: 50% (Current asthma), 55% (No asthma)

*Data from BRFSS 2010
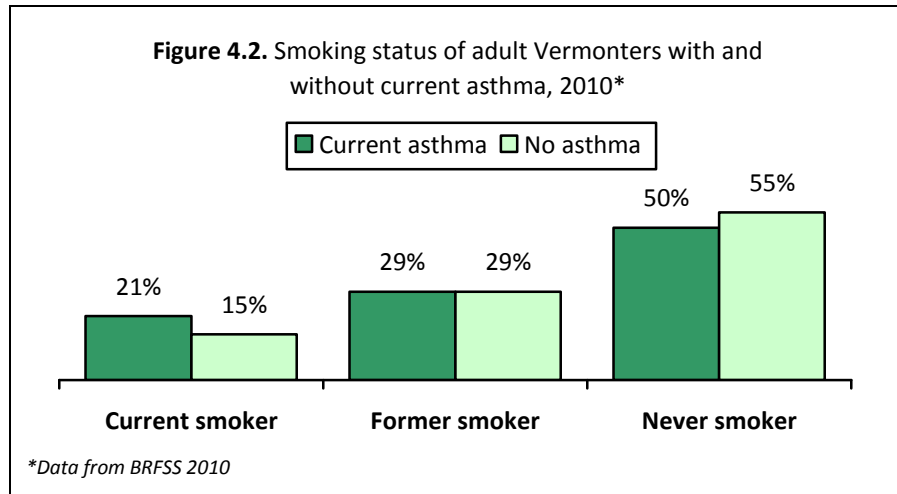
Frequency of Smoking among 'Ever Smokers'

Adult Vermonters with current asthma were significantly more likely to report smoking 'most days' compared to those without asthma. One third (34%) of adult Vermonters with current asthma smoked 'most days' compared to only 23% of adults without current asthma. They were significantly less likely to report that they no longer smoked compared to Vermonters without asthma (57% versus 68%). While these do not take into consideration the number of times an individual has tried to quit, these numbers are concerning since those with asthma reported more frequent use of cigarettes than those without asthma.

Attempts to Quit Smoking

A 'quit attempt' is defined as any time an individual stops smoking for at least one day. From 2006 through 2009, the proportion of those that attempted to quit smoking was significantly higher among adult Vermonters with current asthma than those without asthma (figure 4.3). In 2010, the proportion of those with current asthma that attempted to quit smoking was higher than the proportion of adults without asthma that attempted to quit smoking, but this difference was not statistically significant.

Figure 4.3. Percent of adult Vermonters with and without current asthma who attempted to quit smoking in previous year, 2010*

Current asthma — No asthma

65% 68% 70% 73% 72%

52% 54% 56% 56% 61%

2006 2007 2008 2009 2010

*Data from BRFSS 2010
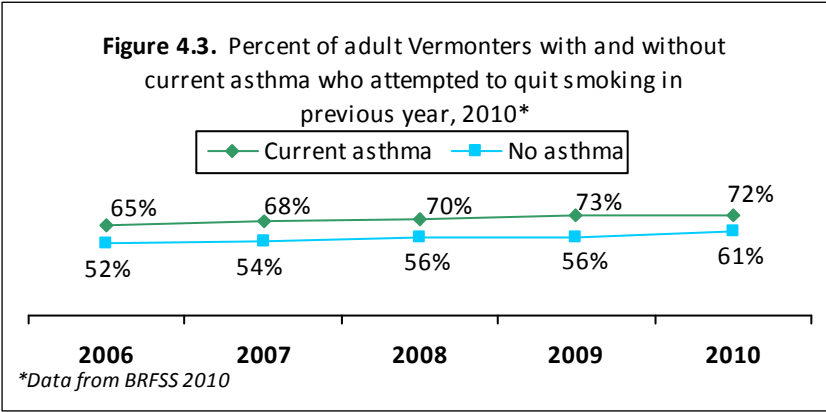
An individuals' sex did not play a significant role in one's attempt to quit smoking among adults with asthma. Both males and females with current asthma were significantly more likely than those without current asthma to attempt to quit smoking. When stratified by age, the proportion of individuals that attempted to quit smoking by current asthma status significantly differed among one age group; middle-aged Vermonters (age 45-64 years) with current asthma were significantly more likely to quit smoking than those of the same age without current asthma. *(Data available in Appendix III)*

Exposure to Secondhand Smoke

Between 2006 and 2007, Nguyen et al. found that environmental tobacco smoke exposure and current smoking were leading environmental factors associated with severe asthma in the New England states (Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island) [22]. According to ACBS data from 2008 through 2010, 15% of adult Vermonters with current asthma lived in homes where someone smoked indoors in the last seven days (this includes self-reported data on tobacco exposure and exposure to smoke from illicit drugs).

While more than 1 in 10 adult Vermonters with current asthma were exposed to SHS in their home, the frequency of SHS exposure is significantly higher among current smokers compared to former smokers and never smokers. Nearly half of adults with asthma that currently smoke are also exposed to SHS in their home (figure 4.4). SHS exposure did not significantly differ between former smokers and never smokers among adult Vermonters with current asthma.

Figure 4.4. Exposure to SHS among adult Vermonters with current asthma by smoking status, 2008-2010*

44%

15%

10%

6%

Total | Current smoker | Former smoker | Never smoker

*Data from BRFSS and ACBS 2008-2010
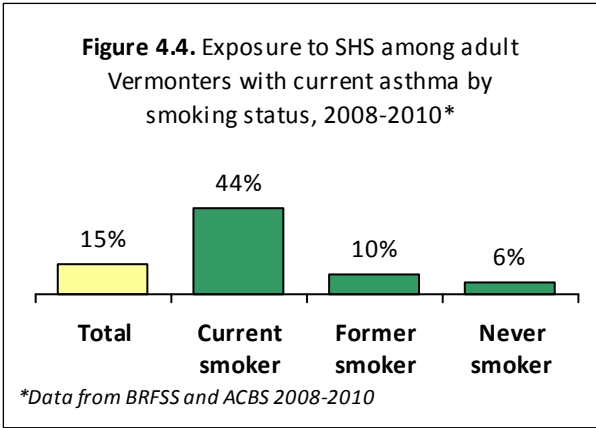
When examining smoking status and exposure to secondhand smoke by asthma severity and control we collapsed smoking status into ever smokers and never smokers and looked at exposed to SHS and not exposed to SHS. This created four groups: smokers exposed to SHS, smokers not exposed to SHS, never smokers exposed to SHS, and never smokers not exposed to

SHS. There were very few never smokers who reported SHS exposure so ultimately we had to eliminate them from the analysis.

Never smokers not exposed to SHS are significantly more likely to have mild intermittent asthma than an ever smokers exposed to SHS (figure 4.5). In fact, ever smokers who were not exposed to SHS were also significantly more likely to have mild intermittent asthma than ever smokers exposed to SHS. This confirms the importance of preventing exposure to SHS at home, especially among smokers.

Figure 4.5. Asthma severity by smoking status and SHS exposure* of adult Vermonters with current asthma, 2008-2010**

Legend: Mild intermittent, Mild persistent, Moderate persistent, Severe persistent

	Never smoker-No SHS	Ever smoker-No SHS	Ever smoker-SHS at home
Severe persistent		16%	29%
Moderate persistent	14%	15%	28%
Mild persistent	20%	22%	20%
Mild intermittent	60%	47%	23%

*Data for never smokers exposed to secondhand smokers supressed due to small sample size of strata
**Data from BRFSS and ACBS 2008-2010

We can use the same method of classifying smoking status and exposure to SHS for looking at asthma control. When asthma control was introduced in Chapter 2, it was noted that only one third of adult Vermonters had well controlled asthma in 2010. When asthma control was examined by smoking status combined with exposure to SHS, we see the ever smokers, regardless of SHS exposure, were significantly less likely to have well controlled asthma and significantly more likely to have poorly controlled asthma compared to never smokers who were not exposed to SHS (figure 4.6). A third of ever smokers that were exposed to SHS had poorly controlled asthma, significantly higher than that of never smokers who were not exposed to SHS.

Based on the data presented thus far, smoking and exposure to tobacco smoke are both key risk factors impacting a person's asthma.

Figure 4.6. Asthma control by smoking status and SHS exposure* of adult Vermonters with current asthma, 2008-2010**

Legend: Well controlled, Not well controlled, Poorly controlled

	Never smoker-No SHS	Ever smoker-No SHS	Ever smoker-SHS at home
Poorly controlled	11%	24%	31%
Not well controlled	26%	28%	39%
Well controlled	63%	48%	30%

*Data for never smokers exposed to secondhand smokers supressed due to small sample size of strata
**Data from BRFSS and ACBS 2008-2010

Secondhand Smoke Exposure among Youth

According to parent-reported data collected through the Children's ACBS, four percent of Vermont youth with asthma live in homes where individuals smoke indoors. We suspect the parent reported data underestimates actual exposure to secondhand smoke based on adult BRFSS data and Youth Risk Behavior Survey (YRBS) data. As reported in the previous section, 15% of all adults reported being exposed to SHS. In the 2011 YRBS, 41% of high school students reported being in the same room as a smoker and 31% reported riding in a car while others were smoking. Unfortunately, the YRBS does not collect information on asthma status so we cannot examine SHS exposure more closely among adolescents with asthma.

However, we can use BRFSS to gauge potential exposure to SHS by examining the smoking status of at least one adult in the household. We found that a quarter of adult respondents who had a child with asthma were former smokers and another quarter were current smokers. Thus, though we are seeing low parent-reporting of smoking in the home, it is evident that a quarter of young Vermonters with current asthma have a parent that smokes. While many parents may not report smoking in their home, youth may be exposed to their parents' smoke in other locations including vehicles and locations outside the home.

Environment Triggers at Home

Questions on the ACBS ask about a number of indoor environmental triggers that may impact one's asthma. In this section we examine both the individual triggers and the impact of having multiple triggers.

Individual Triggers at Home

Table 4.1 shows the various triggers and their occurrence among Vermont adults and youth with current asthma in Vermont. The most common trigger for both was having an indoor pet. Carpeting in one's bedroom and allowing pets in the bedroom were also common with more than half of both youth and adults with current asthma reporting each respective trigger. The least common trigger was the use of an unvented gas stove, fireplace, or log in the home.

Table 4.1. Prevalence of known environmental triggers among Vermonters with current asthma, (ACBS 2008-2010)		
	Adults (%)	Youth (%)
Exposures in one's home		
Indoor Pets	73	80
Pets Allowed in Bedroom	59	51
Carpet in Bedroom	58	58
Cooked with Gas	44	46
Wood stove or fireplace used in home	38	33
Anyone smoked inside home in past week	15	4
Seen or smelled mold in last 30 days	12	16
Seen rats or mice in last 30 days	12	13
Unvented gas stoves/fireplaces/logs used in home	8	3

Multiple Environmental Triggers at Home

In order to get a better sense of one's indoor home environment, we can look at exposure to multiple triggers. We chose to categorize the number of environmental triggers into three categories—zero to one, two to three, and four or more environmental triggers. In adults, the number of environmental triggers can be examined by asthma severity and asthma control. Unfortunately, due to small sample sizes among youth, the latter analysis can only be performed with adult data.

Less than one in five young and adult Vermonters had none or one environmental trigger in their home (figure 4.7). Approximately half of youth and four out of ten adults had two to three environmental triggers in their home. A third of youth and four out of ten adults had four or more environmental asthma triggers in their home.

Figure 4.7. Number of indoor environmental triggers at home among Vermonters with current asthma, 2008-2010*

Adults

- 15%
- 42%
- 43%

Legend:
- Zero to one
- Two to three
- Four or more

Youth

- 15%
- 50%
- 35%

Data from ACBS 2008-2010
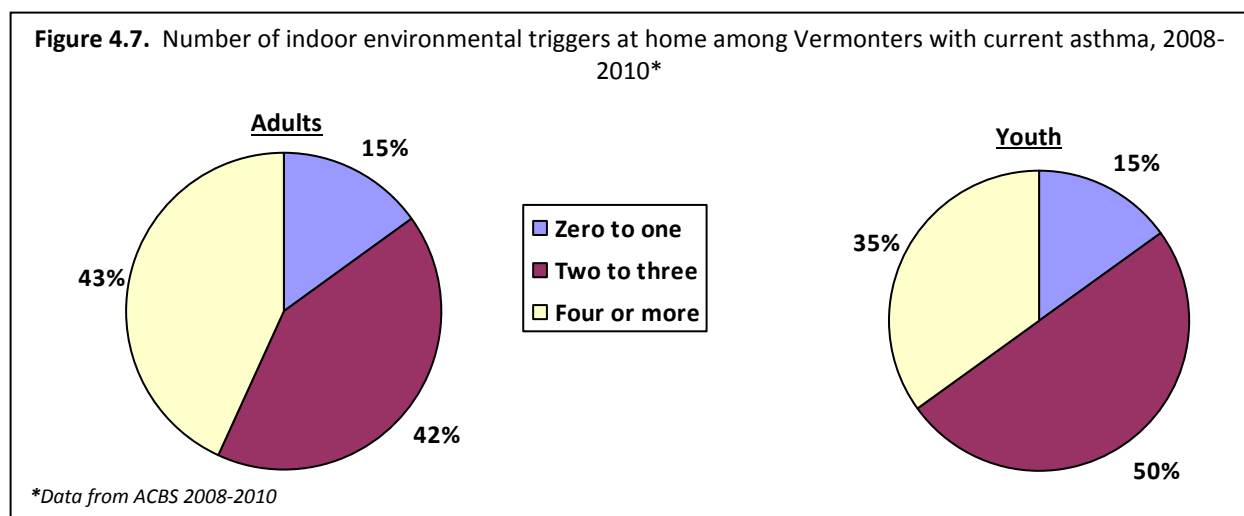
There were no statistically significant differences in asthma severity by the number of environmental triggers in one's home (figure 4.8). However, there was a weak pattern in the data suggesting that a higher proportion of those with four our more triggers had more severe asthma compared to those with fewer triggers.

Figure 4.8. Asthma severity by number of environmental triggers in the home among adult Vermonters with current asthma, 2008-2010*

Legend: Mild intermittent | Mild persistent | Moderate persistent | Severe persistent

	Zero To one	Two to three	Four or more
Severe persistent	12%	11%	15%
Moderate persistent	18%	15%	16%
Mild persistent	21%	19%	23%
Mild intermittent	49%	55%	46%

Number of environmental triggers

Data from ACBS 2008-2010

As with severity, there was no statistical significance or emergent pattern that suggested a strong association between asthma control and the number of environmental triggers in one's home (figure 4.9). Regardless of how many environmental triggers exist in one's home the lack of asthma control persists as less than half of Vermonters had well controlled asthma.

Figure 4.9. Asthma control by the number of environmental triggers in the home among adult Vermonters with current asthma, 2008-2010*

Legend: Well controlled | Not well controlled | Poorly controlled

	Zero To one	Two to three	Four or more
Poorly controlled	20%	17%	21%
Not well controlled	33%	26%	29%
Well controlled	47%	57%	50%

Number of environmental triggers

Data from ACBS 2008-2010
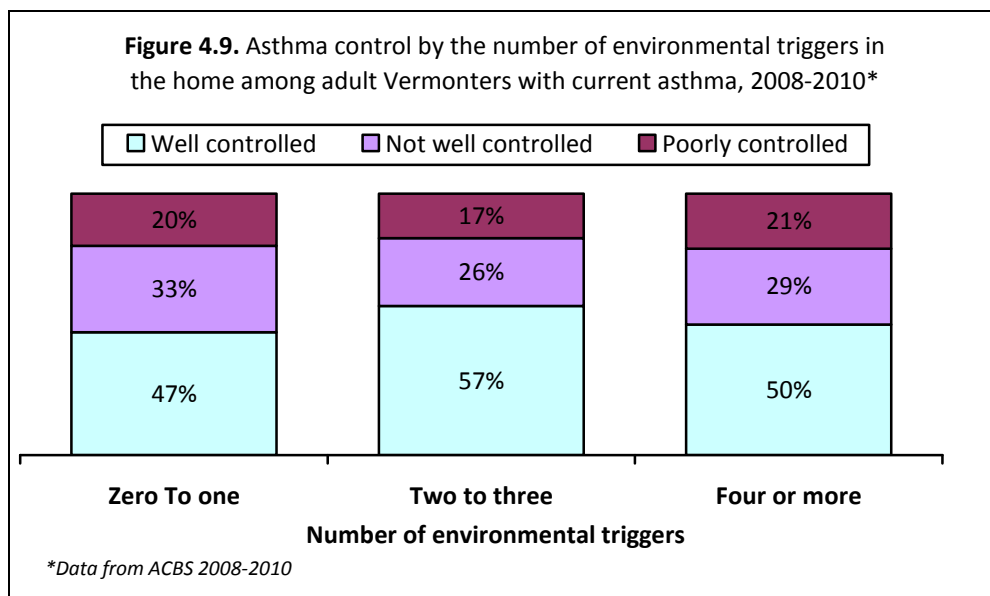
Work-related Asthma

Using ACBS data, it is possible to examine work-related asthma or WRA. The proportion of adult Vermonters reporting various work-related asthma factors is shown in figure 4.10. While a fairly small percentage of those with current asthma had been told by a doctor that their asthma was caused by their work, a quarter of Vermonters with asthma report that their asthma was aggravated by a current or previous job. In addition, a third of adult Vermonters with current asthma had quit a job because the job aggravated or caused their asthma.

When severity was first introduced in Chapter 2, it was noted that among adult Vermonters with current asthma about half had mild intermittent asthma, one in five had mild persistent asthma, and one in ten had either moderate or severe persistent asthma. When we account for WRA, we see quite a different picture (figure 4.11). Approximately half of those that reported

Figure 4.10. Work related asthma among adult Vermonters with current asthma, 2010*

WRA diagnosed by DR.	6%
WRA self identified	8%
Caused by current job**	8%
Caused by previous job **	14%
Aggravated by current job **	27%
Aggravated by previous job **	28%
Quit Job **	32%
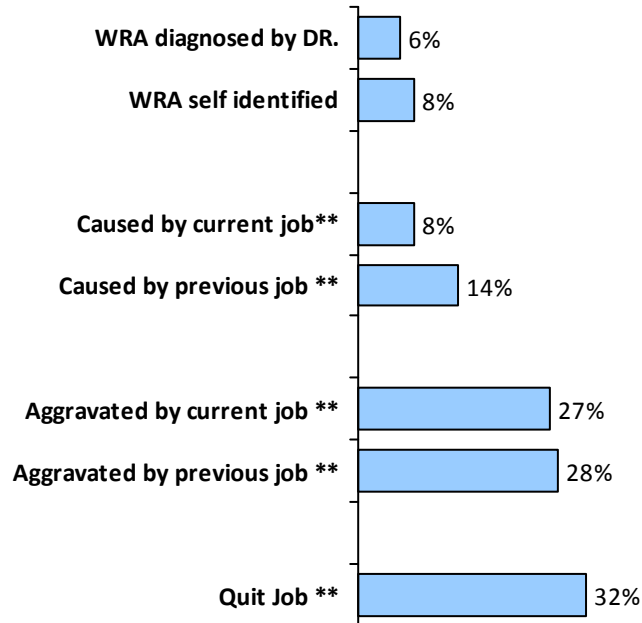
*Data from ACBS 2010
** All questions are asked of those with asthma and should be considered self-reported data

Figure 4.11. Asthma severity by work related asthma factors among adult Vermonters with current asthma, 2008-2010*
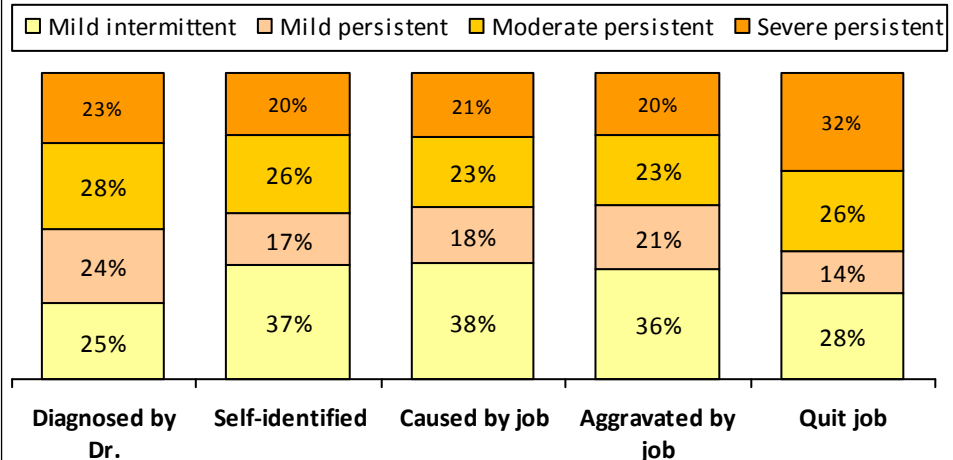
□ Mild intermittent □ Mild persistent □ Moderate persistent □ Severe persistent

	Diagnosed by Dr.	Self-identified	Caused by job	Aggravated by job	Quit job
Severe persistent	23%	20%	21%	20%	32%
Moderate persistent	28%	26%	23%	23%	26%
Mild persistent	24%	17%	18%	21%	14%
Mild intermittent	25%	37%	38%	36%	28%

*Data from ACBS 2008-2010

any WRA factor had moderate to severe persistent asthma. Those Vermonters that reported WRA diagnosed by a doctor, their asthma was caused by a job, or their asthma was aggravated

by a job were significantly less likely to have mild intermittent asthma than those that did not report each given WRA factor (data not shown). Those that reported their asthma was aggravated by a job and those that reported quitting a job because of their asthma were significantly more likely to have severe persistent asthma than those that did not report the WRA factor (data not shown).

Overall, 58% of Vermonters with current asthma had their asthma well controlled. A third of Vermonters with current asthma did not have their asthma well controlled, and 14% had poorly controlled asthma. WRA does affect the likelihood of Vermonters controlling their asthma (figure 4.12). Those that reported WRA diagnosed by a doctor, asthma caused by a job, or asthma aggravated by a job were significantly less likely to have well controlled asthma than

those that did not report a given factor (data not shown). Furthermore, those that reported that their WRA was diagnosed by doctor and those that reported that a job aggravated their asthma were significantly more likely to report poorly controlled asthma than those that did not have each WRA factor (data not shown). Among any WRA factor reported, only 30 to 40% of individuals had well controlled asthma leaving the majority of individuals with 'not well' or 'poorly' controlled asthma.

Figure 4.12. Asthma control by work related asthma factors among adult Vermonters, 2008-2010*

Legend: Well controlled, Not well controlled, Poorly controlled

	Diagnosed by Dr.	Self-identified	Caused by job	Aggravated by job	Quit job
Poorly controlled	38%	28%	27%	25%	36%
Not well controlled	32%	34%	33%	35%	32%
Well controlled	30%	38%	40%	40%	32%

Data From ACBS 2008-2010
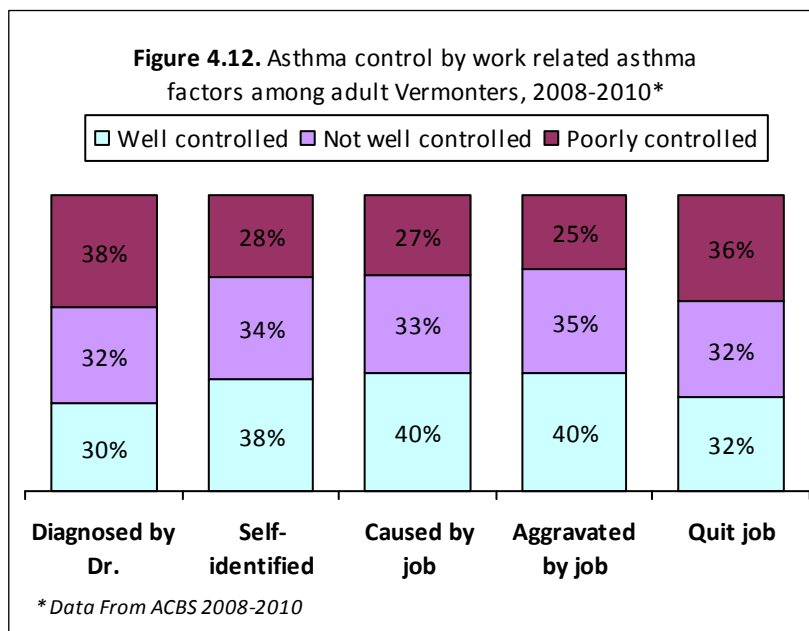
At this time, we do not have occupational information that we could use to better explain the association between WRA and current asthma among our Vermont population. Though not shown here, we found that individuals with asthma who report annual household incomes below 125% of the FPL were significantly more likely to report that their asthma was either caused or aggravated by a current or previous job. While no other Work-related factors were significantly associated with FPL, we believe individuals in the lowest income bracket were more likely to have occupations in less than ideal working environments. Given the number of individuals that report WRA with more severe and uncontrolled asthma, it may be important to consider and further investigate the impact of WRA in the future.

Chapter 5—Asthma Management

According to the most recent guidelines from the NHLBI, health care providers are encouraged to have an active partnership with patients and their families in order to facilitate asthma self-management [1]. It is recommended that all asthma patients learn how to manage their asthma, know how to recognize an asthma episode and respond accordingly, understand how to use their medication, and have a written asthma action plan. We assess general ability to manage one's asthma using the ACBS. Using the same data source we also see how those in Vermont with current asthma modified their environment to reduce exposure to environmental triggers and gauge how they take their medications.

Asthma Self-Management

Questions on ACBS include items about participation in a class on asthma management and whether respondents have an asthma action plan. Responses to these questions allow us to assess whether Vermonters with current asthma have been taught how to recognize the early signs and symptoms of an asthma episode, what to do during an asthma attack, and how to use a peak flow meter.

Asthma Management and Asthma Action Plans among Adults

Most adult Vermonters with current asthma have been taught by a health professional what to do during an asthma attack and how to recognize early symptoms of an asthma episode (figure 5.1). However, only half of adult Vermonters with current asthma reported that a health professional taught them how to use a peak flow meter and only a third of adults had an asthma action plan. Less than 10% of adults with current asthma reported attending a class to learn about asthma management.

Figure 5.1. Likelihood of asthma self-management knowledge among adult Vermonters with current asthma, 2008-2010*

79% — Taught what to do during asthma attack
68% — Taught to recognize early signs of asthma episode
49% — Taught how to use peak flow
30% — Has asthma action plan
8% — Asthma management course participation

Data from ACBS 2008-2010
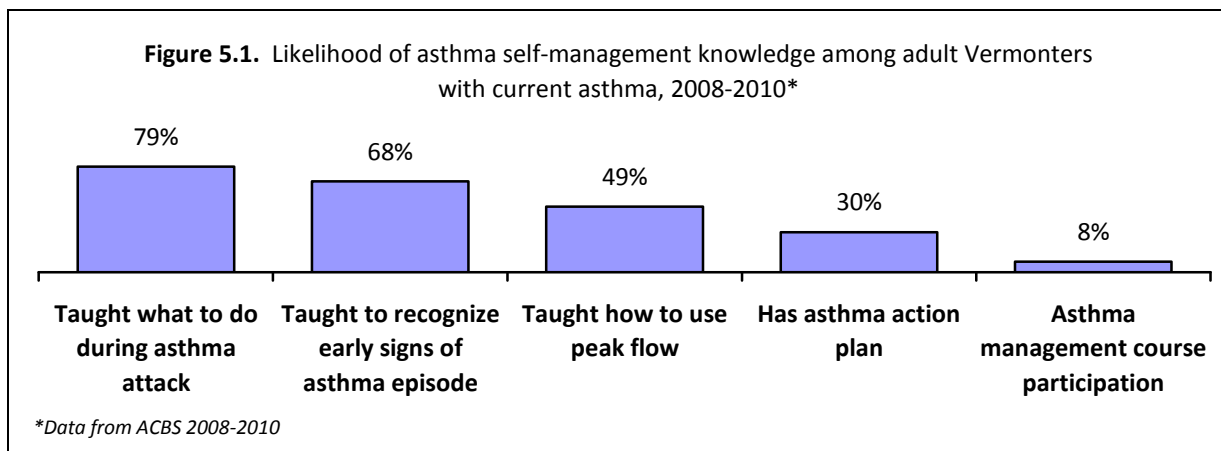
The BluePrint for Health began implementing Healthier Living Workshops in 2005. The workshops are based on a model that showed positive health outcomes for those that learned basic chronic disease management skills. Specific workshops addressing diabetes, pain management, and chronic conditions are available in various locations around the state.

While the proportion of Healthier Living Workshop attendees with asthma has gradually increased, less than one in five attendees had asthma. The Vermont Asthma Program, includes an objective to raise the number of Vermonters with asthma and at least a high school education who attended the workshop. Between 2008 and 2011, there were some improvements in this regard—less than 30 individuals attended in 2008 and a cumulative 183 individuals had attended the workshop by the end of 2011. The state's goal is to have 210 attendees who have at least a high school diploma and asthma by the end of 2012 .

Asthma Management and Asthma Action Plans among Youth

Based on parent-reported data from the Child ACBS, approximately nine out of ten young Vermonters have been taught how to recognize the early signs of an asthma episode and what to do during an asthma attack (figure 5.2). However, less than half of youth were taught how to use a peak flow meter. About half of young Vermonters with current asthma have a written asthma action plan.

Figure 5.2. Likelihood of asthma self-management knowledge among Vermont's youth (<18 years) with current asthma, 2008-2010*

93%	86%	47%	51%	4%
Taught what to do during asthma attack	Taught to recognize early signs of asthma episode	Taught how to use peak flow	Has asthma action plan	Asthma management course participation

Data from ACBS 2008-2010
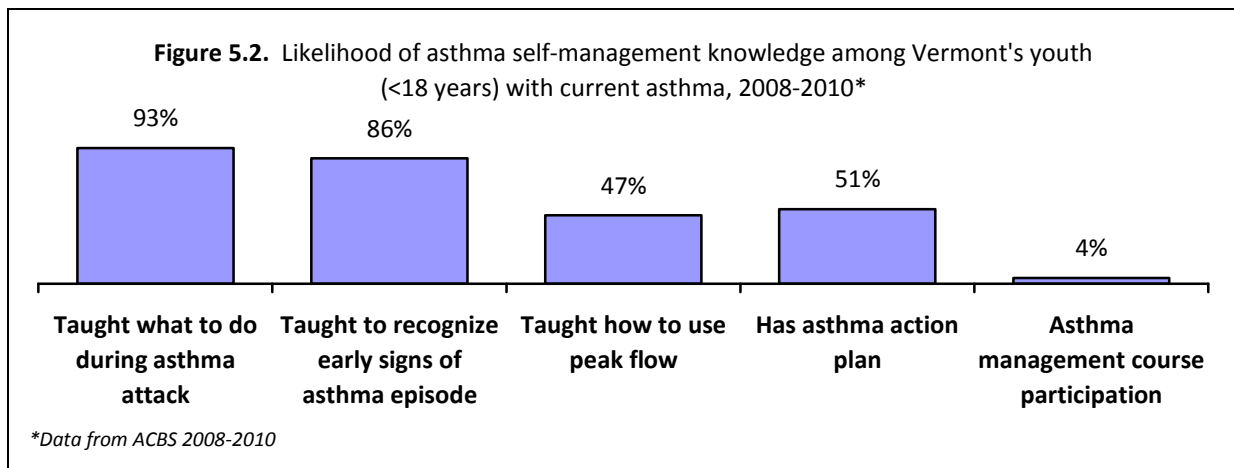
In addition to collecting parent-reported data on the Children's ACBS, we also assessed how many parents submitted an asthma action plan to the school nurse. According to the School Nurses' Report only 31% of students with asthma had an asthma action plan filed with their school nurse. This percentage is noticeably lower than the 51% reported through the Child

ACBS. The difference suggests that not all parents of children with asthma are providing their child's asthma action plans to school nurses.

Preventive Measures for Environmental Triggers in the Home

In addition to measuring environmental triggers, as was done in Chapter 4, we also assessed the types of preventive measures individuals took to reduce exposure to environmental asthma triggers at home. Approximately two out of five Vermonters with current asthma were advised by a health professional to modify their home, school, or work environment to help with asthma control.

Individual Measures for Preventing Environmental Triggers at Home

Table 5.1 shows the individual preventive measures assessed on the ACBS and shows the frequency with which they were utilized by adult and youth Vermonters with asthma. The most common preventive measure used by adults and youth was the use of fans in the bathroom, and in the kitchen while cooking. Other common preventive measures taken by adults included the use of dehumidifiers, washing bedding in hot water and the use of mattress and pillow covers to prevent dust mites.

Table 5.1. Preventive measures in the home environment among Vermonters with current asthma, (ACBS, 2008-2010)		
	Adults (%)	Youth [*] (%)
Health professional advised modifying environment	39	42
Reported preventive measures utilized at home		
Bathroom fan	64	64
Kitchen fan when cooking	55	60
Regular use of dehumidifier	34	38
Wash sheets and pillow cases in hot water	29	36
Mattress cover for dust mites	26	39
Pillow cover for dust mites	24	44
Regular use of air cleaner/purifier	18	25
[*] Youth data is based on parent reporting		

Multiple Preventive Measures for the Home Environment

As we did when examining environmental triggers, we can also look at how many preventive measures individuals utilize and how this relates to their current asthma. In addition, we examined how multiple preventive measures impacted asthma severity and control among adults (sample sizes are too small to perform this analysis with data on youth).

Nearly 70% of adults and 80% of youth utilized more than one preventive measure (figure 5.3). More than a third of adults utilized two to three preventive measures (41%), while the same proportion of young Vermonters used four or more preventive measures.

Figure 5.3. Number of preventive measures to limit environmental triggers at home among Vermonters, 2008-2010*

Adults

27% 32%

41%

Youth

20%

41% 39%

Legend:
- Zero to one
- Two to three
- Four or more

Data from ACBS 2008-2010
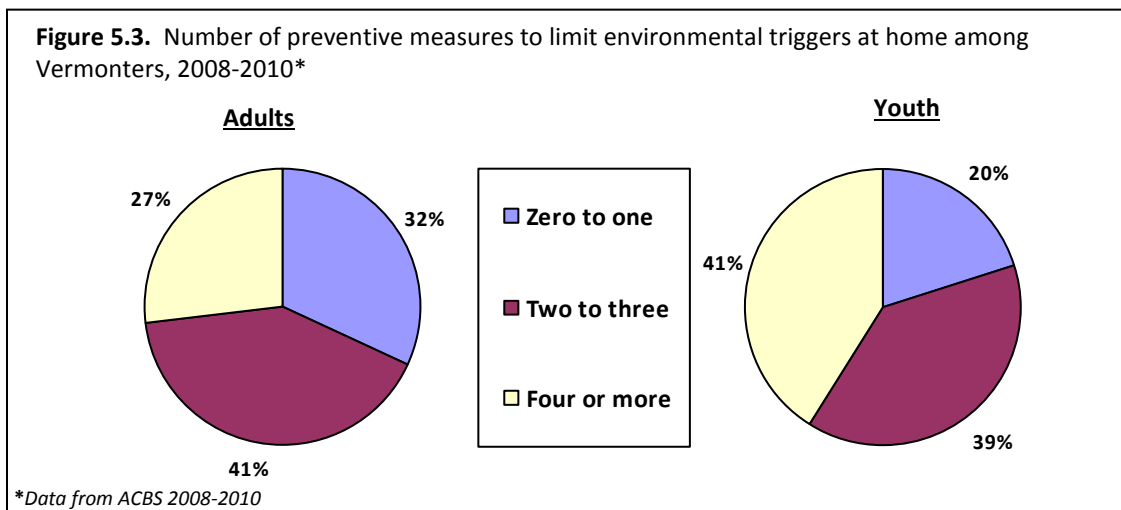
There were no statistically significant differences in the severity of asthma among adult Vermonters that used multiple preventive measures (figure 5.4). Regardless of how many preventive measures were utilized, about half of adult Vermonters had mild intermittent asthma and nearly a third had moderate persistent or severe persistent asthma.

Figure 5.4. Asthma severity by number of preventive measures to limit environmental triggers among adult Vermonters, 2008-2010*

Legend: □ Mild intermittent □ Mild persistent □ Moderate persistent ■ Severe persistent

	Zero To one	Two to three	Four or more
Severe persistent	17%	10%	14%
Moderate persistent	14%	17%	18%
Mild persistent	19%	22%	22%
Mild intermittent	50%	51%	46%

Number of preventive measures

Data from ACBS 2008-2010

While there were no statistically significant differences between the number of preventive measures used and asthma control, there did seem to be an emerging pattern (figure 5.5). Adult Vermonters that utilized one or fewer preventive measures were less likely to have well controlled asthma and more likely to have poorly controlled asthma. Again, this pattern is not statistically significant.

Figure 5.5. Asthma control by number of preventive measures to limit environmental triggers among adult Vermonters, 2008-2010*

Legend: ☐ Well controlled ☐ Not well controlled ■ Poorly controlled

Zero To one	Two to three	Four or more
25%	15%	19%
26%	33%	27%
49%	52%	54%

Number of preventive measures

* Data from ACBS 2008-2010
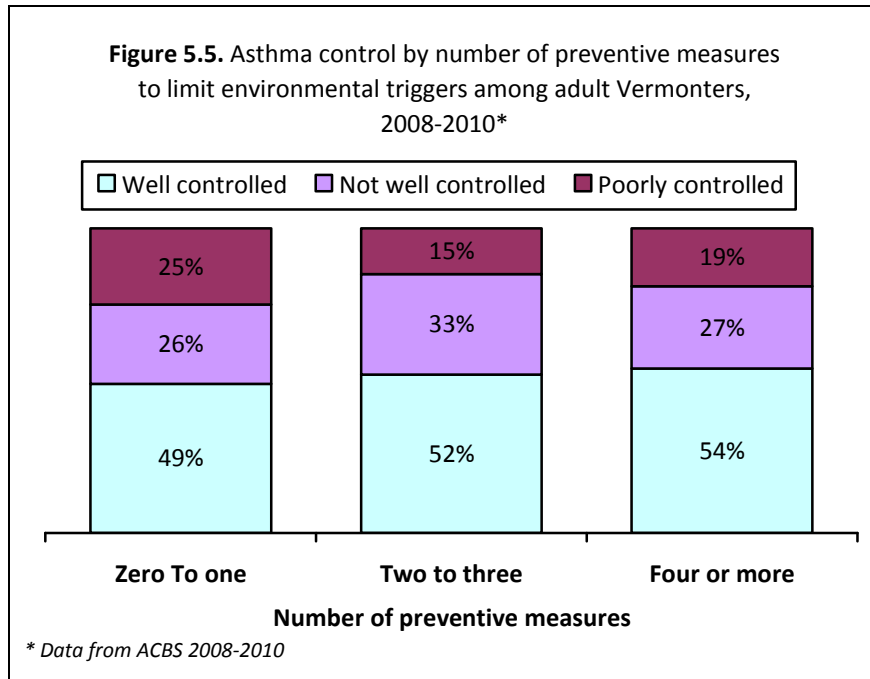
Medication Use for Asthma Management and Control

Medication Use since Initial Diagnosis

In 2010, according to the ACBS, only a small percentage (4%) of adult Vermonters with current asthma had *never* used any type of medication—inhaler, pill, over-the-counter medication, or nebulizer—to treat their asthma. Of adult Vermonters that have ever used a medication to treat their asthma, 95% had used an inhaler, while nearly a quarter had used an over-the-counter medication.

Based on Children's ACBS data from 2010, all youth had used some type of medication to treat their asthma. Nine out of ten youth had used an inhaler at some point since their asthma diagnosis. Nearly one in five youth had used an over-the-counter medication to treat their asthma.

Medication Use in Last 3 Months

The ACBS includes questions about medication use in the last three months. (Parents report on their child's medication use.) Examining medication use in the last three months gives a more current picture of how individuals are treating their asthma. Among adult Vermonters with

current asthma, 72% used some type of medication in the last three months. Almost half of these individuals had used some type of medication in the last week. The most common type of medication used in the last three months was an inhaler (91%), followed by pills (16%) and nebulizers (9%).

Three-quarters of young Vermonters with current asthma had used some type of medication in the last three months for treating their asthma. Nearly half of youth had used medication in the previous week. Inhalers were the most common type of medication used by youth in the last three months (78%) and pills were the least common (8%). A third of youth with asthma had used a nebulizer in the last 3 months for treating their asthma.

Rescue Inhaler compared to Controller Inhaler Use

Slightly more than a quarter of adults used <u>both</u> a rescue and controller medication in the previous three months (figure 5.6). Though not statistically significant, individuals were more likely to use rescue inhalers <u>only</u> in the last three months compared to sole use of a controller in the last three months.

Figure 5.6. Controller and rescue inhaler use among Vermonters with current asthma, 2008-2010*

Adults | Youth

Controller and rescue inhaler: 27% 28%
Rescue only: 26% 22%
Controller only: 11% 7%
Neither controller nor rescue: 36% 43%

*Data from ACBS 2008-2010

We can examine whether cost barriers to obtaining asthma medication influence how medications are used among adults. Unfortunately, due to small sample sizes, we cannot perform this analysis for youth. Slightly more than one in ten Vermonters with current asthma reported cost as a barrier to accessing the medication needed for treating their asthma. Though there were not any statistically significant results, those that reported a cost barrier to accessing medication appeared more likely to use only a rescue inhaler compared to those that did not report a cost as a barrier (figure 5.7).

Figure 5.7. Controller and rescue inhaler use among adult Vermonters with current asthma reporting cost barriers to obtaining asthma medications, 2008-2010*

Cost Barrier | No Cost Barrier

Controller and rescue inhaler: 30% 27%
Rescue only: 36% 25%
Controller only: 6% 12%
Neither controller nor rescue: 28% 37%

*Data from ACBS 2010
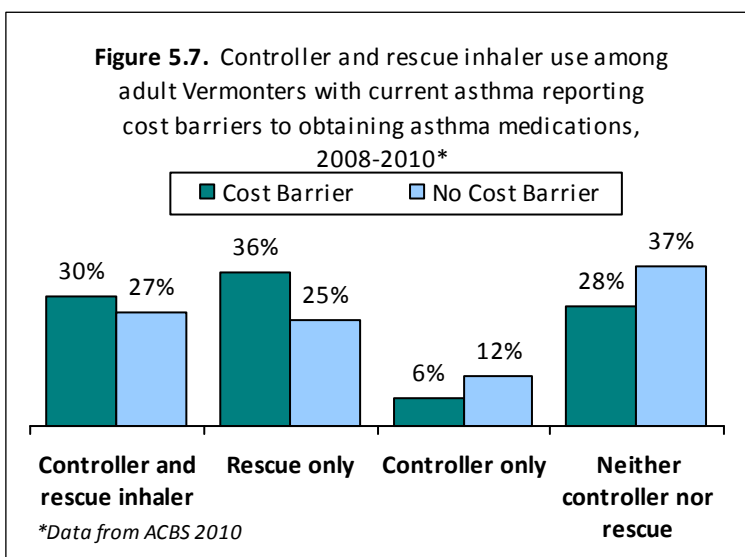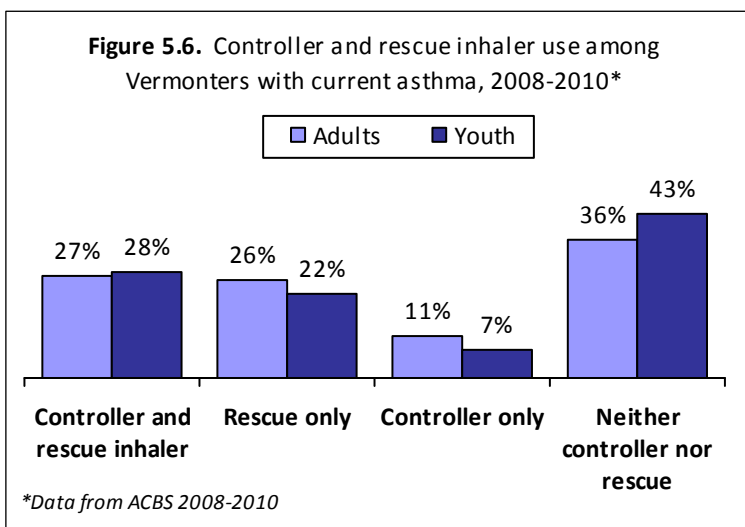
Complementary and Alternative Medicine

People may choose to use methods other than prescription medication to treat or control their asthma symptoms. Approximately a third of adults in Vermont with current asthma have used some sort of complementary or alternative medicine (CAM) to treat their asthma. The most common methods of CAM used in 2010 among Vermonters with asthma were breathing techniques (27%), yoga (8%), and aromatherapy (5%). All other forms of CAM were reported among less than five percent of adults with current asthma.

Chapter 6—Healthcare Service Utilization

In the previous chapter we discussed asthma self-management. One way of assessing poor self-management is by looking at healthcare service utilization. In particular, the use of urgent care centers, the emergency department, and inpatient hospital services. In addition to using self-reported data on service utilization, discharge information for both emergency department visits and hospital admissions related to asthma are discussed in detail. It is also possible to examine charges related to emergency department and hospital utilization related to asthma using discharge data.

Health Insurance and Health Care Access

Adults

Regardless of asthma status, nine out of ten adult Vermonters had some type of health insurance in 2010. Though those with asthma did not statistically differ from adults without asthma in regards to current insurance status, those with asthma were significantly more likely to have seen a doctor for an annual check-up in the preceding year. This annual check-up is not necessarily a routine visit that was strictly related to asthma, it is a general well-being check-up where a variety of health related issues may be discussed. Nearly three-quarters of those with asthma saw their doctor for an annual check-up in the preceding year (compared to 64% of adult Vermonters without asthma).

In addition to being more likely to report an annual check-up, those with current asthma were significantly more likely than those without asthma to report that they could not see a health care provider at some point in the previous year due to cost. In fact, those with current asthma were nearly twice as likely to report a cost barrier to seeing a health care provider as those without asthma. Thus, while we did not see any significant differences in regards to the presence of health insurance, there still may be some significant barriers to obtaining necessary coverage and care for those with asthma.

Youth

Unfortunately, we do not currently have a surveillance tool that assesses insurance status and well-child visits among young Vermonters with asthma. However, we can assess this generally among young Vermonters attending school by examining the School Nurses' Report. Nearly all school children, whose parents reported insurance information to the school nurse, had

insurance in the 2010-2011 school year—98% of elementary school age children, and 97% of both middle school age and high school age children. Most parents who shared well-child visit information with the school nurse reported that their child had a routine visit in the previous year—86% of elementary age children, 82% of middle school age children, and 81% of high school age children.

However, we must consider that the response rates decline as a youth gets older for both insurance status and well-child visits. We can examine those that did not respond to questions related to insurance and well child visits among young Vermonters whose parents returned incomplete paperwork to the school nurse. Nearly one in ten parents of elementary school age children who returned information to the school nurse did not respond to questions about insurance status. The percent of parents that did not share insurance information increases to 11% among middle school age children and to 29% among high school age children. One in five parents of elementary school children, a quarter of parents with middle school age children, and a third of parents with high school age children, who returned health paperwork to the nurse, did not report information about their child's last well-visit appointment.

Routine Asthma Care

According to the EPR-3 guidelines, individuals that have well controlled asthma should see a health care provider for a routine asthma visit once every six months. Those that do not have well controlled asthma should be seeing their health care provider every 2-6 weeks until their asthma is controlled [1]. From our discussion in Chapter 2, we know that only three out of five Vermonters, youth and adults, have well controlled asthma. Thus, we would expect that most individuals would have at least two routine asthma visits a year if the majority of those with asthma were adhering to the current guidelines.

Unfortunately, according to the latest data from the ACBS, that is not the case. In 2010, less than a quarter of adults with current asthma saw a health care provider two or more times in the previous 12 months for a routine asthma visit. In fact, half of adult Vermonters with asthma did not see a provider for a routine asthma visit in the previous year. Among youth, a quarter did not see a health care provider in the previous year for a routine asthma visit. About a third of youth saw their provider two or more times in the previous year for routine asthma care.

We can more closely examine adults who are seeking routine asthma care by stratifying the frequency of visits by asthma severity and control. (Unfortunately we cannot stratify this data by asthma severity and control for youth as individual strata become too small). When looking at the number of visits by level of asthma severity, we see that adults with more routine asthma visits are less likely to have mild intermittent asthma (figure 6.1). Half of those that see a doctor at least twice a year have moderate to severe asthma.

Figure 6.1. Asthma severity by the number of routine asthma care visits among adult Vermonters, 2008-2010*

Mild intermittent | Mild persistent | Moderate persistent | Severe persistent

None
- 12%
- 13%
- 16%
- 59%

One
- 8%
- 18%
- 28%
- 46%

Two or More
- 24%
- 22%
- 22%
- 32%

Number of routine asthma care visits

Data from ACBS 2008-2010
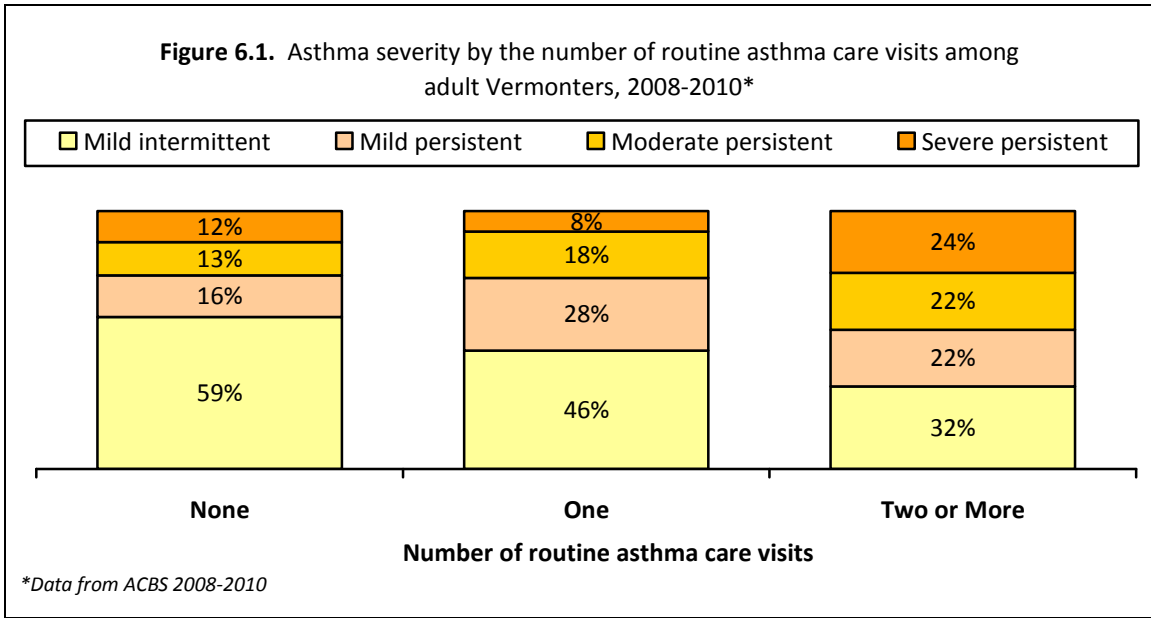
When we examine the frequency of routine visits by the level of asthma control, we see that two-thirds of those seeing the doctor two or more times a year did not have well controlled asthma (figure 6.2). More than half of those that had not seen a provider in the previous year and almost half of those that had seen a provider once in the last year had well controlled asthma. This suggests that there is a need for improving guideline-based care for all individuals with asthma.

Figure 6.2. Asthma control by the number of routine asthma care visits among adult Vermonters, 2008-2010*

Well controlled | Not well controlled | Poorly controlled

None
- 14%
- 24%
- 62%

One
- 16%
- 37%
- 47%

Two or more
- 40%
- 27%
- 33%

Number of routine asthma care visits

Data from ACBS 2008-2010
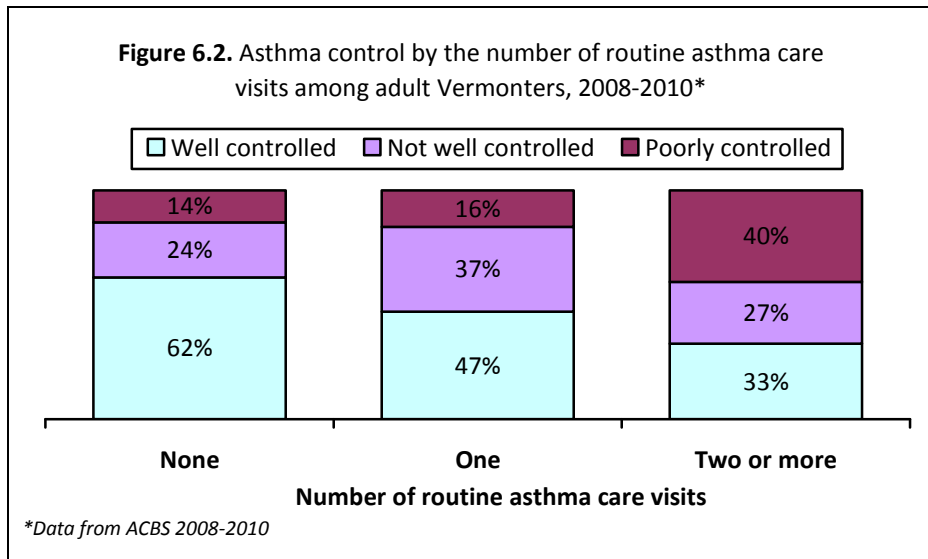
Acute Asthma Care

Acute asthma care refers to a health care provider visit, at the provider's office, for the prompt treatment of symptoms. This type of visit does not include visits to an urgent care center or an emergency department. Nearly one in five adults with current asthma reported needing to see a healthcare provider for treatment of asthma symptoms at a doctor's office in the preceding year. Among adults with current asthma, 8% had to see a health care provider once and 7% had to see a health care provider two or more times in the previous year for the treatment of asthma symptoms.

A third of youth with current asthma saw a health care provider for the treatment of asthma symptoms in the previous year according to parent reports from the 2010 ACBS. Based on parent reported information, 16% of youth saw a health care provider once in the last year for the treatment of asthma symptoms. Nearly one in five youth (18%) saw a physician two or more times because they were experiencing asthma symptoms.

Emergency Department and Hospital Visits

In addition to self-reported data on visits to the emergency department (ED) and the hospital, we can also look at ED and hospital utilization by examining Vermont's Uniform Hospital Discharge data set (VUHDDS). The ED discharge data set includes all visits to the ED and the hospital discharge data set includes data on discharges of individuals that were admitted for hospital stays. It is important to note that the ED discharge data set does not include discharges for individuals that were admitted to the hospital from the ED. Rather, these individuals are found in the hospital discharge data set.

All discharge data relies on the ICD-9 codes used at discharge to identify the purpose of the visit. Upon discharge, a provider can identify up to 20 ICD-9 codes to describe the ED or hospital visit. Visits are identified as having either primary diagnosis of asthma, the first diagnosis code listed was asthma (ICD-9 of 493), and any diagnosis of asthma, meaning the diagnosis code for asthma was mentioned somewhere in the list of twenty ICD-9 codes. The primary diagnosis of asthma is used for most detailed analyses of ED and hospital discharges.

Emergency Department Visits

According to self-reported data collected through the ACBS, nine out of ten youth and adults reported they did not visit the ED in the preceding year. Among those Vermonters that reported going to the ED in the preceding year, most did not report going more than once.

Only 2% of adults and 3% of youth with current asthma reported requiring two or more trips to the emergency department in the preceding year.

We can also examine ED visits by looking at discharge rates of Vermonters from Vermont and neighboring state hospitals. Over the last five years (2005-2009) the number ED discharges with a primary diagnosis of asthma has remained fairly steady (rate of 40.6 per 10,000 Vermonters in 2009). However, the rate of any asthma diagnosis significantly increased from 155.1 diagnoses per 10,000 Vermonters in 2008 to 199.6 per 10,000 Vermonters in 2009. Though the significant increase in any asthma diagnosis is noteworthy, this does not suggest an increase in asthma-related ED visits as the rate of primary asthma diagnoses remains unchanged.

In 2009, female Vermonters had significantly higher rates of ED visits with a primary diagnosis of asthma than their male counterparts. An interesting pattern emerges when ED discharge rates with a primary diagnosis of asthma are stratified by both sex and age. Males under the age of 15 had a significantly higher rate of ED discharges than females in the same age category (figure 6.3). There is an inverse relationship with the next two age groups—females age 15 to 44 years and females age 45-64 years had nearly twice the ED discharge rate with a primary diagnosis of asthma than males in the same respective age groups (differences are statistically significant). There was no statistically significant difference in ED discharges between males and females 65 years of age and older.

Figure 6.3. Rate of ED dicharge* among Vermonters with a primary diagnosis of asthma stratified by age and sex, 2009**

□ Male ■ Female

All Ages: 33.9, 47.1
<15: 63.3, 34.7
15-44: 41.4, 76.9
45-64: 15.0, 30.3
≥65: 16.2, 21.0

Age (years)

*Rate per 10,000
**Data from VHUDDS 2009
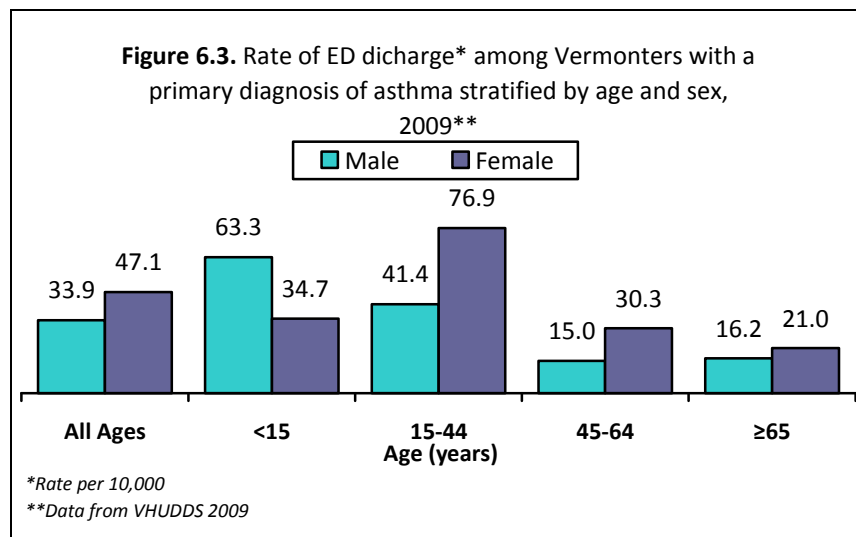
ED discharges with a primary diagnosis of asthma vary around the state (figure 6.4). In 2009, the lowest rate of ED discharges with a primary diagnosis of asthma was seen in the Bennington Hospital Service Area (HSA) while the highest rate was seen in Newport. The Barre, Burlington, Middlebury, and Bennington HSAs all had significantly lower rates of ED discharges than that of the state. The Newport, St. Albans, Rutland, Springfield, and Brattleboro HSAs had significantly higher rates of ED discharge than the state as a whole.

Figure 6.4. Rate of ED discharge* among Vermonters with a primary diagnosis of asthma by HSA, 2009**

St. Albans 55.4
Newport 59.0
Morrisville 38.2
St. Johnsbury 41.8
Burlington 28.5
Barre 31.3
Middlebury 32.8
Randolph 42.9
White River Jct 40.3
Rutland 54.1
Springfield 54.9
Bennington 25.6
Brattleboro 49.1

Red-signifies significantly higher than state rate
Yellow-signifies significantly lower than state rate
*Rate per 10,000
**Data from VUHDDS 2009
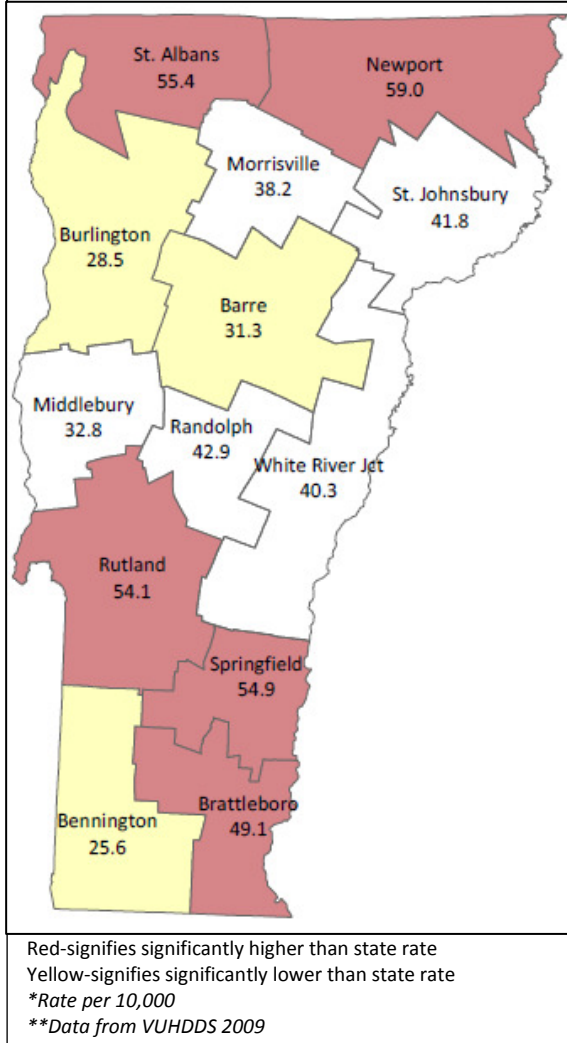
Hospital Visits

Most Vermonters with asthma did not report a visit to the hospital in the previous year according ACBS data from 2010. In fact, only 2% of adults with current asthma reported an overnight stay in the hospital. There are too few youth who required an overnight hospital stay to report a reliable result using data from 2008 through 2010.

Using hospital discharge rates, we get a better sense of asthma-related hospital visits. In the past several years, both primary asthma diagnosis discharges and discharges with any mention of asthma have remained steady. In 2009, the rate of discharges with a primary diagnosis of asthma was 6.7 per 10,000 Vermonters. During the same year, the rate of discharges with any mention of asthma diagnosis was 62.5 per 10,000 Vermonters.

Females had a significantly higher rate of hospital discharge with a primary diagnosis of asthma than males, 8.5 per 10,000 versus 4.9 per 10,000 respectively. When stratified further by age, we see that for most age groups females had higher rates of hospital discharge with a primary diagnosis of asthma than their male counterparts, with the exception of young males and adults 65 years of age and older (figure 6.5). The hospital discharge rate for males under the age of 15 was nearly twice that of females in the same age category. We see the opposite pattern in the two other age groups. Females age 15-44 and females age 45-64 were discharged from the hospital with a primary asthma diagnosis at rates three-fold higher than their male counterparts. Females 65 years of age and older appear to have a higher rate of hospital discharge than their male counterparts, but the difference was not statistically significant.

Figure 6.5. Rate of hospital discharge* among Vermonters with a primary diagnosis of asthma stratified by age and sex, 2009**

*Rate per 10,000
**Data From VUHDDS 2009
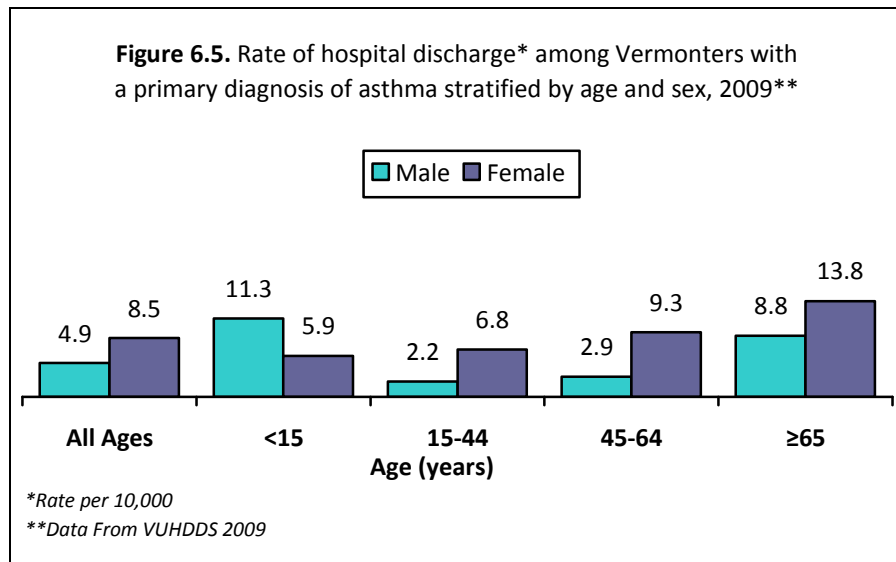
In certain areas of Vermont, we see some significant differences in the rate of hospital discharges with a primary diagnosis of asthma (figure 6.6). The Rutland and Springfield HSAs both had hospital discharge rates with a primary diagnosis of asthma that were significantly higher than that of the state. In the Springfield HSA the rate of hospital discharges with a primary diagnosis of asthma was nearly twice that of the state. Of more concern, the rate of hospital discharges with a primary asthma diagnosis in the Rutland HSA was more than twice that of the state rate. There were also several HSAs that had hospitalization rates with a primary asthma diagnosis that were significantly less than that of the state—Barre, Burlington, Morrisville, St. Johnsbury, St. Albans, and Brattleboro.

Figure 6.6. Rate of hospital discharge* among Vermonters with a primary diagnosis of asthma by HSA, 2009**

St. Albans
4.6

Newport
6.4

Morrisville
3.8

St. Johnsbury
4.3

Burlington
4.2

Barre
4.7

Middlebury
6.7

Randolph
7.7

White River Jct
6.3

Rutland
14.4

Springfield
11.0

Bennington
7.9

Brattleboro
4.4
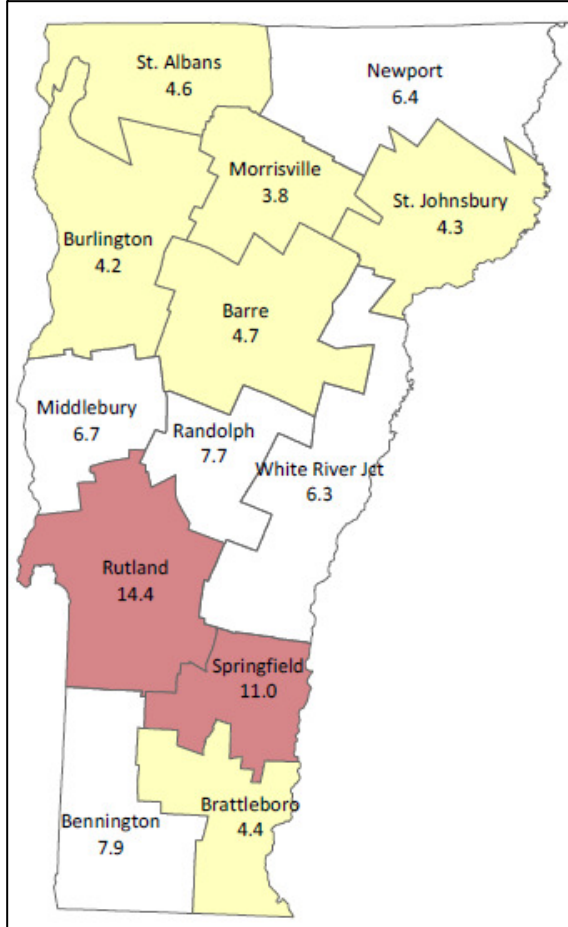
Red-signifies significantly higher than state rate
Yellow-signifies significantly lower than state rate
*Rate per 10,000
**Data from VUHDDS 2009

Emergency Department and Hospital Charges

In addition to being an indicator of poor asthma self-management, ED and hospital visits can be quite costly. Using VUHDDS, we identified the total and average charges associated with asthma visits. It is important to note that this data represents the charges for services provided and not the amount that was paid for services.

Average Charge of Visit

The average charge associated with a primary asthma diagnosis at an ED visit has significantly increased since 2005 (figure 6.7). During those 5 years, the average charge consistently

increased by an amount between $60 and $100 each year. In 2009, the average charge associated with a primary asthma diagnosis was $960, nearly twice the average charge in 2005.

Figure 6.7. Average charges for ED discharge with a primary diagnosis of asthma among Vermonters, 2005-2009*

Data from VUHDDS 2005-2009
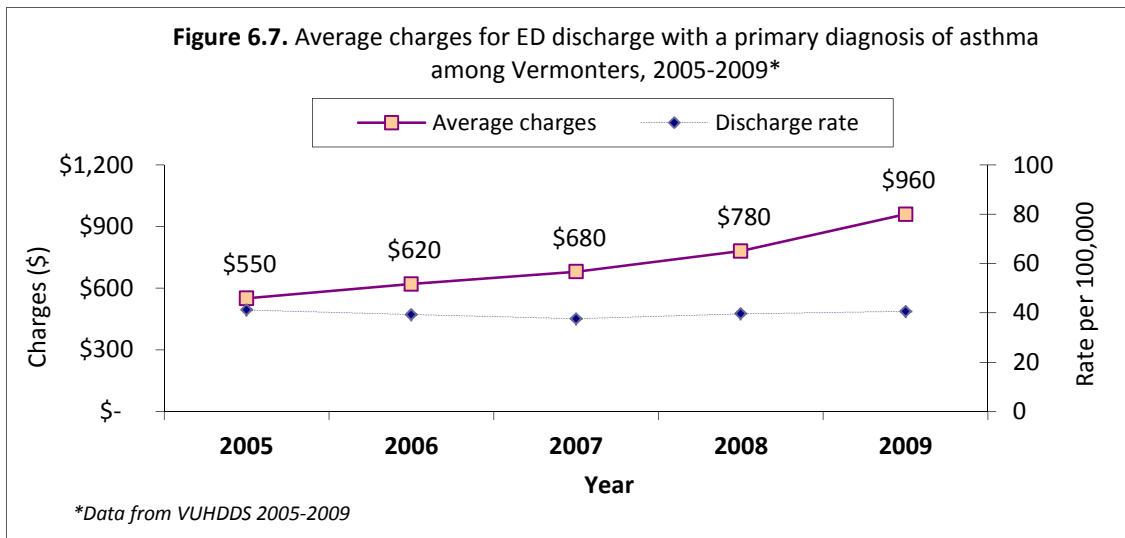
While the average hospital visit charge associated with a primary diagnosis of asthma was significantly higher in 2009 than it was five years before (figure 6.8), the increase has not been quite as smooth as seen with ED charges for asthma. In 2006, the average charge associated with primary asthma diagnosed hospital discharges dropped by nearly $2000 from the previous year. The average charge then began to steadily rise in 2007 and in 2008 only to level off in 2009.

Figure 6.8. Average charges for a hospital discharge with a primary diagnosis of asthma among Vermonters, 2005-2009*

Data from VUHDDS 2005-2009
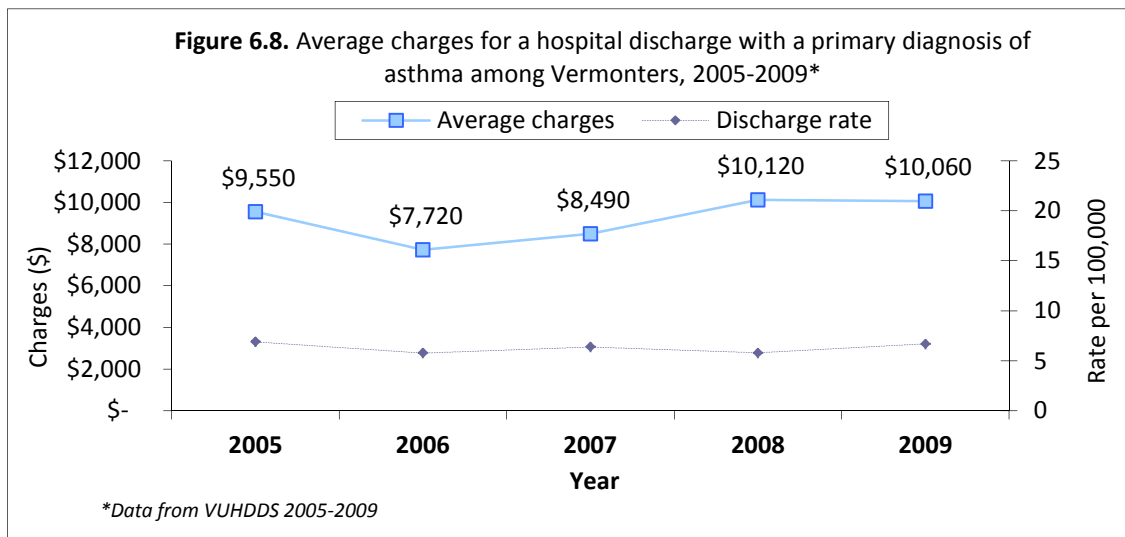
Total Charges for Asthma Visits

We can also examine the total charges associated with primary asthma diagnosis in both ED and hospital visits (figure 6.9). Based on the average charges examined in the previous section, it is not surprising to see that hospital charges contribute more to the overall charges associated with asthma than emergency department visits. Since 2005, we have seen a gradual increase in the total charges associated with a primary diagnosis of asthma. However, the increase in overall charges appears to happen every other year. Thus, we see a jump in the total charges associated with asthma in 2007 while the overall charges in the subsequent year remains constant.

Figure 6.9. Total charges associated with a primary diagnosis of asthma for ED and hospital discharges among Vermonters, 2005-2009*

Year	ED discharges	Hospital discharges
2005	$1,410,220	$3,294,590
2006	$1,517,200	$3,004,690
2007	$1,591,000	$4,067,520
2008	$1,937,000	$3,620,620
2009	$2,419,100	$4,755,570

*Data from VUHDDS 2005-2009
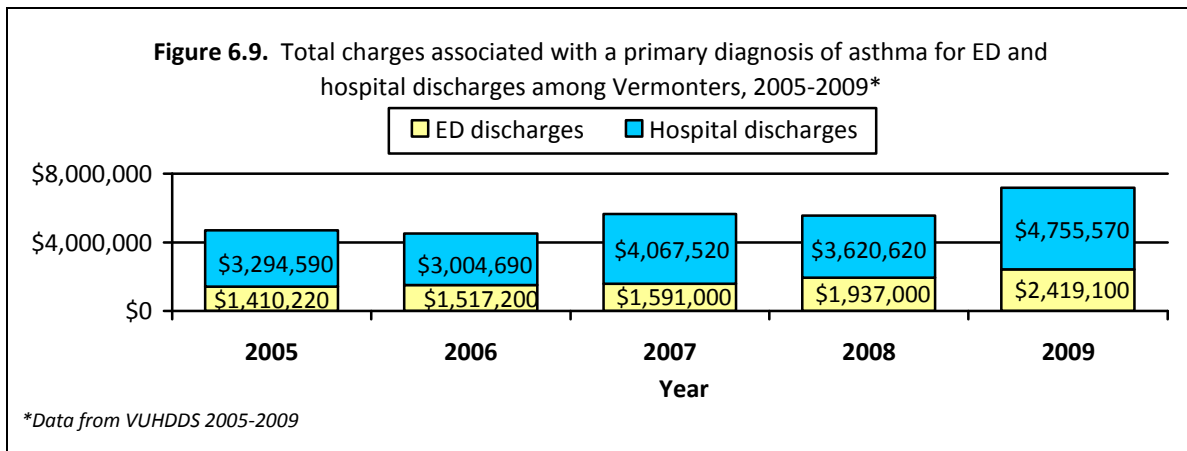
Over time, we are seeing an increase in the amount of overall charges associated with a primary diagnosis of asthma and in the average charges associated with asthma. Yet, we are not seeing an increase in the rate of discharges with a primary diagnosis of asthma in the ED and hospital. Thus, for a similar amount of service we are seeing the charges become more expensive. Focusing efforts on improved self-management of asthma is a critical step in controlling the amount ED and hospital charges directly related to asthma.

Chapter 7—Healthy Vermonters Initiative

The *Healthy Vermonters* initiative is based on the various health outcomes and goals set by the *Healthy People* national initiative. The state is currently in the process of transitioning from the *Healthy Vermonters* 2010 initiative to the *Healthy Vermonters* 2020 initiative.

Healthy Vermonters 2010

Healthy Vermonters 2010 included six goals on respiratory conditions (table 7.1). Five of the goals related directly to asthma and one of the goals focused on the number of COPD deaths. Though asthma and COPD are separate conditions there is some relationship between the two that warrants acknowledgement by the Asthma Program.

Only one of the respiratory disease goals could actually be compared to national data—the goal to reduce the number of COPD deaths among people over the age of 45. The rate of COPD deaths among adults over the age of 45 was significantly higher in Vermont than the U.S.

Table 7.1. Healthy Vermonters 2010 respiratory disease goals and final status

Goal	Goal	Status in 2010	Did VT meet the Goal?
Reduce COPD deaths among people 45 and older (rate per 100,000)	62.3	132.2	No
Reduce asthma hospitalizations among people under age 18 (rate per 10,000)	17.3	7.4	Yes
Reduce the percent of children under age 18 who are regularly exposed to tobacco smoke at home	10	7	Yes
Reduce the percent of adults exposed to smoke in their home during the past 7 days	10	14	No
Increase the percent of adults with asthma who receive formal patient education	30	9	No
Increase the percent of adults with asthma who receive written asthma management plans from their health care provider.	38	32	No

Two of the five goals directly related to asthma were met by the end of 2010. They included a reduction in the rate of asthma hospitalizations among Vermonters less than 18 years of age and a reduction in the percent of children regularly exposed to tobacco smoke at home.

Healthy Vermonters 2020

The goals related to asthma in the *Healthy Vermonters* 2020 initiative changed slightly from those presented in *Healthy Vermonters* 2010. Table 7.2 shows the new *Healthy Vermonters* 2020 goals that relate to asthma. Our baseline hospitalization rates for those less than age 5, those 5-64 years, and those over the age of 65 are all significantly lower than the U.S. baseline.

With the *Healthy Vermonters* 2020 initiative the Vermont Department of Health is implementing a system for tracking various goals throughout the state and in various sub-geographies (county, HSA, and district office region) on an annual basis. This system will allow community members and local health staff to monitor various health outcomes in their region.

Table 7.2. Healthy Vermonters 2020 respiratory disease baseline and goals

Goal	Baseline	2020 Goal
Reduce the asthma hospitalization rate per 10,000 for children less than age 5.	18.8	14.0
Reduce the asthma hospitalization rate per 10,000 for persons age 5 to 64.	4.9	4.2
Reduce the asthma hospitalization rate per 10,000 for adults age 65 and older.	11.7	9.3
Reduce the percent of adult non-smokers exposed to secondhand smoke.	43	40
Increase the percentage of adults who have a written asthma management plan from a health care provider	32	40
Increase the percentage of children (<18 years) who have a written asthma management plan from a health care provider	48	65
Increase the percent of adults with asthma advised to change things in home, school, or work environments	35	45
Increase the percent of children with asthma advised to change things in home, school, or work environments	33	50

Chapter 8—Target Populations

In previous chapters we outlined the prevalence of asthma and discussed various sociodemographic, biological, and environmental risk factors associated with asthma. We have chosen a variety of target groups based on the strength of a given factor's association with asthma prevalence, as an asthma risk factor, or role in asthma severity and control. These factors are outlined in table 8.1.

Table 8.1. Target populations for addressing asthma in Vermont

Focus area	Target group
Sociodemographic	Education
	FPL
Biological factors	Co-existing chronic conditions
Environmental factors	Smoking status and exposure to secondhand smoke
	Work-related asthma
Regional focus	Springfield
	Rutland

Since the actual causes of asthma remain unclear, it is very difficult to change the prevalence of asthma over time. Thus, the rationale for selecting a target population was not limited to a statistical difference in asthma prevalence. However, given the implementation of effective interventions across the state, it is possible to make an impact on asthma control and self-management. This led us to focus on factors that were significantly associated with asthma severity and control, either from data collected through the BRFSS or hospital and emergency department service utilization.

Throughout this chapter, we have chosen to present odds ratios for each factor that show how a given factor predicts severe asthma and uncontrolled asthma. In order to make this comparison, asthma severity and asthma control must be divided into two levels. Asthma severity can be divided into severe asthma (moderate persistent asthma and severe persistent asthma) and asthma that is not severe (mild intermittent asthma and mild persistent asthma). Asthma control can be divided into two groups; those with well controlled asthma and those with uncontrolled asthma ('not well' and 'poorly' controlled asthma). For each risk factor, a referent category must be assigned. In some cases, this is the absence of the condition or risk factor and in some cases it is a particular level of the given risk factor. Because of the small samples sizes of youth in individual strata, we are only able to perform these analyses among adult Vermonters with asthma.

The odds ratios presented throughout this chapter are crude; they were not calculated using complex models that would allow us to control for all factors related to each target area. Rather, they are meant to offer insight into areas where more sophisticated analyses may help the program better understand target populations. The goal of this chapter is to present the preliminary analyses that serve as a foundation for future work by Vermont's asthma surveillance team.

Sociodemographic Target Populations

Level of Education

In Chapter 3, we examined the prevalence of various levels of asthma severity and control by educational status. Vermonters who reported their highest level of educational attainment as a high school degree or less were significantly more likely to have severe and poorly controlled asthma than Vermonters that graduated from college.

Compared to those who graduated from college, Vermonters with a high school degree or less and those that attended some college both had significantly higher odds of severe asthma (figure 8.1). The odds of Vermonters that attended some college having severe asthma were 60% higher than the odds of a Vermonter that graduated from college. Even more striking, a Vermonter with a high school diploma or less had nearly five-fold higher odds of severe asthma than a Vermonter that graduated from college.

Figure 8.1. Odds of severe asthma by level of education among adult Vermonters with current asthma, 2008-2010*

(Referent is college graduate)

Data from BRFSS and ACBS 2008-2010

Figure 8.2. Odds of uncontrolled asthma by level of education among adult Vermonters with current asthma, 2008-2010*

(Referent is college graduate)

Data from BRFSS and ACBS 2008-2010
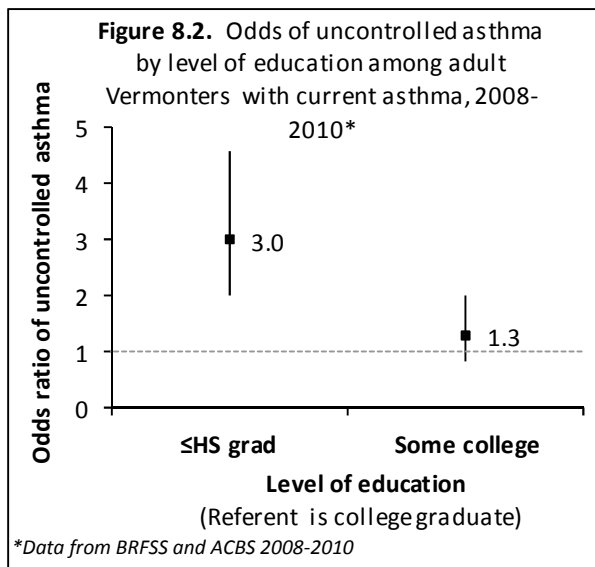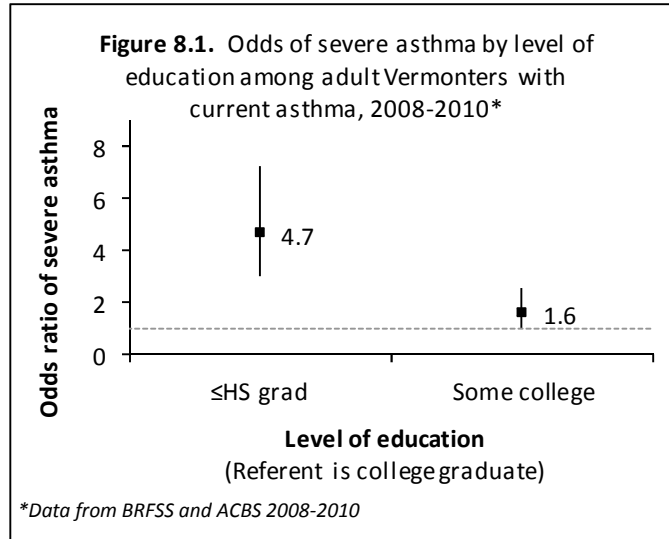
The odds of uncontrolled asthma did not significantly differ between Vermonters who attended some college and those who graduated from college (figure 8.2). However, the odds of a Vermonter with a high school degree or less having uncontrolled asthma were three-fold higher than that of a Vermonter that graduated from college.

These two crude odds ratios serve as a good foundation for further analysis related to education. Further investigation into the individuals with low levels of education and well controlled asthma may offer insight into program activities that are working well and should be expanded.

In Chapter 3, when annual household income proximity to the FPL was discussed as a risk factor for asthma, we did not see a consistent pattern with asthma severity and control. We found that those with annual household incomes below 125% of the FPL and between 250%-349% did not significantly differ from one another. When we examine the odds ratio for severe asthma of those below 125% of the FPL and those between 250% and 349% of the FPL this pattern

persists; both groups were significantly more likely to have severe asthma compared to those making more than 350% of the FPL (figure 8.3). Furthermore, the size of the odds ratio for those making less than 125% of the FPL is striking as their odds of severe asthma are seven-fold higher than that of an individual making more than 350% of the FPL. Vermonters with annual household incomes between 125% and 249% of the FPL and those with annual household incomes above 350% of the FPL did not significantly differ from one another in regards to odds of severe asthma.

Figure 8.3. Odds of severe asthma by annual household income among adult Vermonters with current asthma, 2008-2010*

Odds ratio of severe asthma

Annual household income (% of FPL)
(Referent is ≥350%)

Data from BRFSS and ACBS 2008-2010

Figure 8.4. Odds of uncontrolled asthma by annual household income household income among adult Vermonters with current asthma, 2008-2010*

Odds ratio of uncontrolled asthma

Annual household income (% of FPL)
(Referent is ≥350%)

Data from BRFSS and ACBS 2008-2010

The only group with significantly higher odds of uncontrolled asthma was among those making less than 125% of the FPL (figure 8.4). Those in the lowest income group had four-fold higher odds of uncontrolled asthma when compared to those with annual household incomes above 350%. The pattern seen in Chapter 3, showing similarities between those with annual household incomes between 250% and 349% and those in the lowest income group, is less apparent when looking at the odds of uncontrolled asthma.

It would be interesting to combine annual household income with level of education to better understand the socioeconomic status of Vermonters with asthma. It would also be interesting to further examine annual household income in a statistical model that controlled for factors such as employment status, age, presence of a primary care doctor, and the number of routine

asthma visits. To better understand what is working well for those with low income and well controlled asthma, it would also be interesting to look at common characteristics among those with annual household incomes below 125% of the FPL who have well controlled asthma.

Biological Target Populations

Presence of Multiple Chronic Conditions

In Chapter 3, we showed that as the number of chronic conditions increased, the likelihood of moderate to severe asthma and uncontrolled asthma significantly increased. This pattern of association persists as we examine the odds of severe and uncontrolled asthma. Vermonters with current asthma and two additional chronic conditions have nearly three-fold higher odds of severe asthma and those with three or more chronic conditions have nearly four-fold higher odds of severe asthma than those with asthma but no other chronic conditions (figure 8.5). The odds of severe asthma did not significantly differ among those with current asthma and one additional chronic condition and those with asthma without any additional chronic conditions.

Figure 8.5. Odds of severe asthma by the number of chronic conditions, in addition to current asthma among adult Vermonters, 2008-2010*

Number of additional conditions
(Referent is no additional conditions)

Data from BRFSS and ACBS 2008-2010

Figure 8.6. Odds of uncontrolled asthma by the number of chronic conditions in addition to current asthma among adult Vermonters, 2008-2010*

Number of additional conditions
(Referent is no additional conditions)

Data from BRFSS and ACBS 2008-2010

With only one additional chronic condition reported, adult Vermonters with current asthma have significantly higher odds of uncontrolled asthma (figure 8.6). Compared to Vermonters with current asthma who have no other chronic conditions, those with one additional chronic condition have 70% higher odds of uncontrolled asthma. Adult Vermonters with current asthma and two or more chronic conditions have three-fold higher odds of uncontrolled asthma compared to with current asthma who do not have any additional chronic conditions.

In future analyses involving multiple chronic conditions there are a number of additional factors that should be controlled for. This includes, but is not limited to, age and other related demographic and socioeconomic factors. While the data presented here is self-reported from BRFSS and ACBS, further investigation into those that are discharged from the emergency department and hospital with a primary asthma diagnosis, but with secondary diagnoses of other chronic conditions could offer some insight into the individuals utilizing these services and their possible difficulties achieving asthma control.

The presence of multiple chronic conditions can make self-management more complicated. The Vermont Asthma Program feels it is important to collaborate with other chronic disease programs and local partners to address better self-management among these individuals.

Individual Chronic Conditions

In addition to considering how many chronic conditions an individual has, it is also important to consider whether certain individual chronic conditions have a stronger association to the odds of severe and uncontrolled asthma. Depression, cardiovascular disease (CVD), cancer, COPD (data not shown), being overweight, or being obese significantly increased the odds of severe asthma when compared to those that did not have a given condition (figure 8.7). Depression, CVD, and cancer increased the odds of severe asthma approximately three-fold compared to the absence of the respective condition. Being overweight increased the odds of severe asthma by 90% while being obese increased the odds of severe asthma two-fold compared to those that were neither overweight nor obese. When independently assessed, the odds of severe asthma did not significantly differ for those with current asthma and diabetes or arthritis compared to those with current asthma but did not have either respective condition.

Figure 8.7. Odds of severe asthma by co-occuring chronic condition among adult Vermonters with current asthma, 2008-2010*
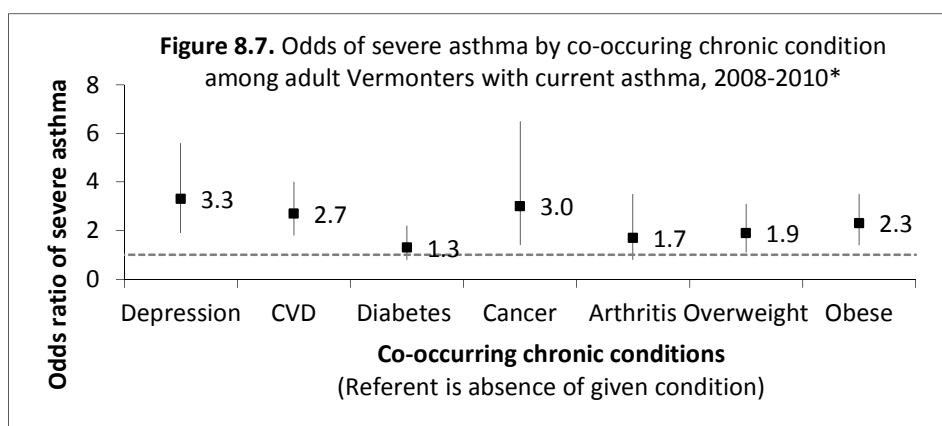
Data from BRFSS and ACBS 2008-2010

The same conditions that showed increased odds of severe asthma were also significantly associated with higher odds of uncontrolled asthma (figure 8.8). Those with depression, cardiovascular disease, cancer, COPD (data not shown) and those who are overweight or obese

had significantly higher odds of uncontrolled asthma compared to those without each chronic condition.

Figure 8.8. Odds of uncontrolled asthma by co-occurring chronic conditions among adult Vermonters with current asthma, 2008-2010*

(chart showing odds ratios)

Odds ratio of uncontrolled asthma (y-axis): Depression 2.5, Diabetes 2.3, 1.6, 2.6, Arthritis 1.8, 1.7, Obesity 2.1

Co-occurring chronic condition
(Referent is absence of given condition)
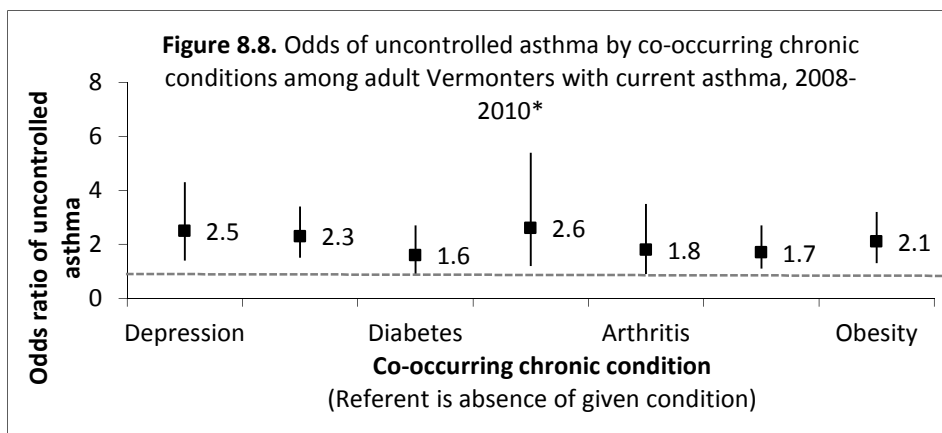
Data from BRFSS and ACBS 2008-2010

It is important to note that certain conditions are consistently associated with increased odds of severe and uncontrolled asthma. Though these analyses are fairly crude, this information could be useful in designating where we should focus chronic disease integration efforts.

Indoor Environment Target Populations

Work-related Asthma

In Chapter 4, approximately a quarter to a third of those that reported any work-related asthma (WRA) factor had severe persistent asthma and were more likely to have poorly controlled asthma. This pattern persists when we examine odds ratios.

Reporting any individual WRA significantly increased the odds of severe asthma by two-fold or more when compared to those that did not have a given WRA factor (figure 8.9). Those that report their asthma has been aggravated by their job had four-fold higher odds of severe asthma than those who did not report a job aggravating their asthma.

Figure 8.9. Odds of severe asthma by work-related asthma (WRA) factors among adult Vermonters with current asthma, 2008-2010*
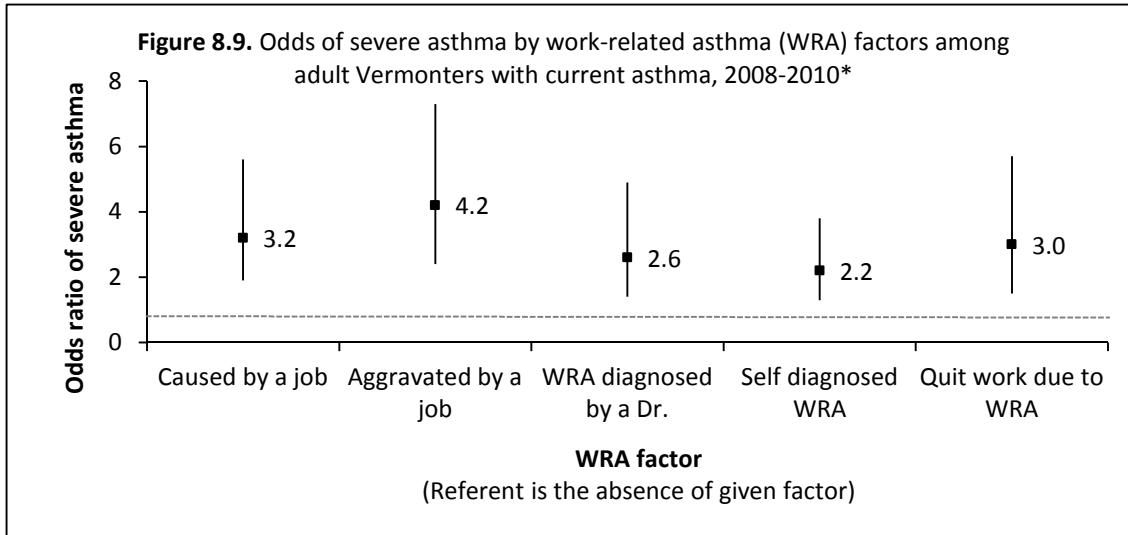
Data from BRFSS and ACBS 2008-2010

Those that reported any WRA factor had significantly higher odds of uncontrolled asthma by approximately two-fold or more compared to those that did not report a given WRA factor (figure 8.10). Those that reported their asthma was aggravated by a current or previous job and those that reported quitting work because of a WRA had the highest odds of severe asthma compared to those not reporting each respective WRA factor.

Figure 8.10. Odds of uncontrolled asthma by work-related asthma (WRA) factors among adult Vermonters with current asthma, 2008-2010*
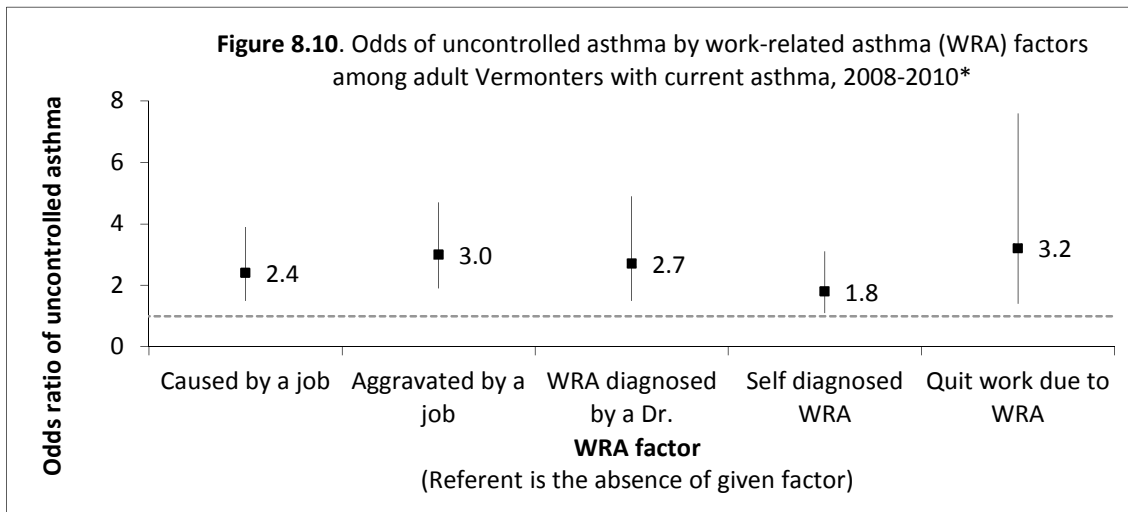
Data from BRFSS and ACBS 2008-2010

In future analyses of WRA we plan to include annual household income proximity to the FPL since those with an annual household income below 125% of the FPL were significantly more likely to report that their asthma was either caused or aggravated by a job (discussed in Chapter 4). It is not entirely clear if this data can be obtained, but working toward learning more about

the association between occupation and Work-related asthma is something the Vermont Asthma Program is interested in better understanding.

Smoking Status and Exposure to Secondhand Smoke

In Chapter 4, we mentioned that those with current asthma were significantly more likely to be current smokers than those without asthma. When we examine the odds of severe and uncontrolled asthma by smoking status only we find that current smokers had significantly higher odds of severe asthma (OR= 3.4) and uncontrolled asthma (OR=2.6) compared to never smokers. Former smokers did not significantly differ from never smokers in regard to the odds of severe asthma, but they did have significantly higher odds of uncontrolled asthma (OR=1.8) than never smokers

When we also take secondhand smoke (SHS) into consideration we see that ever smokers, regardless of SHS exposure, had significantly higher odds of severe and uncontrolled asthma. However, the difference between smokers exposed to SHS and those not exposed to SHS is striking. Compared to a never smoker not exposed to SHS, an ever smoker not exposed to SHS had 80% higher odds of severe asthma and an ever smoker exposed to SHS had five-fold higher odds of severe asthma (figure 8.11).

Figure 8.11. Odds of severe asthma by smoking status and SHS among adult Vermonters with current asthma, 2008-2010*

Data from BRFSS and ACBS 2008-2010

Figure 8.12. Odds of uncontrolled asthma by smoking status and SHS among adult Vermonters with current asthma, 2008-2010*

Data from BRFSS and ACBS 2008-2010
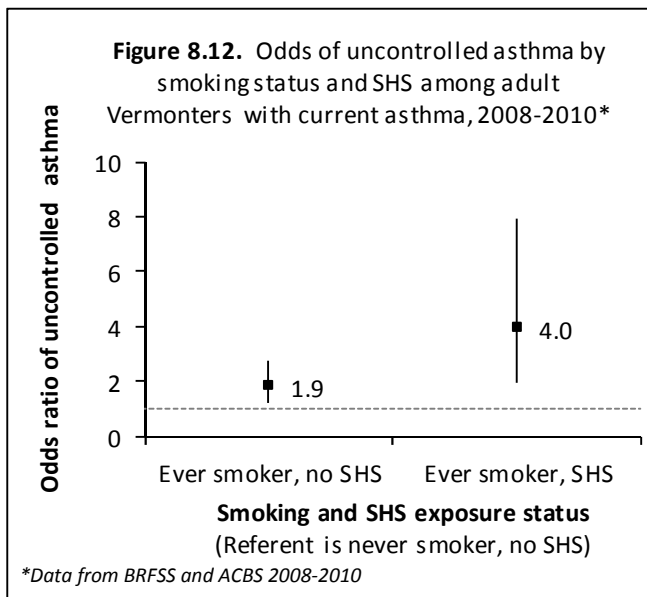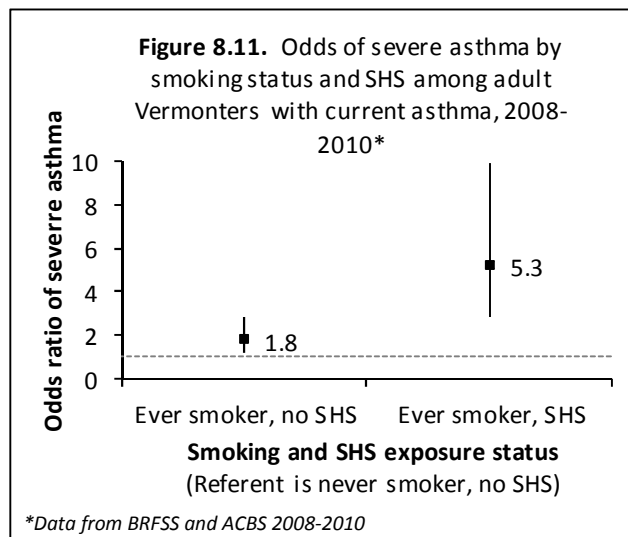
An ever smoker without SHS exposure had nearly two-fold higher odds of uncontrolled asthma, while an ever smoker exposed to SHS had four-fold higher odds of uncontrolled asthma compared to a never smoker without SHS exposure (Figure 8.12).

Though this evidence is not new nor novel, it suggests that smoking and SHS continue to interfere with asthma self-management. Smokers and those exposed to SHS continue to be important target populations in attempts to decrease the burden of asthma.

Regional Target Populations

Springfield Region

Though Springfield did not have an asthma prevalence that significantly differed from the state for either adults or youth, we did find that individuals in the Springfield HSA utilized both the emergency department and hospital services significantly more frequently than the state average. In fact, Springfield HSA residents were discharged from the ED at a rate 35% higher than that of the state. Furthermore, residents were discharged from the hospital at a rate 64% higher than that of the state.

Also, when we look at prevalence among youth in the Springfield district office region we find that there are large discrepancies in asthma prevalence between BRFSS and the School Nurses' report. This suggests that management of asthma among school age children could be hampered by the lack of awareness among the school nurses in the region.

Overall, these factors lead us to suggest that better awareness and more efforts to improve asthma self-management would be beneficial to individuals with asthma living in the Springfield region.

Rutland Region

Rutland did not significantly differ from the state in regards to asthma prevalence. However, the rate of emergency department and hospital service utilization is significantly higher in Rutland than the state. Rutland residents are discharged with a primary asthma diagnoses from the ED at a rate 30% higher than that of the state. The hospital discharge rate with a primary diagnosis of asthma in Rutland was twice that of the state.

In the previous Vermont State Asthma Plan, written in 2008, the Rutland region was targeted because of their statistically higher utilization rates. The most current data suggests that more work needs to be done in the Rutland region to help residents gain control of their asthma and decrease ED and hospital service utilization rates.

Conclusion

There is significant work to be done in Vermont to lessen the burden of asthma. This report has outlined the current burden and highlighted areas where improvement is needed and work may be targeted. Prevalence is used to introduce disparate groups affected by asthma. Women, those living below 125% of the FPL, those who did not graduate from high school, those who are unemployed, and those who are unable to work all have a significantly higher prevalence of asthma compared to respective counterparts. While prevalence is commonly used to describe asthma, a better indicator for measuring the asthma status and the impact of interventions and initiatives is asthma control.

A variety of sociodemographic, biological, and environmental factors were associated with poor asthma control. Level of education, annual household income, the presence of multiple chronic conditions, smoking status and exposure to secondhand smoke, and work-related asthma all significantly impacted one's ability to control their asthma. While many individuals reported knowing some self-management techniques, including how to recognize an asthma attack and what to do during an asthma attack, less than half knew how to use a peak flow meter or had an asthma action plan and very few had ever taken a course to learn how to better manage their asthma.

Data showed that few individuals with asthma follow the current guideline recommendation to see a healthcare provider every six months for routine evaluation of their asthma. Further, rates of emergency department and hospital services are high among males under the age of 15 and women between the ages of 15 and 64. Both of these factors suggest a need for addressing self-management. In the last chapter of this report we identified several potential target populations for future interventions. We presented the odd ratios describing asthma severity and control on each individual target group. We hope to analyze these populations further with more complex models that account for a variety of factors in order to better understand where opportunities for collaboration exist.

Appendix

I. Technical Notes

A) **Definition of Asthma:** The Council of State and Territorial Epidemiologists (CSTE) definition for asthma is used for surveillance analyses. For self-reported data the CSTE recommends using a validated tool that asks if a doctor or health professional has ever diagnosed the individual with asthma and whether or not the individual still has asthma. For hospital discharge and vital records data CSTE recommends the use of the ICD-9 codes 493.0-493.9.

B) **Statistical Analyses:** *All statistical Analyses were completed using SAS 9.2 and SUDAAN.*

a) Prevalence and odds ratio calculations utilized weighted Behavioral Risk Factor Surveillance System and Asthma Call Back Survey data. Data was weighted to be representative of the Vermont youth and adult population. Calculations using weighted data were completed with SUDAAN.

   i) Prevalence was calculated by using descriptive statistical procedures in SUDAAN. Prevalence describes the proportion of individuals with a given condition or trait in the population during a specified period of time.

   ii) *Odd Ratios* were calculated using logistic regression for uncontrolled asthma and severe asthma. The outcome variables, asthma control and asthma severity, had to be reclassified into two levels for this logistic regression. Uncontrolled asthma included those with not well and poorly controlled asthma. While controlled asthma included only those with asthma that classified as well controlled. Severe asthma included those whose asthma was classified as either moderate or severe persistent. Those individuals with asthma that was classified as mild intermittent or mild persistent were not considered to have severe asthma. The odds ratios in all analyses for this report were crude. There were no complex models used and there were no additional adjustments made to individual models. Each set of odds ratios presented in this report represents a single crude model comparing a given factor to either the odds of uncontrolled asthma or severe asthma.

b) Mortality rates and discharge rates are considered crude rates, unless otherwise specified.

   i) *Mortality rates* were calculated using the data from vital records on deaths where the main cause of death was listed as ICD-9 codes 493.0-493.9. We only included deaths of Vermont residents. We calculated rates by comparing the number of

deaths in a given time period to the overall population of Vermont in the same time period.

ii) *Discharge rates* were calculated using the Vermont Uniform Hospital Discharge data set. We looked at all hospital and ED discharge among Vermont residents who utilized services at regional hospitals (including hospitals in bordering states). We compared the number of discharges in a given time period to the Vermont population in the same time period to calculate discharge rates.

c) In cases where age adjustment was noted as being part of the statistical anlaysis, the estimates were adjusted based on the proportional age breakdowns of the U.S. population in 2000.

d) *Confidence Intervals and Statistical Significance*—A confidence interval represents the range in which a parameter estimate would fall which is calculated based on the observed data. For this analysis, we used a 95% confidence interval, meaning that we are 95% confident that the true value of the parameter being examined falls within the specified confidence interval. We test for statistically significant difference by comparing the confidence intervals of different groups. If the confidence intervals from two groups, such as males and females, do not overlap we consider the estimates to be significantly different from one another. Throughout this report, 'statistically significant' and 'significantly different' are both used to describe statistically significant differences.

C) **Data Sources**

a) The *Behavioral Risk Factor Surveillance System (BRFSS)* is an annual telephone survey that is conducted by individual state health departments with support from the CDC. The survey uses a random digit dialing technique to contact and interview subjects. All 50 states complete a set of core BRFSS questions and some states chose to include additional questions or question modules that focus on health topics relevant to the state. One of the optional modules completed in the State of Vermont provides data on asthma prevalence in children. In 2010, the optional childhood asthma module was completed by 34 states. BRFSS data is weighted so that it is representative of the Vermont population. All analyses completed with BRFSS data utilized weighted data.

b) In 38 states, there is an additional annual survey for subjects that report having current asthma, the *Asthma Call Back Survey (ACBS)*. In Vermont, this survey is conducted for both adults and children with current asthma. This survey allows for more detailed information on asthma risk factors, control, severity, and self-management. Information collected for the childhood ACBS is reported by a parent or guardian.

c) The *School Nurses' Report* serves as an additional source of information for school age children. The School Nurses' Report is not a survey; rather it is a school based tracking system for calculating counts of various indicators based on parent or guardian reports

to the school nurse. Data on asthma, immunizations, health insurance status and well child and dental visits that are collected by school nurses are then reported to the Vermont Department of Health. It is important to note that the information in this report may not necessarily be complete, as individual schools may have different policies on collecting this information. In other words, some schools may require this information be provided every school year and will follow-up with parents that do not provide this information. Other schools may collect what parents hand-in and may not do any follow-up to collect information that is missing.

d) Hospital and emergency department discharge data are collected from in-state hospitals and from hospitals in bordering states in the _Vermont Hospital Utilization Reports and Discharge Data Sets (VUHDDS)_. The VUHDDS data set was narrowed to only include Vermont residents for this analysis. We used the CSTE definition of asthma to identify asthma diagnosis. A primary asthma diagnosis refers to when asthma was listed as the first diagnosis code. Any asthma diagnosis refers to when asthma is listed as any of the twenty diagnosis codes. Patients admitted to the hospital from the emergency department are included in the hospital discharge data set and are not included in the emergency discharge data set.

e) The Vermont _Vital Statistics System_ monitors vital events, including deaths. Information on the cause of death is obtained from a physician and reported on the death certificate. Using information from the death certificate we utilized the CSTE definition to identify individual Vermonters whose leading cause of death was asthma.

II. *Glossary*

ACBS- the Asthma Call Back Survey, those that responded on the BRFSS as having current asthma are contacted to complete this survey for additional information on their asthma.

Adult- Individuals age 18 years and older.

BRFSS- the Behavioral Risk Factor Surveillance System, a population survey funded by the CDC.

Current asthma prevalence- The proportion of individuals ever told by a healthcare provider that they had asthma and responded that they currently have asthma.

Current smoker- An individual who reported smoking at least 100 cigarettes in their lifetime and reports they currently smoke 'some days' or 'everyday'.

Ever smoker- An individual who reported smoking at least 100 cigarettes in their lifetime.

Former smoker- An individual who reported smoking at least 100 cigarettes in their lifetime and reports they currently smoke 'not at all'.

HSA- Hospital Service Area, towns are assigned to one hospital service area based on where the majority of residents seek common hospital services.

Lifetime asthma prevalence- The proportion of individuals ever told by a healthcare provider that they had asthma.

Never smoker- An individual who reported that had not smoked at least 100 cigarettes in their lifetime.

Prevalence- the proportion of individuals with a condition or disease in a population in a given period of time .

Odds of uncontrolled asthma- The odds an individual has either not well or poorly controlled asthma compared to having well controlled asthma given the presence of an additional factor, such as level of education or presence of other chronic conditions.

Odds of severe asthma- The odds an individual has either moderate to severe persistent asthma compared to having mild intermittent or mild persistent asthma given the presence of an additional factor, such as level of education or presence of other chronic conditions.

School Nurses' Report- This is parent-reported data on asthma and immunizations that school nurse offices maintain and report to the Vermont Department of Health.

Youth- Individuals less than 18 years of age.

III. *Useful acronyms*

ACBS	*Asthma Call Back Survey*
BRFSS	*Behavioral Risk Factor Surveillance System*
CI	*Confidence Interval*
EPR-3	*Expert Panel Report 3*
NHLBI	*National Heart, Lung, and Blood Institute*
SABA	*Short-acting beta agonists*
SHS	*Secondhand Smoke*
VUHDDS	*Vermont Uniform Hospital Discharge Data Set*

IV. Medication Lists

SABA Medications	Controller Inhalers	Rescue Inhalers
Albuterol	Advair	Albuterol
Alupent	Aerobid	Alupent
Bitolterol	Asmanex	Astrovent
Brethaire	Azmacort	Bitolterol
Combivent	Beclomethasone dipropionate	Brethaire
Levalbuterol tartrate	Beclovent	Combivent
Maxair	Budesonide	Ipratropium bromide
Metaproteronol	Cromolyn	Levalbuterol tartrate
Pirbuterol	Flovent	Maxair
Pro-Aire HFA	Flovent Rotadisk	Metaproteronol
Proventil	Flunisolide	Pirbuterol
Terbutaline	Flucticasone	Pro-Aire HFA
Tornalate	Foradil	Proventil
Ventolin	Formoterol	Salbutamol
Xopenex HFA	Intal	Terbutaline
	Mometasone furoate	Tornalate
	Nedocromil	Ventolin
	Pulmicort turboinhaler	Xopenex HFA
	QVAR	
	Slameterol	
	Serevent	
	Symbicort	
	Tilade	
	Triamcinolone acetonide	
	Vanceril	

V. Detailed tables

Table 1.1. Current and lifetime asthma prevalence in the U.S.[*], BRFSS 2010					
	Current Asthma			Lifetime Asthma	
	Prevalence	95% CI		Prevalence	95% CI
Adult [3]	8.6	(8.5 – 8.8)		13.5	(13.3 – 13.7)
Child [4]	8.4	(8.0 – 8.8)		12.6	(12.1 – 13.2)

[*] *Asthma prevalence of U.S. Adults includes information from all 50 states and the District of Columbia. Asthma prevalence of U.S. children includes data from 38 states and the District of Columbia. Information from U.S. territories is not included in these estimates.*

Table 1.2. Prevalence of current and lifetime asthma among various sociodemographic groups in Vermont, BRFSS 2010

	Current asthma		Lifetime asthma	
	Prevalence	*95% CI*	Prevalence	*95% CI*
Total	11.2	*(10.2 - 12.3)*	17.3	*(15.9 - 18.7)*
Age (years)				
18-24	14.5	*(9.6 - 21.3)*	28.6	*(21.7 - 36.8)*
25-34	15.0	*(11.6 - 19.0)*	24.6	*(20.3 - 29.5)*
35-44	11.1	*(9.1 - 13.4)*	14.3	*(12.0 - 16.9)*
45-54	10.1	*(8.5 - 11.9)*	14.6	*(12.7 - 16.7)*
55-64	9.9	*(8.4 - 11.5)*	14.3	*(12.6 - 16.2)*
>65	8.7	*(7.5 - 10.1)*	12.3	*(10.9 - 13.9)*
Sex				
Male	8.0	*(6.7 - 9.6)*	14.9	*(17.7 - 21.2)*
Female	14.1	*(12.6 - 15.7)*	19.4	*(15.4 - 18.2)*
Annual Household Income (%FPL)				
<125%	14.9	*(12.0 - 18.4)*	23.6	*(19.5 - 28.3)*
125%-249%	13.4	*(10.9 - 16.3)*	18.1	*(15.2 - 21.5)*
250%-349%	9.9	*(8.0 - 12.1)*	15.4	*(12.9 - 18.3)*
≥350%	8.5	*(7.3 – 10.0)*	13.4	*(11.7 - 15.2)*
Level of Education				
<HS	16.2	*(11.3 - 22.7)*	27.1	*(19.7 – 36.0)*
HS grad	11.7	*(9.8 - 13.9)*	17.3	*(15.0 – 20.0)*
Some College	11.6	*(9.5 - 14.1)*	16.3	*(13.6 - 19.4)*
College Grad	9.7	*(8.4 - 11.3)*	16.3	*(14.4 - 18.3)*
Employment status				
Employed	10.1	*(8.9 - 11.5)*	16.5	*(14.8 - 18.3)*
Not Working (homemaker, student, retired)	10.2	*(8.3 - 12.4)*	14.6	*(12.4 - 17.1)*
Unemployed	18.5	*(12.6 - 26.3)*	26.7	*(19.7 – 35.0)*
Unable to work	23.4	*(18.7 - 28.9)*	31.1	*(25.1 - 37.8)*
Race/Ethnicity				
White, non-Hispanic	11.0	*(10.0 - 12.1)*	16.4	*(15.1 - 17.9)*
Racial or Ethnic Minority	14.5	*(9.0 - 22.6)*	29.1	*(20.8 - 39.2)*

Table 1.3. Asthma prevalence in Vermont counties and hospital service areas (HSAs), BRFSS 2008-2010

	Current asthma		Lifetime asthma	
	Prevalence	*95% CI*	Prevalence	*95% CI*
County				
Addison	8.6	*(6.7 - 11.1)*	13.8	*(11.3 - 16.7)*
Bennington	13.3	*(11.1 – 16.0)*	21.3	*(17.8 - 25.1)*
Caledonia	11.8	*(9.5 - 14.7)*	18.5	*(15.2 - 22.2)*
Chittenden	9.3	*(8.1 - 10.5)*	14.6	*(13.2 - 16.2)*
Essex	15.4	*(9.8 - 23.5)*	19.9	*(13.6 - 28.3)*
Franklin	9.6	*(7.8 - 11.8)*	15.7	*(13.3 - 18.4)*
Grand Isle	12.0	*(6.8 - 20.4)*	14.6	*(9.0 - 22.8)*
Lamoille	9.3	*(6.8 - 12.4)*	16.1	*(12.8 - 20.1)*
Orange	10.2	*(8.3 - 12.4)*	15.7	*(13.2 - 18.6)*
Orleans	13.4	*(10.7 - 16.7)*	17.4	*(14.3 – 21.0)*
Rutland	11.5	*(9.8 - 13.6)*	15.2	*(13.1 - 17.5)*
Washington	7.8	*(6.3 - 9.6)*	13.9	*(11.9 - 16.1)*
Windham	10.9	*(9.0 - 13.3)*	17.0	*(14.4 – 20.0)*
Windsor	10.5	*(8.7 - 12.5)*	15.4	*(13.2 – 18.0)*
Hospital Service Area				
Barre	8.3	*(6.8 - 10.1)*	13.8	*(12.0 – 16.0)*
Burlington	9.0	*(7.9 - 10.2)*	14.4	*(13.0 - 15.9)*
Morrisville	10.4	*(7.8 - 13.6)*	18.6	*(14.7 - 23.3)*
Randolph	12.2	*(8.9 - 16.5)*	17.0	*(13.2 - 21.5)*
Newport	11.0	*(8.8 - 13.8)*	15.2	*(12.3 - 18.5)*
St. Johnsbury	13.6	*(10.7 - 17.0)*	18.3	*(15.1 - 22.1)*
St. Albans	9.9	*(8.0 - 12.3)*	15.9	*(13.3 - 18.9)*
Middlebury	9.3	*(7.1 - 12.2)*	14.2	*(11.4 - 17.5)*
Rutland	11.2	*(9.3 - 13.3)*	14.6	*(12.5 – 17.0)*
Bennington	14.0	*(11.6 - 16.7)*	22.4	*(18.9 - 26.3)*
Springfield	11.9	*(8.9 - 15.7)*	16.9	*(13.3 - 21.3)*
White River Junction	10.1	*(8.4 - 12.1)*	16.4	*(14.0 - 19.1)*
Brattleboro	9.2	*(7.3 - 11.6)*	14.8	*(12.0 - 18.1)*

Table 1.4. Prevalence of asthma among youth in Vermont, BRFSS 2010

	Current asthma		Lifetime asthma	
	Prevalence	*95% CI*	Prevalence	*95% CI*
Total	10.0	*(8.3 – 12.0)*	14.2	*(12.2 – 16.3)*
Sex				
Male	10.1	*(7.6 – 13.3)*	15.4	*(12.4 – 18.8)*
Female	9.7	*(7.6 – 12.3)*	12.9	*(10.5 – 15.7)*
Age (years)				
<5	8.1	*(4.5 – 14.2)*	11.2	*(7.1 – 17.3)*
5-9	8.1	*(5.6 – 11.7)*	11.5	*(8.4 – 15.4)*
10-14	12.7	*(9.6 – 16.5)*	16.5	*(13.0 – 20.6)*
15-17	10.5	*(7.4 – 14.6)*	16.9	*(13.1 – 21.6)*

Table 1.5. Prevalence of current and lifetime asthma by school age, BRFSS 2010

	Current asthma		Lifetime asthma	
	Prevalence	*95%CI*	Prevalence	*95%CI*
Elementary school age (age 5-10yrs)	8.8	*(6.4 - 12.1)*	12.3	*(9.4 - 15.9)*
Middle school age (age 11-13yrs)	12.1	*(8.4 - 17.1)*	15.9	*(11.7 - 21.4)*
High school age (age 14-17 yrs)	11.3	*(8.5 – 15.0)*	17.2	*(13.7 - 21.4)*

Table 1.6. Prevalence of asthma among school age youth in the 2009-10 and 2010-11 school years, School Nurses' Reports 2009-2011

	Prevalence of asthma
School level	
Kindergarten through grade 5	8.7
Grades 6-8	9.4
Grades 9-12	9.4

Table 1.7. Prevalence of asthma among youth by district office region in Vermont, BRFSS 2008-2010 and School Nurses' Report 2009-2011

District office	Elementary school		Middle school		High school	
	BRFSS currrent asthma prevalence *(95% CI)*	School Nurses' Report prevalence	BRFSS currrent asthma prevalence *(95% CI)*	School Nurses' Report prevalence	BRFSS currrent asthma prevalence *(95% CI)*	School Nurses' Report prevalence
Barre	6.9 *(3.7 - 12.6)*	10.1	3.7 *(1.1 - 11.2)*	11.3	13.5 *(8.7 - 20.3)*	12.1
Bennington	22.7 *(12.7 - 37.3)*	8.4	9.1 *(3.3 - 22.5)*	9.7	13.1 *(6.9 - 23.4)*	2.4
Brattleboro	6.2 *(2.2 - 16.4)*	6.0	21.6 *(10.2 - 40.1)*	7.9	11.5 *(5.7 - 21.9)*	7.9
Burlington	7.6 *(5.2 - 10.9)*	8.8	8.1 *(4.7 - 13.5)*	8.4	8.4 *(5.5 - 12.4)*	9.3
Middlebury	6.7 *(2.8 - 15.2)*	9.3	12.8 *(5.6 - 26.9)*	10.1	11.8 *(6.0 - 21.9)*	9.7
Morrisville	9.9 *(4.5 - 20.4)*	8.4	13.2 *(5.6 - 27.8)*	11.5	21.0 *(12.2 - 33.6)*	10.2
Newport	8.3 *(3.9 – 17.0)*	9.3	7.2 *(1.8 – 25.0)*	10.0	13.6 *(5.1 - 31.7)*	8.3
Rutland	14.2 *(8.5 - 22.8)*	10.9	7.8 *(3.5 - 16.3)*	10.8	7.5 *(4.1 - 13.1)*	10.5
Springfield	13.9 *(5.7 - 29.9)*	9.3	15.4 *(6.3 – 33.0)*	9.6	18.8 *(9.9 - 32.8)*	8.9
St. Albans	12.9 *(8.0 - 20.1)*	7.8	6.4 *(2.8 - 14.1)*	9.1	8.1 *(4.1 - 15.4)*	6.4
St. Johnsbury	15.6 *(8.2 - 27.6)*	6.1	11.5 *(3.8 - 30.2)*	7.1	12.0 *(5.5 - 24.1)*	8.6
White River Junction	6.8 *(2.7 - 15.8)*	7.7	13.6 *(6.3 - 26.8)*	7.9	15.8 *(9.8 - 24.3)*	9.2

Table 2.1. General health status and life satisfaction of adult Vermonters, BRFSS 2010

	Current asthma		Adults without asthma	
	%	*95% CI*	%	*95% CI*
General Health Status				
Excellent	13.6	*(10.2 – 17.9)*	25.7	*(24.1 – 27.2)*
Very good	33.0	*(28.3 – 38.1)*	39.2	*(37.5 – 40.9)*
Good	31.8	*(27.2 – 36.8)*	25.8	*(24.3 – 27.3)*
Fair	14.7	*(11.8 – 18.2)*	6.8	*(6.1 – 7.6)*
Poor	7.0	*(5.3 – 9.2)*	2.6	*(2.2 – 3.1)*
Life Satisfaction				
Very satisfied	41.1	*(36.0 – 46.3)*	48.5	*(46.7 – 50.2)*
Satisfied	50.1	*(44.9 – 55.3)*	47.4	*(45.6 – 49.1)*
Dissatisfied	6.0	*(4.3 – 8.3)*	3.5	*(2.8 – 4.3)*
Very dissatisfied	2.8	*(1.4 – 5.7)*	0.7	*(0.5 – 1.1)*

Table 2.2. Limitations due to asthma among Vermonters with current asthma, ACBS 2010

	Adults		Youth	
	%	*95% CI*	%	*95% CI*
Activity limitations				
Not limited	44.2	*(36.8 - 51.9)*	29.3	*(18.8 - 42.6)*
Limited a little	38.1	*(31.3 - 45.5)*	59.9	*(45.8 - 72.5)*
Limited	17.7	*(13.2 - 23.2)*	10.9	*(5.2 - 21.2)*
Sleep Limitations				
Disrupted 1 or more nights	20.9	*(15.2 - 28.1)*	21.5	*(11.4 - 36.8)*
Sleep not disrupted	79.1	*(71.9 - 84.8)*	78.5	*(63.2 - 88.6)*
Work/school Limitations				
Missed at least 1 day of work/school	25.5	*(19.4 - 32.9)*	42.4	*(27.6 - 58.6)*
No work/school missed	74.5	*(67.1 - 80.6)*	57.6	*(41.4 - 72.4)*

Table 2.3. Quality of life factors associated with asthma severity among Vermonters with current asthma, ACBS 2010

	%	95% CI
Emergency room and urgent care visits in the last 12 months		
None	89.9	*(84.1 – 93.8)*
1-2 visits	9.1	*(5.4 – 15.1)*
3-6 visits	1.0	*(0.4 – 2.1)*
7 or more visits	0	*(. - .)*
Days of missed work		
None	74.5	*(67.1 – 80.6)*
1-5 days	16.7	*(11.2 – 24.3)*
6 to 74 days	7.8	*(5.3 – 11.3)*
75 days or more	1.1	*(0.5 – 2)*
Days with asthma symptoms in the last 30 days		
8 days or less	67.3	*(60.3 – 73.7)*
9-29 days	19.1	*(13.9 – 25.7)*
Every day but not all day	5.8	*(3.4 – 9.7)*
All day AND every day	7.7	*(5.3 – 11.2)*
Days with asthma symptoms that made it difficult to sleep in the last 30 days		
2 days or less	83.5	*(76.6 – 88.7)*
3-4 days	6.6	*(2.9 – 14.3)*
5-10 days	5.3	*(3.1 – 9.0)*
11 days or more	4.6	*(2.9 – 7.3)*

Table 2.4. Quality of Life Indicators associated with asthma control among Vermonters with current asthma, ACBS 2010

	%	95% CI
Days with asthma symptoms in the last 30 days		
8 days or less	67.2	(60.2 - 73.6)
9-30 days*	25.1	(19.3 - 31.9)
Every day and all day in last 30 days	7.7	(5.3 - 11.2)
Days with asthma symptoms that made it difficult to sleep in the last 30 days		
0-2 nights	85.9	(79.7 - 90.4)
3-12 nights	10.2	(6.1 - 16.4)
13 or more nights	4.0	(2.5 - 6.3)
SABA inhaler use (times per day)		
Less than 0.29	82.3	(77.1 - 86.6)
0.29 to <2	9.7	(6.4 - 14.4)
2 or more	8.0	(5.6 - 11.1)
*if 30 days, symptoms did not last all day		

Table 2.5. Asthma severity and control among Vermonters with current asthma, ACBS 2010

	Adults		Youth	
	%	95% CI	%	95% CI
Asthma severity*				
Mild intermittent	53.0	(45.6 – 60.3)	49.1	(39.4 – 58.8)
Mild persistent	24.4	(18.3 – 31.8)	31.3	(23.4 – 40.4)
Moderate persistent	12.9	(9.2 – 17.7)	16.0	(8.6 – 27.7)
Severe persistent	9.7	(6.9 – 13.3)	3.7	(1.4 – 9.4)
Asthma control				
Well controlled	57.7	(50.4 - 64.7)	58.7	(42.9 - 72.9)
Not well controlled	28.7	(22.4 - 35.9)	22.7	(13.8 - 35.1)
Poorly controlled	13.6	(10.2 - 17.8)	18.6	(7.1 - 40.6)
*Due to small numbers youth severity includes data from 2009 and 2010				

Table 2.6. Asthma control by level of asthma severity in adult Vermonters with current asthma, ACBS 2008-2010

	Mild intermittent		Mild persistent		Moderate persistent		Severe persistent	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Well controlled	88.7	(83.6 - 92.4)	28.9	(20.7 - 38.8)	11.2	(7.1 - 17.4)	2.7	(0.6 - 10.7)
Not well controlled	6.3	(4.2 - 9.5)	58.3	(48.6 - 67.4)	74.7	(66.5 - 81.5)	6.8	(3.1 - 14.3)
Poorly controlled	4.9	(2.3 - 10.2)	12.8	(7.9 - 19.9)	14.1	(9.7 - 20.1)	90.6	(81.9 - 95.3)

Table 3.1. Level of education as a risk factor for current asthma among adult Vermonters (≥18 years), BRFSS 2010

	Adults with current asthma			Adults-no asthma	
	%	*95% CI*		%	*95% CI*
At least HS diploma	40.5	*(35.5 - 45.8)*		36.1	*(34.4 - 37.8)*
Some college	25.4	*(21.1 - 30.2)*		24.2	*(22.7 - 25.8)*
College graduate	34.1	*(29.7 - 38.9)*		39.7	*(38.1 - 41.4)*

Table 3.2. Level of education stratified by the level of asthma severity and control among adult Vermonters with current asthma (≥18 years), BRFSS and ACBS 2008-2010

	At most a HS diploma		Some College		College graduate	
	%	*95% CI*	%	*95% CI*	%	*95% CI*
Asthma severity						
Mild intermittent	36.8	*(29.5 - 44.9)*	53.6	*(44.9 – 62.0)*	61.7	*(55.8 - 67.2)*
Mild persistent	16.9	*(11.8 - 23.7)*	23.3	*(16.8 - 31.5)*	22.8	*(18.2 - 28.2)*
Moderate persistent	23.1	*(16.8 - 30.8)*	12.6	*(8.5 - 18.3)*	10.4	*(7.7 - 13.8)*
Severe persistent	23.2	*(16.3 - 31.9)*	10.5	*(7.2 - 15.1)*	5.2	*(3.4 - 7.8)*
Asthma control						
Well controlled	37.5	*(30.1 - 45.7)*	58.6	*(49.8 - 66.8)*	65.0	*(58.7 - 69.8)*
Not well controlled	30.8	*(23.6 – 39.0)*	26.2	*(19.7 - 33.9)*	26.4	*(16.3 - 24.2)*
Poorly controlled	31.7	*(24.3 - 40.2)*	15.3	*(9.8 – 23.0)*	9.2	*(6.6 - 12.7)*

Table 3.3. Employment status as a risk factor for current asthma among adult Vermonters with current asthma(≥18 years), BRFSS 2010

	Adults with current asthma			Adults without asthma	
	%	*95% CI*		%	*95% CI*
Currently employed (outside employment and self-employed)	57.5	*(52.4 - 62.5)*		64.3	*(62.6 – 66.0)*
Not working (retired, homemaker, students)	24.3	*(20.1 – 29.0)*		26.9	*(25.4 - 28.5)*
Unemployed	9.0	*(6.0 - 13.2)*		5.0	*(4.2 - 5.9)*
Not able to work	9.2	*(7.3 - 11.6)*		3.8	*(3.2 - 4.4)*

Table 3.5. Employment status by the level of asthma severity and control among adult Vermonters with current asthma(≥18 years), BRFSS and ACBS 2008-2010

	Currently employed		Not working*		Unemployed		Unable to work	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Asthma severity								
Mild intermittent	55.5	(49.3 - 61.5)	42.8	(25.3 - 62.3)	49.0	(40.7 - 57.3)	20.9	(13.9 – 30.0)
Mild persistent	21.0	(17.0 - 25.6)	14.7	(6.1 - 31.1)	21.9	(15.0 - 30.8)	20.2	(10.1 - 36.2)
Moderate persistent	14.5	(10.4 - 19.9)	18.4	(7.9 - 37.3)	15.7	(11.3 - 21.3)	23.6	(16.3 – 33.0)
Severe persistent	9.1	(5.5 - 14.6)	24.2	(9.0 - 50.8)	13.5	(9.7 - 18.5)	35.3	(26.0 - 45.9)
Asthma Control								
Well controlled	58.9	(52.6 - 64.9)	41.6	(24.5 – 61.0)	47.0	(38.2 - 54.8)	34.5	(23.3 - 47.8)
Not well controlled	27.5	(22.5 - 33.2)	29.1	(15.3 - 48.2)	31.3	(23.6 - 40.2)	20.6	(13.6 - 29.8)
Poorly controlled	13.6	(9.2 - 19.6)	29.3	(12.6 - 54.5)	22.3	(17.3 - 28.2)	44.9	(34.4 - 55.9)
Not working includes homemakers, students and retired individuals								

Table 3.6. Annual household income as a risk factor for current asthma among adult Vermonters with current asthma(≥18 years), BRFSS 2010

	Adults with current asthma			Adults-no asthma	
Annual household income % of FPL	%	95% CI		%	95% CI
<125%	21.0	(17.1 - 25.7)		15.0	(13.6 - 16.5)
125%-249%	29.0	(24.1 - 34.4)		23.3	(21.8 - 24.9)
250%-349%	25.9	(21.3 - 31.1)		29.6	(27.9 - 31.3)
≥350%	24.1	(20.4 - 28.2)		32.2	(30.7 - 33.7)

Table 3.7. Annual household income by the level of asthma severity and control among adult Vermonters with current asthma (≥18 years), BRFSS and ACBS 2008-2010

	<125% of the FPL		125%-249% of the FPL		250%-349% of the FPL		≥350% of the FPL	
	%	*95% CI*	%	*95% CI*	%	*95% CI*	%	*95% CI*
Asthma severity								
Mild intermittent	25.9	*(18.4 – 35.0)*	50.6	*(41.2 – 60.0)*	49.9	*(39.1 - 60.8)*	60.0	*(53.4 - 66.3)*
Mild persistent	16.5	*(9.6 - 26.9)*	28.0	*(19.9 - 37.8)*	17.6	*(12.1 - 24.8)*	23.6	*(18.5 - 29.6)*
Moderate persistent	26.9	*(17.7 - 38.6)*	12.1	*(7.7 - 18.5)*	19.4	*(12.2 - 29.3)*	10.9	*(7.3 – 16.0)*
Severe persistent	30.8	*(20.7 - 43.1)*	9.3	*(6.0 - 14.1)*	13.2	*(5.8 - 27.3)*	5.5	*(3.5 - 8.5)*
Asthma control								
Well controlled	31.8	*(22.8 - 42.4)*	56.9	*(47.5 - 65.8)*	49.7	*(38.9 - 60.5)*	60.1	*(53.4 - 66.4)*
Not well controlled	29.5	*(19.8 - 41.7)*	29.6	*(21.7 - 38.9)*	24.8	*(17.0 - 34.8)*	29.8	*(24.1 - 36.3)*
Poorly controlled	38.6	*(28.1 - 50.3)*	13.5	*(9.1 - 19.6)*	25.5	*(15.4 - 39.1)*	10.1	*(7.2 – 14.0)*

Table 3.8. Number of co-occurring chronic conditions* as a risk factor for current asthma among adult Vermonters, BRFSS 2008-2010

	Adults with current asthma			Adults-no asthma	
Number of additional chronic conditions	%	*95% CI*		%	*95% CI*
None	48.5	*(45.6 - 51.4)*		62.4	*(61.5 - 63.3)*
1	31.6	*(28.9 - 34.4)*		27.7	*(26.9 - 28.6)*
2	14.0	*(12.4 - 15.8)*		7.8	*(7.4 - 8.3)*
3	5.9	*(4.9 - 7.1)*		2.1	*(1.9 - 2.3)*

*Chronic conditions measured include: moderate to severe depression, cardiovascular disease, obesity, diabetes, and cancer in 2010. Arthritis was measured in 2009 and COPD was measured in 2008.

Table 3.9. Number of co-occurring chronic conditions and level of asthma severity and control among Vermonters with current asthma, BRFSS and ACBS 2008-2010

| | Number of co-occurring chronic conditions in addition to asthma | | | | | | | |
| | None | | One | | Two | | Three or more | |
	%	*95% CI*	%	*95% CI*	%	*95% CI*	%	*95% CI*
Asthma severity								
Mild intermittent	55.0	*(47.7 - 62.1)*	52.5	*(44.5 - 60.4)*	31.7	*(24.1 - 40.3)*	29.7	*(20.3 - 41.3)*
Mild persistent	21.8	*(16.6 – 28.0)*	17.9	*(13.6 - 23.4)*	23.2	*(15.8 - 32.7)*	17.3	*(8.0 - 33.6)*
Moderate persistent	13.4	*(9.5 - 18.6)*	17.4	*(12.1 - 24.4)*	21.5	*(12.9 - 33.6)*	19.4	*(12.6 - 28.6)*
Severe persistent	9.8	*(5.1 - 18.2)*	12.2	*(8.1 - 17.8)*	23.6	*(17.3 - 31.5)*	33.6	*(23.7 - 45.2)*
Asthma control								
Well controlled	61.2	*(53.8 - 68.1)*	48.0	*(40.0 - 56.1)*	35.4	*(27.4 - 44.3)*	34.1	*(23.1 - 47.1)*
Not Well controlled	26.1	*(20.6 - 32.6)*	31.5	*(24.7 - 39.3)*	32.0	*(22.6 - 43.1)*	18.3	*(10.7 - 29.5)*
Poorly controlled	12.7	*(7.6 - 20.3)*	20.5	*(14.4 - 28.3)*	32.6	*(24.4 - 42.1)*	47.6	*(35.9 - 59.6)*

Table 3.10. Co-occurring chronic conditions among adult Vermonters with and without asthma(≥18 years), BRFSS and ACBS 2008-2010

| | Adults with current asthma | | Adults-no asthma | |
	%	*95% CI*	%	*95% CI*
Depression[*]	17.4	*(13.9 - 21.5)*	6.2	*(5.3 - 7.1)*
CVD[*]	7.9	*(6.2 – 10.0)*	6.9	*(6.3 - 7.5)*
Diabetes mellitus [*]	10.4	*(8.2 - 13.1)*	6.4	*(5.8 - 7.1)*
Cancer[*]	7.1	*(5.4 - 9.3)*	6.1	*(5.6 - 6.7)*
Arthritis[**]	41.4	*(36.7 - 46.3)*	27.1	*(25.8 - 28.4)*
COPD[***]	10.2	*(8 - 12.9)*	1.9	*(1.6 - 2.3)*

[*] Assessed using 2010 BRFSS data
[**] Assessed using 2009 BRFSS data
[***] Assessed using 2008 BRFSS data

Table 3.11. Overweight and obesity* among adult Vermonters with and without asthma (≥18 years), BRFSS 2010

	Adults with current asthma		Adults-no asthma	
	%	*95% CI*	%	*95% CI*
Neither overweight or obese	33.7	*(28.8 – 39.0)*	41.1	*(39.1 - 43.1)*
Overweight	31.2	*(26.7 - 36.1)*	35.6	*(33.7 - 37.5)*
Obese	35.1	*(30.4 - 40.1)*	23.4	*(21.7 - 25.1)*
All data are age-adjusted				

Table 3.12. Influenza an d pneumonia immunizations among adult Vermonters with and without current asthma (≥18 years), BRFSS 2010

	Adults with current asthma		Adults-no asthma	
	%	*95% CI*	%	*95% CI*
Influenza shot in previous year				
All adults	53.7	*(48.5 - 58.8)*	42.5	*(40.8 - 44.1)*
Age 18-64 years	49.9	*(44.1 - 55.7)*	35.6	*(33.7 - 37.6)*
Age ≥65 years	76.4	*(69.3 - 82.2)*	71.1	*(68.9 - 73.3)*
Ever received a Pneumonia vaccine				
All adults	42.0	*(37.0 - 47.2)*	26.4	*(24.9 - 27.8)*
Age 18-64 years	33.8	*(28.4 - 39.7)*	14.2	*(12.8 - 15.8)*
Age ≥65 years	86.5	*(80.3 - 90.9)*	71.5	*(69.2 - 73.7)*

Table 3.13. Immunization among young Vermonters (≤17 years) with current asthma, ACBS 2010

	%	*95% CI*
Influenza Shot in previous year	72.7	*(59.5 - 82.9)*

Table 3.14. Adverse childhood experiences (ACE) among adult Vermonters with and without current asthma (≥18 years), BRFSS 2010

Number of ACE	Adults with current asthma		Adults-no asthma	
	%	95% CI	%	95% CI
No ACE	36.1	*(31.0 - 41.5)*	43.1	*(41.4 - 44.9)*
1 ACE	21.7	*(17.5 - 26.7)*	23.3	*(21.8 - 24.9)*
2 ACE	11.5	*(8.8 – 15.0)*	12.6	*(11.5 - 13.9)*
3 ACE	10.4	*(7.4 - 14.5)*	8.4	*(7.5 - 9.5)*
4 or more ACE	20.2	*(16.7 - 24.3)*	12.5	*(11.4 - 13.7)*

Table 3.15. Adverse childhood experiences (ACE) by the level of asthma severity and control among adult Vermonters with current asthma (≥18 years), BRFSS and ACBS 2010

	None		1-2 ACE		3 or more ACE	
	%	95% CI	%	95% CI	%	95% CI
Asthma severity						
Mild intermittent	64.3	*(52.2 - 74.7)*	54.5	*(41.5 - 66.9)*	42.2	*(30.2 - 55.1)*
Mild persistent	18.0	*(11.3 - 27.4)*	27.4	*(16.2 - 42.4)*	28.0	*(17.1 - 42.3)*
Moderate persistent	10.4	*(5.1 - 19.9)*	11.1	*(5.9 - 19.8)*	17.4	*(10.7 - 26.8)*
Severe persistent	7.4	*(4.1 - 13)*	7.1	*(3.9 - 12.4)*	12.5	*(7.4 - 20.4)*
Asthma control						
Well controlled	34.5	*(22.7 - 48.5)*	28.2	*(18.5 - 40.4)*	24.0	*(13.8 - 38.5)*
Not well controlled	49.2	*(36.8 - 61.7)*	62.0	*(49.6 – 73.0)*	59.2	*(46.3 - 70.9)*
Poorly controlled	16.4	*(10.4 - 24.8)*	9.8	*(5.7 - 16.2)*	16.8	*(10.4 - 26.2)*

Table 4.1. Current smoking prevalence and percent who attempted to quit in the last year among adult Vermonters with and without asthma, BRFSS 2006-2010*

	Smoking prevalence				Quit attempts			
	Adults with current asthma		Adults without asthma		Adults with current asthma		Adults without asthma	
Year	%	95% CI	%	95% CI	%	95% CI	%	95% CI
2006	21.4	*(17.9 - 25.4)*	18.0	*(16.7 - 19.4)*	65.3	*(55.8 - 73.8)*	51.8	*(48.2 - 55.4)*
2007	23.9	*(19.3 - 29.2)*	17.6	*(16.3 – 19.0)*	67.8	*(58.6 - 75.8)*	53.6	*(49.8 - 57.4)*
2008	23.7	*(19.7 - 28.2)*	16.4	*(15.1 - 17.7)*	69.6	*(59.7 - 77.9)*	55.6	*(51.4 - 59.7)*
2009	24.5	*(20.2 - 29.4)*	17.0	*(15.6 - 18.6)*	73.2	*(64.4 - 80.5)*	56.1	*(52.0 - 60.2)*
2010	21.1	*(17.2 - 25.7)*	15.3	*(13.9 - 16.7)*	72.3	*(62.6 - 80.2)*	60.7	*(56.3 - 64.9)*
*Data from all 5 years is age-adjusted.								

Table 4.2. Smoking habits among Vermonters with and without current asthma, BRFSS 2010	Adults with current Asthma		Adults-no asthma	
	%	95% CI	%	95% CI
Smoking Status				
Current Smoker	21.1	(17.2 – 25.7)	15.3	(13.9 - 16.7)
Former Smoker	29.0	(25.3 – 33.0)	29.4	(28.0 – 31.0)
Never Smoker	49.9	(45.0 – 54.7)	55.3	(53.5 – 57.1)
Frequency of smoking among ever smokers* smokers				
Smoke most days	34.1	(27.1 - 41.8)	22.6	(20.6 - 24.8)
Smoke some days	8.7	(5.8 - 12.9)	9.2	(7.7 - 10.9)
No longer smoke	57.2	(49.9 - 64.2)	68.2	(65.9 - 70.5)

Current smokers and Former smokers can be combined into an 'ever smoker' category

Table 4.3. Percent of Vermonters with and without current asthma who currently smoke and attempted to quit smoking, stratified by age and sex, BRFSS 2010	Adults with current Asthma		Adults-no asthma	
	%	95% CI	%	95% CI
Age				
18-24	58.7	(38.8 – 76.0)	60.0	(49.3 - 69.7)
25-34	79.5	(67.8 - 87.8)	62.1	(55.9 - 67.9)
35-44	69.8	(57.6 - 79.7)	57.3	(52.0 - 62.4)
45-54	78.8	(67.6 - 86.9)	55.3	(51.2 - 59.4)
55-64	74.1	(62.3 - 83.2)	52.1	(47.6 - 56.6)
>65	68.9	(52.8 - 81.5)	53.9	(48.1 - 59.7)
Sex				
Male	71.2	(61.6 - 79.1)	56.7	(53.1 - 60.2)
Female	72.5	(65.7 - 78.3)	57.3	(53.8 - 60.8)

Table 4.4. Secondhand smoke (SHS) exposure among Vermonters with current asthma stratified by smoking status in adults, BRFSS and ACBS 2008-2010

	Adults		Youth	
	%	95% CI	%	95% CI
Exposed to SHS at home				
Total	14.9	(11.5 – 19.0)	3.5	(1.9 - 6.3)
SHS exposure by current smoking status				
Current Smoker	43.6	(32.7 - 55.1)	---	---
Former Smoker	10.0	(5.7 - 17.1)	---	---
Never Smoker	5.6	(2.3 - 13.1)	---	---

Table 4.5. Asthma severity and control among adult 'ever smokers' and 'never smokers' with current asthma exposed to SHS in Vermont, BRFSS and ACBS 2008-2010

	Never smoker*		Ever smoker			
	No SHS exposure at home		No SHS exposure at home		Exposed to SHS at home	
	%	95% CI	%	95% CI	%	95% CI
Asthma severity						
Mild intermittent	59.9	(53.5 – 66.0)	47.0	(40.1 – 54.0)	22.9	(13.2 - 36.7)
Mild persistent	20.0	(15.5 - 25.6)	21.7	(16.5 – 28.0)	20.2	(11.4 - 33.3)
Moderate persistent	14.3	(10.3 - 19.4)	15.0	(11.0 - 20.2)	27.9	(16.4 - 43.3)
Severe persistent	5.8	(4.1 - 8.3)	16.3	(10.8 - 23.8)	29.1	(19.7 - 40.6)
Asthma control						
Well controlled	62.6	(56.0 - 68.7)	47.5	(40.6 - 54.5)	29.7	(18.2 - 44.5)
Not well controlled	26.3	(20.9 - 32.4)	28.2	(22.5 - 34.7)	39.1	(26.3 - 53.5)
Poorly controlled	11.1	(7.5 - 16.2)	24.3	(18.3 - 31.7)	31.2	(21.8 - 42.6)

Too few individuals that never smoked with secondhand smoking exposure to include in the analysis

Table 4.6. Known exposures to environmental triggers among Vermonters with current asthma, ACBS 2008-2010

	Adults		Youth	
	%	95% CI	%	95% CI
Triggers in one's home				
Seen or smelled mold in last 30 days	11.9	(9.6 - 14.7)	15.8	(11.0 - 22.3)
Seen rats or mice in last 30 days	12.2	(9.8 - 14.9)	13.4	(9.0 - 19.7)
Wood stove or fireplace used in home	37.5	(33.0 - 42.2)	32.9	(26.4 – 40.0)
Unvented gas stoves/fireplaces/logs used in home	8.3	(5.7 - 11.8)	2.9	(1.2 - 6.9)
Cooked with gas	43.9	(39.4 - 48.5)	46.2	(38.6 – 54.0)
Anyone smoked inside in past week	14.9	(11.5 – 19.0)	3.5	(1.9 - 6.3)
Indoor pets	73.4	(69.7 - 76.8)	79.7	(73.2 – 85.0)
Pets allowed in bedroom	58.9	(54.5 - 63.1)	50.8	(43.1 - 58.5)
Carpet in bedroom	58.0	(53.3 - 62.6)	58.4	(50.4 - 65.9)

Table 4.7. Number of environmental triggers at home among Vermonters with current asthma, ACBS 2008-2010

	Adults		Youth	
	%	95% CI	%	95% CI
Number of triggers in one's home				
Zero to one	14.9	(12.3 - 17.9)	14.7	(10.1 - 20.7)
Two to three	42.5	(38.1 – 47.0)	50.6	(42.9 - 58.3)
Four or more	42.6	(38.1 - 47.2)	34.7	(28.0 - 42.2)

Table 4.8. Asthma severity and control among adult Vermonters with known environmental triggers in their home that have current asthma, ACBS 2008-2010

	Zero to one trigger		Two to three triggers		Four or more triggers	
	%	*95% CI*	%	*95% CI*	%	*95% CI*
Asthma severity						
Mild intermittent	48.7	*(39.2 - 58.2)*	54.5	*(47.8 - 61.1)*	46.5	*(39.2 - 53.9)*
Mild persistent	21.4	*(13.8 - 31.5)*	18.9	*(14.4 - 24.4)*	22.6	*(17.1 - 29.2)*
Moderate persistent	17.8	*(10.7 - 28.3)*	15.3	*(11.3 - 20.3)*	16.4	*(11.4 - 22.9)*
Severe persistent	12.1	*(7.9 - 18.1)*	11.3	*(7.9 - 15.8)*	14.6	*(9.7 - 21.3)*
Asthma control						
Well controlled	47.4	*(38.0 - 57.0)*	57.3	*(50.8 - 63.7)*	50.3	*(42.9 - 57.7)*
Not well controlled	32.5	*(23.1 - 43.7)*	25.6	*(20.5 - 31.3)*	29.2	*(22.8 - 36.5)*
Poorly controlled	20.1	*(14.5 - 27.1)*	17.1	*(13.1 - 22.0)*	20.5	*(14.5 - 28.1)*

Table 4.9. Work-related asthma among adult Vermonters with current asthma, ACBS 2010

	%	*95% CI*
Doctor dx work asthma	6.1	*(4.1 – 9.0)*
Self-identified work asthma	7.8	*(5.1 - 11.8)*
Caused by current job	7.7	*(4.4 - 13.1)*
Caused by previous job	14.2	*(10.1 - 19.5)*
Aggravated by current job	27.2	*(20.0 - 35.9)*
Aggravated by previous job	27.5	*(21.8 – 34.0)*
Quit job because caused or made asthma worse	31.6	*(21.6 - 43.8)*

Table 4.10. Asthma severity and control among adult Vermonters with current asthma reporting work-related asthma (WRA), ACBS 2008-2010

	Caused by a job (current or previous)		Aggravated by a job (current or previous)		Diagnosed by a Doctor		Self-identified work asthma		Quit job because caused or made asthma worse	
	%	*95% CI*	%	*95% CI*	%	*95% CI*	%	*95% CI*	%	*95% CI*
Asthma severity										
Mild intermittent	38.0	*(29.6-47.2)*	36.0	*(29.6-42.9)*	25.6	*(16.6-37.3)*	36.8	*(26.3-48.7)*	28.1	*(18.0-41.2)*
Mild persistent	18.4	*(12.1-26.9)*	21.2	*(16.3-27.0)*	23.6	*(12.4-40.4)*	16.7	*(10.1-26.3)*	14.2	*(6.5-28.3)*
Moderate persistent	22.6	*(15.6-31.6)*	23.1	*(17.1-30.4)*	28.0	*(15.4-45.2)*	26.3	*(15.6-40.7)*	26.2	*(14.9-41.8)*
Severe persistent	21.0	*(14.9-28.8)*	19.7	*(14.0-27.0)*	22.8	*(14.2-34.4)*	20.2	*(13.1-29.7)*	31.5	*(20.8-44.5)*
Asthma control										
Well controlled	40.2	*(31.6-49.5)*	40.4	*(33.7-47.4)*	29.9	*(19.9-42.4)*	38.4	*(27.8-50.4)*	32.0	*(21.0- 45.3)*
Not Well controlled	32.4	*(24.4-41.7)*	34.8	*(28.1-42.1)*	32.5	*(19.4-49.0)*	33.5	*(22.2-47.1)*	32.1	*(19.6-47.9)*
Poorly controlled	27.3	*(20.1-36.1)*	24.8	*(18.7-32.2)*	37.6	*(24.5-52.8)*	28.1	*(19.5-38.7)*	35.9	*(24.5-49.2)*

Table 5.1. Asthma self-management among Vermonters with current asthma, ACBS 2008-2010

	Adults		Youth	
	%	*95% CI*	%	*95% CI*
Participated in an asthma management course	7.9	*(5.9 - 10.4)*	3.9	*(2.1 - 7.3)*
Have an asthma action plan	29.7	*(25.6 - 34.2)*	50.9	*(43.2 - 58.6)*
Taught how to recognize early symptoms	67.8	*(63.3 – 72.0)*	86.0	*(80.4 - 90.2)*
Taught what to do during an asthma attack	78.6	*(74.7 - 82.1)*	93.3	*(89.5 - 95.7)*
Taught how to use peak flow	48.9	*(44.3 - 53.5)*	46.9	*(39.4 - 54.5)*

Table 5.2. Healthier living workshop attendance among all Vermonters and those with asthma, 2008-2010

Year	Total number of attendees	Number of attendees with asthma *(% of attendees)*
2008	360	43 *(12%)*
2009	224	38 *(17%)*
2010	599	113 *(19%)*

Table 5.3. Preventive measures in the home environment among Vermonters with current asthma, ACBS 2008-2010

	Adults		Youth	
	%	*95% CI*	%	*95% CI*
Advised to Modify Home Environment	39.3	*(34.9 - 43.8)*	42.1	*(34.9 - 49.7)*
Exposures in one's home				
Regular use of if cleaner/purifier	18.0	*(15.3 – 21.0)*	25.1	*(18.3 - 33.3)*
Regular use of dehumidifier	33.5	*(29.4 - 37.8)*	38.3	*(31.5 - 45.7)*
Kitchen fan when cooking	55.4	*(50.8 - 59.9)*	60.4	*(52.8 - 67.6)*
Bathroom Fan	63.8	*(59.1 - 68.3)*	63.8	*(55.6 - 71.3)*
Mattress cover for dust mites	26.4	*(23.1 - 30.1)*	39.1	*(31.8 – 47.0)*
Pillow cover for dust mites	23.8	*(20.7 - 27.2)*	43.8	*(36.3 - 51.7)*
Sheets and pillow cases washed in hot water	29.2	*(25.5 - 33.2)*	35.6	*(28.3 - 43.6)*

Table 5.4. Number of preventive measures in the home environment among Vermonters with current asthma, ACBS 2008-2010

Preventive measures in one's home	Adults		Youth	
	%	*95% CI*	%	*95% CI*
Zero to one	32.0	*(27.4 - 37.1)*	20.5	*(14.8 - 27.6)*
Two to three	40.7	*(36.1 - 45.4)*	39.0	*(31.8 - 46.7)*
Four or more	27.3	*(23.8 - 31.2)*	40.6	*(33.0 - 48.7)*

Table 5.5. Asthma severity and control among adult Vermonters with current asthma taking preventive measures for environmental exposures, ACBS 2008-2010

	Zero to one preventive measures		Two to three preventive measures		Four or more preventive measures	
	%	*95% CI*	%	*95% CI*	%	*95% CI*
Asthma severity						
Mild intermittent	50.1	*(40.4 - 59.9)*	51.0	*(43.7 - 58.3)*	46.2	*(39.1 - 53.4)*
Mild persistent	19.4	*(13.8 - 26.6)*	22.2	*(16.6 - 28.9)*	22.0	*(16.0 - 29.3)*
Moderate persistent	13.8	*(9.2 - 20.2)*	16.7	*(11.1 - 24.3)*	17.8	*(13.2 - 23.7)*
Severe persistent	16.7	*(9.0 - 28.9)*	10.2	*(7.4 - 13.8)*	14.0	*(10.2 – 19.0)*
Asthma control						
Well controlled	48.7	*(39.0 - 58.4)*	52.4	*(45.1 - 59.7)*	53.7	*(46.5 - 60.7)*
Not well controlled	25.8	*(19.2 - 33.7)*	32.9	*(25.9 - 40.7)*	27.1	*(21.3 - 33.9)*
Poorly controlled	25.6	*(16.4 - 37.4)*	14.7	*(11.5 - 18.6)*	19.2	*(14.7 - 24.5)*

Table 5.6. Frequency of medication use among adults and youth with current asthma, ACBS 2010

	Adults		Youth	
	Percent	95% CI	Percent	95% CI
Last Medication Used (*ANY* medication)				
In last week	44.3	*(37.3 - 51.6)*	44.4	*(31.2 - 58.5)*
Between 1 week and 3 months	27.7	*(20.9 - 35.7)*	29.7	*(16.6 - 47.4)*
3 months or more	23.9	*(18.0 - 31.1)*	25.8	*(16.3 - 38.5)*
Never	4.1	*(1.5 - 10.5)*	0	*…*
Ever Used Medication				
Ever used inhaler	95.0	*(89.1 - 97.8)*	91.7	*(80.3 - 96.8)*
Ever used over-the-counter	22.5	*(16.9 - 29.3)*	17.9	*(10.4 - 29.1)*
Type of Med used in last 3 months				
Inhaler	91.3	*(83.2 - 95.7)*	77.8	*(50.7 - 92.3)*
Pills	15.6	*(11.5 - 20.9)*	8.0	*(3.5 - 17.4)*
Nebulizer	8.7	*(5.9 - 12.5)*	33.5	*(16.8 - 55.7)*

Table 5.7. Rescue and controller medication use among adults and youth with current asthma, ACBS 2008-2010

	Adults		Youth	
	%	95% CI	%	95% CI
Inhaler use in last 3 months				
Neither control or rescue medication used	36.3	*(31.8 - 41.1)*	43.3	*(35.8 - 51.1)*
Used controller medication only	11.0	*(8.9 - 13.4)*	7.2	*(4.3 - 11.9)*
Used rescue medication only	25.8	*(22.1 – 30.0)*	21.9	*(16.4 - 28.5)*
Used controller and rescue medication	26.9	*(23.1 - 31.1)*	27.7	*(21.5 - 34.8)*

Table 5.8. Rescue and controller medication use among adult Vermonters with current asthma that report a cost barrier to accessing medication, ACBS 2008-2010

	Cost barrier to accessing medication		No cost barrier to accessing medication	
	%	95% CI	%	95% CI
Adults with current asthma	11.7	*(9.0 - 15.2)*	88.3	*(84.9 – 91.0)*
Stratified by inhaler use in last 3 months				
Neither control or rescue medication used	27.9	*(17.1 - 42.2)*	37.4	*(32.6 - 42.5)*
Used controller medication only	6.3	*(2.3 - 16.1)*	11.6	*(9.4 - 14.2)*
Used rescue medication only	35.7	*(23.2 - 50.5)*	24.5	*(20.7 - 28.7)*
Used controller and rescue medication	30.1	*(19.2 - 43.9)*	26.5	*(22.5 - 30.9)*

Table 5.9. Use of complimentary alternative medicine (CAM) among adult Vermonters with current asthma, ACBS 2010

	%	95% CI
CAM		
Ever used CAM	35.3	(28.9 - 42.3)
Never Used CAM	64.7	(57.7 - 71.1)
Type of CAM used		
Herbs	3.4	(1.9 - 6.2)
Vitamins	4.4	(2.5 - 7.1)
Acupuncture	1.3	(0.5 - 3.4)
Acupressure	1.3	(0.4 - 4.1)
Aromatherapy	5.3	(2.9 - 9.6)
Homeopathy	2.4	(1.1 - 5.1)
Reflexology	1.0	(0.4 - 2.6)
Yoga	7.9	(4.6 – 13.0)
Breathing	27.0	(21.3 - 33.7)
Other	6.8	(4.6 - 9.9)
Naturopathy	2.0	(1.0 – 4.0)

Table 6.1. Insurance coverage and basic healthcare utilization among adult Vermonters, BRFSS 2010

	Adults with current asthma			Adults-no asthma	
	%	95% CI		%	95% CI
Currently have insurance coverage	91.2	(86.8 - 94.3)		91.9	(90.7 - 92.9)
Routine checkup (past 12 months)*	72.2	(67.0 - 76.9)		63.6	(61.8 - 65.3)
Could not see provider due to cost	13.6	(10.2 - 17.9)		7.8	(6.8 - 8.8)
*This refers to any routine type of annual physical					

Table 6.2. Health insurance and well child visits among youth that returned health forms to the School Nurse, School Nurses' Report 2010-11

	Health insurance		Well child visit	
School age	% of students with health insurance [†]	% of students that did not respond to question[‡]	% of students with well child visit [†]	% of students that did not respond to question[‡]
Elementary school (grades k-5)	98%	8%	86%	20%
Middle school (grades 6-8)	97%	11%	82%	24%
High school (grades 9-12)	97%	29%	81%	35%
[†] percent of those that returned form to school nurse <u>and</u> responded to question				
[‡] percent of those that returned form to school nurse, but left question unanswered				

Table 6.3. Health care utilization for asthma among adults and youth with current asthma, BRFSS 2010

	Adults		Youth*	
	%	95% CI	%	95% CI
Routine care specifically for asthma				
No visits past 12 months	49.7	(42.2 - 57.2)	24.5	(17.3 - 33.3)
1 visit in past 12 months	26.7	(20.8 - 33.6)	39.1	(30.5 - 48.5)
2 or more visits in past 12 months	23.6	(18.1 - 30.2)	36.4	(27.1 - 46.9)
Dr visits for urgent treatment of asthma				
No visits past 12 months	84.6	(79.7 - 88.6)	66.3	(58.2 - 73.6)
1 visit in past 12 months	8.2	(5.2 - 12.7)	16.1	(11.6 - 22.1)
2 or more visits in past 12 months	7.2	(5.0 - 10.1)	17.5	(11.4 – 26.0)
Visit to emergency room				
No visits past 12 months	90.0	(84.2 - 93.8)	89.7	(84.5 - 93.3)
1 visit in past 12 months	7.8	(4.3 - 13.7)	7.3	(4.4 - 11.9)
2 or more visits in past 12 months	2.2	(1.2 - 4.3)	3.0	(1.3 - 6.7)

Due to small numbers, youth estimates include data from 2009 and 2010

Table 6.4. Routine asthma care stratified by asthma severity and asthma control in adult Vermonters with current asthma, ACBS 2008-2010

	No visits in the past 12 months		1 visit in the past 12 months		2 or more visits in the past 12 months	
	%	95% CI	%	95% CI	%	95% CI
Asthma severity						
Mild intermittent	58.9	(51.8 - 65.7)	45.7	(37.2 - 54.5)	31.8	(24.3 - 40.4)
Mild persistent	16.2	(12.2 - 21.3)	27.8	(20.7 - 36.3)	21.9	(15.6 – 30.0)
Moderate persistent	12.6	(8.9 - 17.5)	18.4	(11.6 - 27.8)	21.9	(16.6 - 28.5)
Severe persistent	12.3	(7.3 - 20.1)	8.1	(5.1 - 12.5)	24.3	(19.0 - 30.6)
Asthma control						
Well controlled	62.2	(55.1 - 68.8)	47.4	(38.9 – 56.0)	33.5	(25.9 – 42.0)
Not well controlled	24.1	(19.2 - 29.9)	37.0	(28.6 - 46.3)	27.0	(20.4 - 34.7)
Poorly controlled	13.7	(8.6 - 21.2)	15.6	(9.8 - 24.1)	39.6	(32.4 - 47.2)

Table 6.5. Emergency department visits with any mention of asthma diagnosis or a primary diagnosis of asthma, VUHDDS 2009

	Any mention of an asthma diagnosis		Primary asthma diagnosis	
	Rate	*95% CI*	Rate	*95% CI*
Total	199.6	*(196.2 - 203.1)*	40.6	*(39.0 - 42.2)*

Table 6.6. Emergency department visits with any mention of asthma diagnosis or a primary diagnosis of asthma by age and sex, VUHDDS 2009

	Any mention of an asthma diagnosis				Primary asthma diagnosis			
	Males		Females		Males		Females	
Age (years)	Rate per 10,000	*95% CI*	Rate per 10,000	*95% CI*	Rate per 10,000	*95% CI*	Rate per 10,000	*95% CI*
All Ages	145.0	(140.8 - 149.2)	252.6	(247.2 - 258.1)	33.9	(31.9 - 36.0)	47.1	(44.7 - 49.4)
<15	220.1	*(207.7 - 232.5)*	149.2	*(138.7 - 159.7)*	63.3	*(56.6 − 70.0)*	34.7	*(29.6 - 39.8)*
15-44	190.3	*(182.6 − 198.0)*	425.4	*(413.9 - 436.8)*	41.4	*(37.8 − 45.0)*	76.9	*(72.0 - 81.9)*
45-64	70.5	*(65.1 - 75.9)*	162.1	*(154.1 - 170.1)*	15.0	*(12.6 - 17.5)*	30.3	*(26.8 - 33.8)*
≥65	81.3	*(72.5 - 90.2)*	121.6	*(112.0 - 131.2)*	16.2	*(12.2 - 20.1)*	21.0	*(17.0 − 25.0)*

Table 6.7. Emergency department visits with any mention of asthma diagnosis or a primary diagnosis of asthma by Hospital Service Area, VUHDDS 2007-2009

	Any mention of an asthma diagnosis		Primary asthma diagnosis	
HSA	Rate per 10,000	*95% CI*	Rate per 10,000	*95% CI*
Barre	190.9	*(184.9 - 196.9)*	31.3	*(28.9 - 33.8)*
Burlington	198.9	*(195.1 - 202.7)*	28.5	*(27.1 − 30.0)*
Morrisville	98.3	*(91.3 - 105.2)*	38.2	*(33.9 - 42.6)*
Randolph	71.8	*(63.9 - 79.7)*	42.9	*(36.7 − 49.0)*
Newport	298.5	*(287.0 − 310.0)*	59.0	*(53.9 - 64.2)*
St. Johnsbury	131.6	*(123.9 - 139.2)*	41.8	*(37.5 - 46.1)*
St. Albans	359.7	*(349.8 - 369.7)*	55.4	*(51.4 - 59.3)*
Middlebury	92.3	*(85.9 - 98.7)*	32.8	*(29.0 - 36.6)*
Rutland	103.4	*(98.9 − 108.0)*	54.1	*(50.8 - 57.4)*
Bennington	68.3	*(63.7 - 72.9)*	25.6	*(22.7 - 28.4)*
Springfield	107.7	*(100.8 - 114.6)*	54.9	*(50.0 - 59.9)*
White River Junction	117.0	*(111.5 - 122.5)*	40.3	*(37.1 - 43.6)*
Brattleboro	176.4	*(168.1 - 184.6)*	49.1	*(44.7 - 53.5)*

Table 6.8. Hospital discharges with any mention of asthma diagnosis or a primary diagnosis of asthma, VUHDDS 2009

	Any mention of an asthma diagnosis		Primary asthma diagnosis	
	Rate per 10,000	*95% CI*	Rate per 10,000	*95% CI*
Total	62.5	*(60.5 - 64.4)*	6.7	*(6.1 - 7.4)*

Table 6.9. Hospital discharges with any mention of asthma diagnosis or a primary diagnosis of asthma by age and sex, VUHDDS 2009

	Any mention of asthma diagnosis				Primary asthma diagnosis			
	Males		Females		Males		Females	
Age (years)	Rate per 10,000	*95% CI*	Rate per 10,000	*95% CI*	Rate per 10,000	*95% CI*	Rate per 10,000	*95% CI*
All ages	40.4	*(38.1 - 42.6)*	83.9	*(80.7 - 87.1)*	4.9	*(4.1 - 5.7)*	8.5	*(7.5 - 9.5)*
<15	37.5	*(32.3 - 42.6)*	25.3	*(20.9 - 29.6)*	11.3	*(8.5 - 14.2)*	5.9	*(3.8 – 8.0)*
15-44	26.4	*(23.5 - 29.3)*	84.0	*(78.8 - 89.1)*	2.2	*(1.4 - 3.1)*	6.8	*(5.3 - 8.3)*
45-64	42.2	*(38.1 - 46.4)*	81.7	*(76.0 - 87.3)*	2.9	*(1.8 – 4.0)*	9.3	*(7.4 - 11.2)*
≥65	82.6	*(73.7 - 91.5)*	148.0	*(137.4 - 158.6)*	8.8	*(5.9 - 11.8)*	13.8	*(10.5 - 17.1)*

Table 6.10. Hospital discharges with any mention of asthma diagnosis or a primary diagnosis of asthma by Hospital Service Area, VUHDDS 2007-2009

HSA	Any mention of asthma diagnosis		Primary asthma diagnosis	
	Rate per 10,000	*95% CI*	Rate per 10,000	*95% CI*
Barre	52.4	*(49.2 - 55.6)*	4.7	*(3.7 - 5.6)*
Burlington	50.6	*(48.7 - 52.6)*	4.2	*(3.6 - 4.8)*
Morrisville	53.4	*(48.3 - 58.6)*	3.8	*(2.4 - 5.1)*
Randolph	72.7	*(64.8 - 80.7)*	7.7	*(5.1 - 10.4)*
Newport	75.0	*(69.2 - 80.8)*	6.4	*(4.7 - 8.1)*
St. Johnsbury	45.9	*(41.4 - 50.4)*	4.3	*(2.9 - 5.7)*
St. Albans	51.8	*(48.0 - 55.7)*	4.6	*(3.4 - 5.7)*
Middlebury	48.0	*(43.4 - 52.7)*	6.7	*(4.9 - 8.4)*
Rutland	101.7	*(97.2 - 106.3)*	14.4	*(12.7 - 16.1)*
Bennington	64.7	*(60.1 - 69.2)*	7.9	*(6.3 - 9.4)*
Springfield	86.9	*(80.7 - 93.1)*	11.0	*(8.8 - 13.3)*
White River Junction	67.3	*(63.1 - 71.5)*	6.3	*(5.0 - 7.6)*
Brattleboro	35.7	*(32.0 - 39.4)*	4.4	*(3.1 - 5.7)*

Table 6.11. Total and mean charges[*] associated with hospital and emergency department visits (with primary asthma diagnosis), VUHDDS 2005-2009					
	2005	2006	2007	2008	2009
	Charge ($)	Charge ($)	Charge ($)	Charge ($)	Charge ($)
ED Visits					
Total Charges	$1,410,220	$1,517,200	$1,591,000	$1,937,000	$2,419,100
Mean charge per visit	$550	$620	$680	$780	$960
95% CI of Mean	*(530 - 580)*	*(590 - 650)*	*(650 - 710)*	*(750 - 820)*	*(920 - 990)*
Hospital Visits					
Total Charges	$3,294,590	$3,004,690	$4,067,520	$3,620,620	$4,755,570
Mean charge per visit	$7,720	$8,490	$10,120	$10,060	$11,320
95% CI of Mean	*(6990 - 8440)*	*(7590 - 9390)*	*(9000 - 11240)*	*(8970 - 11140)*	*(10210 - 12430)*
[*] Charges are rounded to the nearest $10					

Table 8.1. Justifications for populations of interest		
Focus area	Target group	Reason for selection
Sociodemographic	Education	Data suggests that those with a high school degree or less were significantly more likely to have severe asthma and poorly controlled asthma than Vermonters that graduated from college.
	FPL	Vermonters with annual household incomes above 350% of the FPL had a significantly lower prevalence of asthma compared to those with annual household incomes below 350% of the FPL. The association between FPL and asthma severity and control is complex as those with an annual household income below 125% of the FPL and those 250%-349% of the FPL showed similar patterns in asthma control and severity.
Biological Factors	Co-occurring chronic conditions	We see that some individual co-existing chronic conditions were significantly associated with current asthma in adults, and we see that having numerous chronic conditions contributed to a lack of asthma control and increased severity of asthma.
Environmental factors	Smoking status and exposure to secondhand smoke	Unfortunately, we do not see a strong association with many individual environmental triggers and asthma severity and control, with the exception of smoking status and exposure to SHS.
	Work-related asthma	The prevalence of work-related factors among adult Vermonters with asthma is substantial. Improving working conditions for those with asthma is an achievable target for future interventions.
Regional focus	Springfield	Though Springfield did not significantly differ from the state in regards to prevalence, there were some concerning trends in the data that suggested a better awareness of asthma and asthma control was needed in the area. In the two data sets used to assess asthma prevalence in youth we see some notable differences in asthma prevalence among elementary, middle, and high school age individuals in the Springfield District Office region. Furthermore, there were some significant differences in service utilization in the Springfield HSA, suggesting poor asthma control on a broad level. The Springfield area could benefit from an intervention that focused on more clearly defining youth with asthma and

	Rutland	Rutland did not significantly differ from the state with regard to asthma prevalence. However, the rates that the emergency department and hospital service were used suggest that individuals have poor control of their asthma.
		that also focused on improving asthma control among HSA residents.

Table 8.2. Odds of severe asthma by level of education among adult Vermonters with current asthma, BRFSS and ACBS 2008-2010

	Odds of severe asthma	
	Odds ratio	95% CI
≤HS diploma	4.7	*(3.0 - 7.3)*
Some college	1.6	*(1.1 - 2.6)*
College graduate	1.0	---

Table 8.3. Odds of uncontrolled asthma by level of education among adult Vermonters with current asthma, BRFSS and ACBS 2008-2010

	Odds of uncontrolled asthma	
	Odds ratio	95% CI
≤HS diploma	3.0	*(2.0 - 4.6)*
Some college	1.3	*(0.8 – 2.0)*
College graduate	1.0	---

Table 8.4. Odds of severe asthma by annual household income proximity to the FPL among adult Vermonters with current asthma, BRFSS and ACBS 2008-2010

Annual Household income (% of FPL)	Odds of severe asthma	
	Odds ratio	*95% CI*
< 125%	7.0	*(4.0 - 12.2)*
125%-249%	1.4	*(0.8 - 2.4)*
250%-349%	2.5	*(1.3 - 4.6)*
>350%	1.0	---

Table 8.5. Odds of uncontrolled asthma by annual household income proximity to the FPL among adult Vermonters with current asthma, BRFSS and ACBS 2008-2010

Annual Household Income (% of FPL	Odds of uncontrolled asthma	
	Odds ratio	*95% CI*
< 125%	3.2	*(1.9 - 5.5)*
125%-249%	1.1	*(0.7 - 1.8)*
250%-349%	1.5	*(0.9 - 2.6)*
>350%	1.0	---

Table 8.6. Odds of severe asthma by the number of co-occurring chronic conditions (in addition to asthma) among adult Vermonters with current asthma, BRFSS and ACBS 2008-2010

Number of co-occurring chronic conditions	Odds of severe asthma	
	Odds ratio	*95% CI*
None	1.0	---
One	1.4	*(0.8 - 2.3)*
Two	2.7	*(1.6 - 4.8)*
Three or more	3.7	*(2.0 - 7.0)*

Table 8.7. Odds of uncontrolled asthma by the number of co-occurring chronic conditions (in addition to asthma) among adult Vermonters with current asthma, BRFSS and ACBS 2008-2010

Number of co-occurring chronic conditions	Odds of uncontrolled asthma	
	Odds ratio	95% CI
None	1.0	---
One	1.7	(1.1 - 2.7)
Two	2.9	(1.8 - 4.7)
Three or more	3.1	(1.6 - 5.7)

Table 8.8. The odds of severe asthma given the presence of various individual chronic conditions in addition to current asthma among adult Vermonters, BRFSS and ACBS 2008-2010

Co-occurring chronic condition [*]	Odds of severe asthma	
	Odds ratio	95% CI
Depression	3.3	(1.9 - 5.6)
CVD	2.7	(1.8 - 4.0)
Diabetes mellitus	1.3	(0.8 - 2.2)
Cancer**	3.0	(1.4 - 6.5)
Arthritis[†]	1.7	(0.8 - 3.5)
COPD [‡]	4.1	(2.0 - 8.2)
Overweight	1.9	(1.1 - 3.1)
Obesity	2.3	(1.4 - 3.5)

[*] Referent category is the absence of the given chronic condition
**Data from 2008 and 2010 only
[†] Data from 2009 only
[‡] Data from 2008 only

Table 8.9. The odds of uncontrolled asthma given the presence of various individual chronic conditions in addition to current asthma among adult Vermonters, BRFSS and ACBS 2008-2010

Co-occurring chronic condition [*]	Odds of uncontrolled asthma	
	Odds ratio	*95% CI*
Depression	2.5	*(1.4 - 4.3)*
CVD	2.3	*(1.5 - 3.4)*
Diabetes mellitus	1.6	*(0.9 - 2.7)*
Cancer**	2.6	*(1.2 - 5.4)*
Arthritis[†]	1.8	*(0.9 - 3.5)*
COPD [‡]	4.7	*(2.4 - 9.3)*
Overweight	1.7	*(1.1 - 2.7)*
Obesity	2.1	*(1.3 - 3.2)*

[*] *Referent category is the absence of the given chronic condition*
**Data from 2008 and 2010 only
[†]*Data from 2009 only*
[‡] *Data from 2008 only*

Table 8.10. Odds of severe asthma among adult Vermonters with current asthma reporting any Work-related asthma (WRA), ACBS 2008-2010

WRA factor	Odds of severe asthma	
	Odds ratio	*95% CI*
Caused by a job *(current or previous)*	3.2	*(1.9 - 5.6)*
Aggravated by a job *(current or previous)*	4.2	*(2.4 - 7.3)*
WRA diagnosed by a Dr.	2.6	*(1.4 - 4.9)*
Self-diagnosed WRA	2.2	*(1.3 - 3.8)*
Quit work due to WRA	3.0	*(1.5 - 5.7)*

[*] Referent category is the absence of the given WRA factor

Table 8.11. Odds of Uncontrolled Asthma among adult Vermonters with current asthma reporting any Work-related asthma (WRA), ACBS 2008-2010

WRA factor	Odds of uncontrolled asthma	
	Odds ratio	*95% CI*
Caused by a job *(current or previous)*	2.4	*(1.5 - 3.9)*
Aggravated by a job *(current or previous)*	3.0	*(1.9 - 4.7)*
WRA diagnosed by a Dr.	2.7	*(1.5 - 4.9)*
Self-diagnosed WRA	1.8	*(1.1 - 3.1)*
Quit work due to WRA	3.2	*(1.4 - 7.6)*

[*] Referent category is the absence of the given WRA factor

Table 8.12. Odds of severe asthma by self-reported smoking status among Vermonters with current asthma, BRFSS and ACBS 2008-2010

Smoking status	Odds of severe asthma	
	Odds ratio	*95% CI*
Never smoker	1.0	---
Current smoker	3.4	*(1.9 - 6.1)*
Former smoker	1.5	*(1.0 - 2.4)*

Table 8.13. Odds of uncontrolled asthma given self-reported smoking status among Vermonters with current asthma, BRFSS and ACBS 2008-2010

Smoking status	Odds of uncontrolled asthma	
	Odds ratio	*95% CI*
Never smoker	1.0	---
Current smoker	2.6	*(1.5 - 4.6)*
Former smoker	1.8	*(1.2 - 2.7)*

Table 8.14. Odds of severe asthma by smoking status and secondhand smoke (SHS) exposure[*] among Vermonters with current asthma, BRFSS and ACBS 2008-2010

	Odds of severe asthma	
	Odds ratio	*95% CI*
Never Smoker, No SHS exposure	1.0	---
Smoker, No SHS exposure	1.8	*(1.2 - 2.8)*
Smoker, SHS exposed	5.3	*(2.8 - 9.9)*

[*]Category of never smoker with SHS exposure is not reported as the group contains too few individuals

Table 8.15. Odds of uncontrolled asthma by smoking status and secondhand smoke (SHS) exposure[*] among Vermonters with current asthma, BRFSS and ACBS 2008-2010

	Odds of uncontrolled asthma	
	Odds ratio	*95% CI*
Never Smoker, No SHS exposure	1.0	---
Smoker, No SHS exposure	1.9	*(1.3 - 2.7)*
Smoker, SHS exposed	4.0	*(2.0 - 7.9)*

[*]Category of never smoker with SHS exposure is not reported as the group contains too few individuals

References

1. *Expert Panel Report 3 (EPR-3): Guidelines for the Diagnosis and Management of Asthma-Summary Report 2007.* J Allergy Clin Immunol, 2007. **120**(5 Suppl): p. S94-138.
2. Akinbami, L.J., et al., *Trends in asthma prevalence, health care use, and mortality in the United States, 2001-2010.* NCHS Data Brief, 2012(94): p. 1-8.
3. CDC. *2010 Adult Asthma Data: Prevalence Tables and Maps.* 2012 August 27, 2012 [cited 2012 November 1]; Available from: http://www.cdc.gov/asthma/brfss/2010/brfssdata.htm.
4. CDC. *2010 Child Asthma Data: Prevalence Tables.* 2012 November 16, 2011 [cited 2012 November 1]; Available from: http://www.cdc.gov/asthma/brfss/2010/brfsschilddata.htm.
5. Bacon, S.L., et al., *Individual-level socioeconomic status is associated with worse asthma morbidity in patients with asthma.* Respir Res, 2009. **10**: p. 125.
6. Boulet, L.P. and M.E. Boulay, *Asthma-related comorbidities.* Expert Rev Respir Med, 2011. **5**(3): p. 377-93.
7. Chen, Y., M. Bishop, and H. Liepold, *Increased effect of obesity on asthma in adults with low household income.* J Asthma, 2010. **47**(3): p. 263-8.
8. McLeish, A.C., J.R. Cougle, and M.J. Zvolensky, *Asthma and cigarette smoking in a representative sample of adults.* J Health Psychol, 2011. **16**(4): p. 643-52.
9. McLeish, A.C. and M.J. Zvolensky, *Asthma and cigarette smoking: a review of the empirical literature.* J Asthma, 2010. **47**(4): p. 345-61.
10. Burke, H., et al., *Prenatal and passive smoke exposure and incidence of asthma and wheeze: systematic review and meta-analysis.* Pediatrics, 2012. **129**(4): p. 735-44.
11. Anto, J.M., *Recent advances in the epidemiologic investigation of risk factors for asthma: a review of the 2011 literature.* Curr Allergy Asthma Rep, 2012. **12**(3): p. 192-200.
12. Valet, R.S., T.T. Perry, and T.V. Hartert, *Rural health disparities in asthma care and outcomes.* J Allergy Clin Immunol, 2009. **123**(6): p. 1220-5.
13. Adams, R.J., et al., *Coexistent chronic conditions and asthma quality of life: a population-based study.* Chest, 2006. **129**(2): p. 285-91.
14. Johnson, R.C. and R.F. Schoeni, *Early-life origins of adult disease: national longitudinal population-based study of the United States.* Am J Public Health, 2011. **101**(12): p. 2317-24.
15. Korkeila, J., et al., *Childhood adversities and adult-onset asthma: a cohort study.* BMJ Open, 2012. **2**(5).
16. Schatz, M., *Predictors of asthma control: what can we modify?* Curr Opin Allergy Clin Immunol, 2012. **12**(3): p. 263-8.
17. Wainwright, N.W., et al., *Psychosocial factors and asthma in a community sample of older adults.* J Psychosom Res, 2007. **62**(3): p. 357-61.
18. Dube, S.R., M.L. Cook, and V.J. Edwards, *Health-related outcomes of adverse childhood experiences in Texas, 2002.* Prev Chronic Dis, 2010. **7**(3): p. A52.

19. de Groot, V., et al., *How to measure comorbidity. A critical review of available methods.* J Clin Epidemiol, 2003. **56**(3): p. 221-9.

20. Nuorti JP, W.C., *Updated Recommendations for Prevention of Invasive Pneumoccocal Disease Among Adults Using the 23-Valent Pneumoccocal Polysaccharide Vaccine (PPSV23)*, in *Morbidity and Mortality Weekly Report (MMWR)*, A.P.V.W. Group, Editor 2010, CDC. p. 1102-1106.

21. Nuorti JP, W.C., *Prevention of Pneumococcal Disease Among Infants and Children -- Use of 13-Valent Pneumococcal Conjugate Vaccine and 23-Valent Pneumococcal Polysaccharide Vaccine*, in *Morbidity and Mortality Weekly Report*, CDC, Editor 2010, CDC. p. 1-18.

22. Nguyen, K., J. Peng, and E. Boulay, *Effect of Smoking on the Association Between Environmental Triggers and Asthma Severity Among Adults in New England.* Journal of Asthma & Allergy Educators, 2010. **1**: p. 210-218.