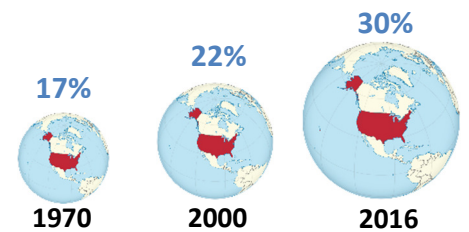


Introduction

Asthma is an inflammatory disease of the airways of lungs that causes breathing difficulties. Obesity, defined as having a body mass index (BMI) ≥ 30 , is also an inflammatory disease. Obesity increases health-related complications such as asthma, insulin resistance, type 2 diabetes, cancer, cardiovascular disease, liver disease, and neurodegeneration.¹ In addition, chronic obesity permanently skews the body's immune system to exhibit proinflammatory characteristics which may contribute to those with high BMI having more severe and more difficult-to-control asthma. Certain asthma medications are less effective for those with high BMI² and preventative measures such as the annual flu vaccine may be less effective in preventing viral infections than among people with a lower BMI.³

In the U.S., the rate of obesity has increased from 17% in 1970 to 30% in 2016. In addition, 36% of the U.S. population are overweight. Furthermore, those who are obese often encounter financial burden from increased healthcare and insurance costs, lost productivity and wages, disability, and increased fuel costs. On average, these costs add to \$4,880 for women and \$2,650 for men annually.⁴ Furthermore, obesity is a leading cause of preventable death in the U.S.⁵ Many factors contribute to the rising obesity rate in the U.S., including increased consumption of processed foods and sugar-sweetened beverages, addition of sugar to savory foods, the low cost of highly-processed foods in comparison to healthful alternatives, decreased physical activity, and increased exposure to sedentary screen time.

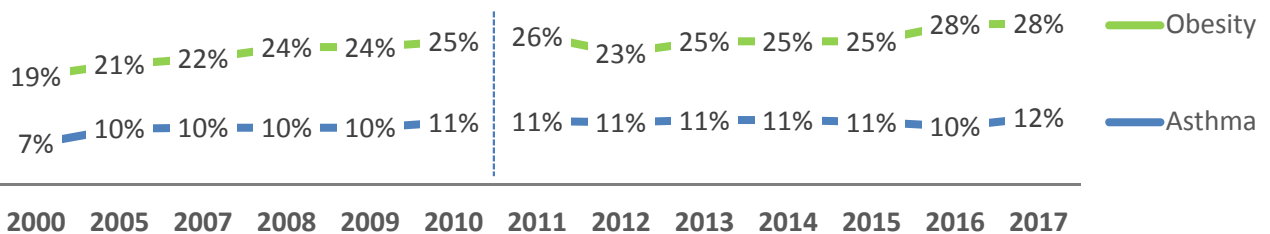
Obesity in the U.S., BRFSS †



Asthma and Obesity in Vermont

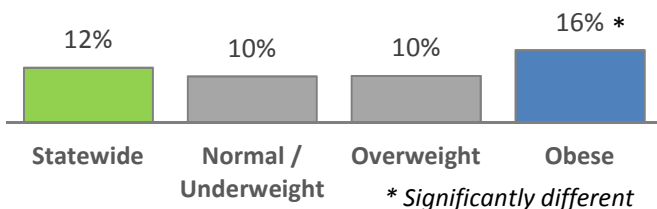
The prevalence of asthma in Vermont has increased from 7% in 2000 to 12% in 2017 and has been higher than the U.S. rate since 2007. Similarly, the rate of obesity in Vermont was 19% in 2000 and increased to 28% in 2017. Since at least 2000, Vermont has had a significantly lower rate of adult obesity compared to the U.S. rate.

Asthma and Obesity[†] Prevalence among Vermont Adults, BRFSS

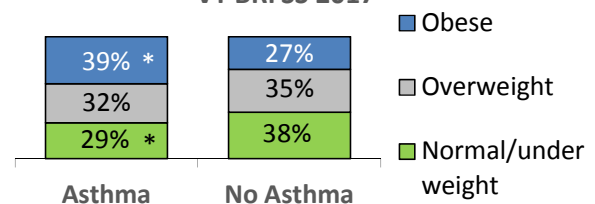


The current asthma prevalence in Vermont was 12% and varies by BMI. Those who are obese had a significantly higher rate of asthma compared to those of lower BMI (16% vs. 10%). Vermont adults with asthma were significantly more likely to be obese than those without asthma (39% vs. 27%). In 2017, there were an estimated 59,000 Vermont adults with asthma, 127,000 adults who were obese, and 20,000 who had asthma and were obese.

Current Asthma Prevalence by BMI Category, VT BRFSS 2017



Body Mass Index[†] by Asthma Status, VT BRFSS 2017



Co-occurring Chronic Conditions

People with asthma or obesity often have other chronic health conditions in addition to asthma that complicate disease management, coordination of care, and preventative activities.

Vermonters with both asthma and obesity had significantly higher rates of the following chronic conditions compared to the statewide rates:


- ✓ arthritis
- ✓ disability
- ✓ cognitive decline
- ✓ cancer
- ✓ cardiovascular disease (CVD)
- ✓ diabetes
- ✓ chronic kidney disease
- ✓ depression
- ✓ chronic obstructive pulmonary disease (COPD), and
- ✓ hypertension

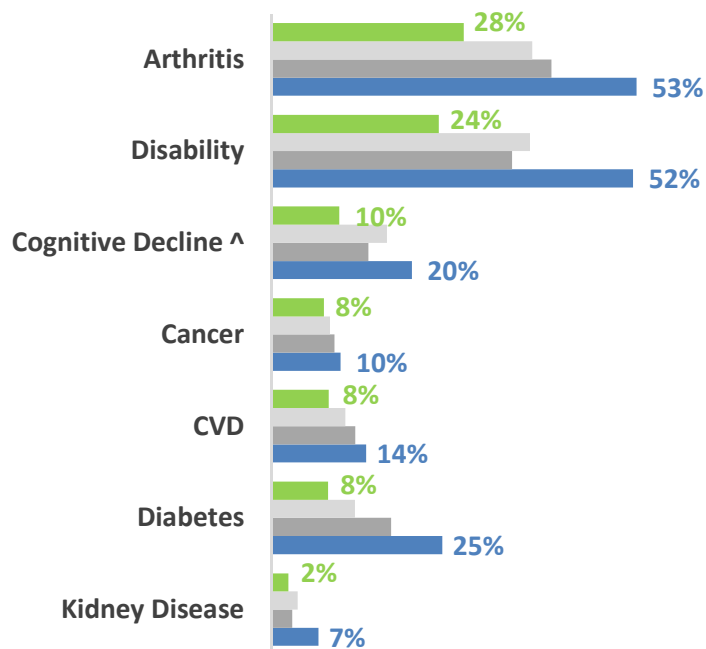
For most of these conditions, there was a stepwise increase in the rate of each chronic condition with the presence of asthma or obesity. This was the case for arthritis, disability, cognitive decline, cancer, CVD, diabetes, and kidney disease as shown in **Part A** of the adjacent figure. However, the patterns of increasing prevalence of the chronic condition were distinct for depression and COPD in which the prevalence was mainly influenced by having asthma (**Part B**) and for hypertension which was primarily driven by obesity (**Part C**).

- **Over half** of adults with asthma and obesity had arthritis, disability and depression.
- Those with **asthma and obesity** were **twice** as likely to have a disability, cognitive decline or depression; **three times** as likely to have chronic kidney disease or diabetes; and **four times** as likely to have COPD compared to the statewide rates.


Prevalence of Common Co-occurring Chronic Conditions, VT BRFSS 2017

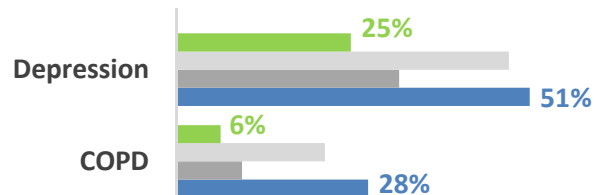
■ Statewide ■ Asthma ■ Obesity ■ Asthma & Obesity


A  Both asthma and obesity contributed to higher prevalence of these chronic conditions.



[^] Cognitive decline rates from 2016 BRFSS.

B  Asthma was the main contributor to the higher prevalence of depression and COPD.

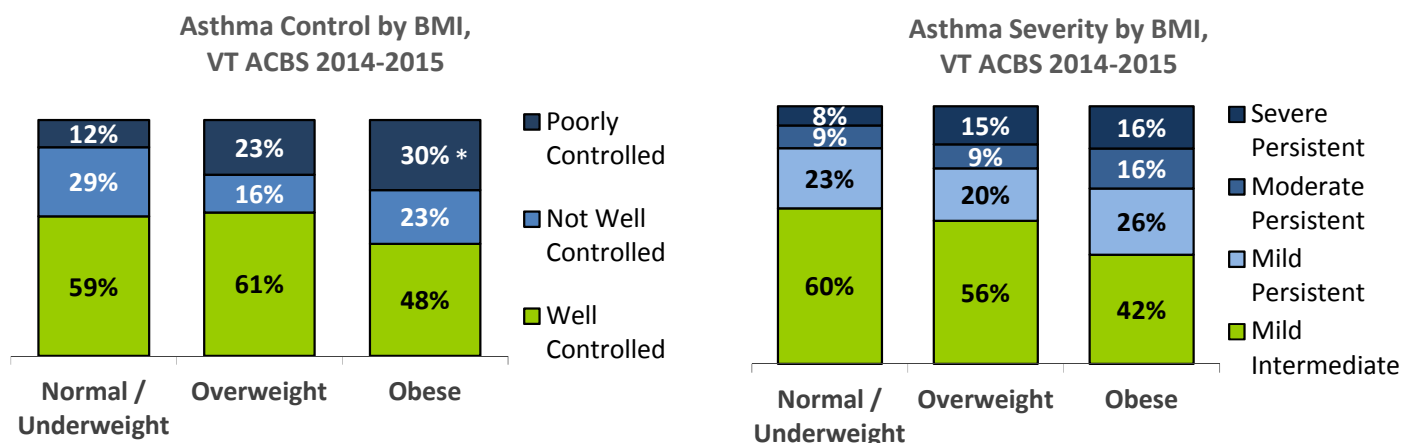


C  Obesity was the main contributor to the increased rate of hypertension among those with asthma and obesity.



Asthma Control and Severity

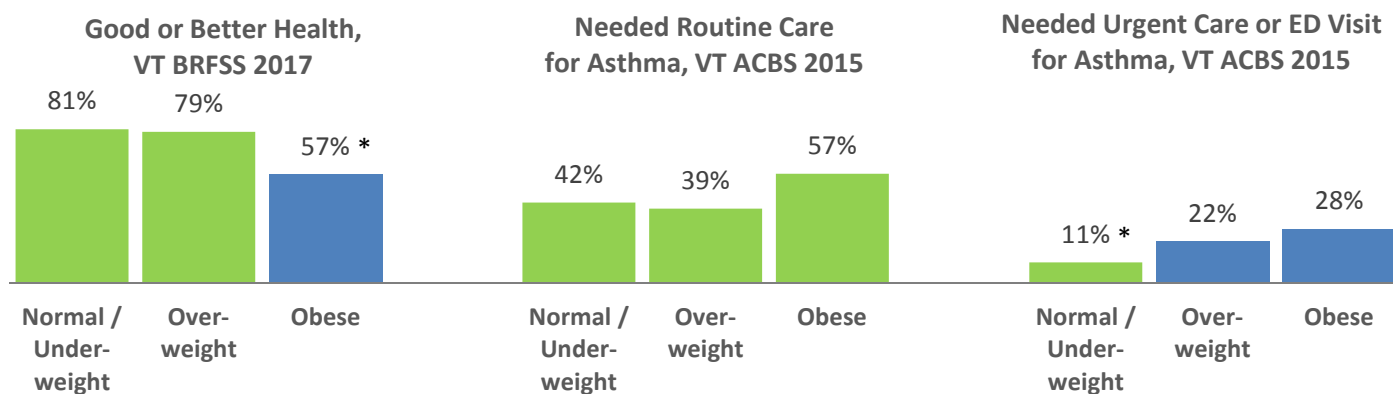
Asthma control is a measure of how well a person's asthma is managed that is based on the frequency of asthma symptoms, nighttime awakenings, and use of rescue medication (short-acting beta₂ agonist) for symptom control. Asthma severity is a measure of impairment due to asthma that is determined from the frequency of missed work or normal activity and number of emergency visits for asthma, in addition to, the frequency of asthma symptoms and nighttime awakenings. The rate of poorly-controlled asthma increased with increasing BMI. Vermonters with asthma who were obese had a significantly higher rate of poorly-controlled asthma compared to those who were normal/underweight (30% vs 12%). Similarly, there was a trend for asthma severity to increase with increasing BMI, however, there were no significant differences between groups.



Asthma, Obesity and Health

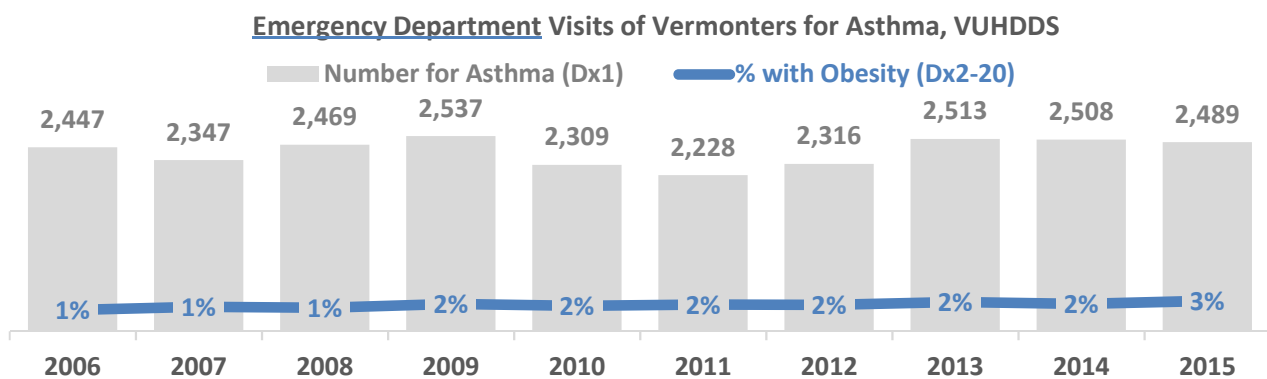
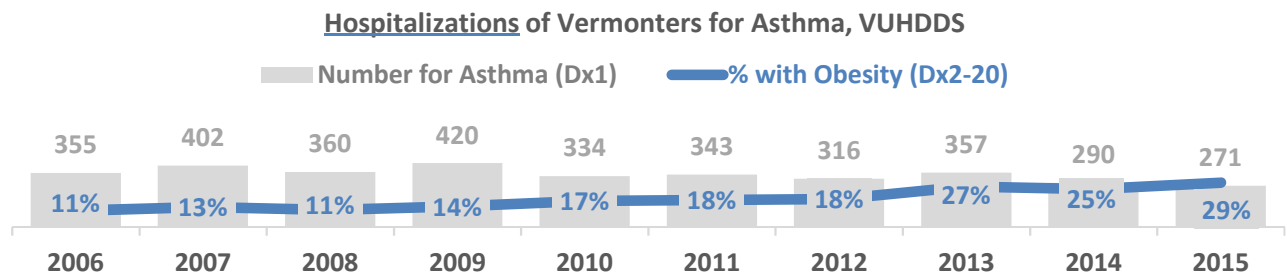
Vermonters with asthma who were obese were significantly less likely to rate their health as good or better than those who were normal/underweight or overweight. No significant differences were found in need for routine care by BMI. Those of normal weight or below were significantly less likely to have had an urgent care visit for their asthma than those of higher body weight.

Prevalence of Health Indicators among Those with Asthma by BMI



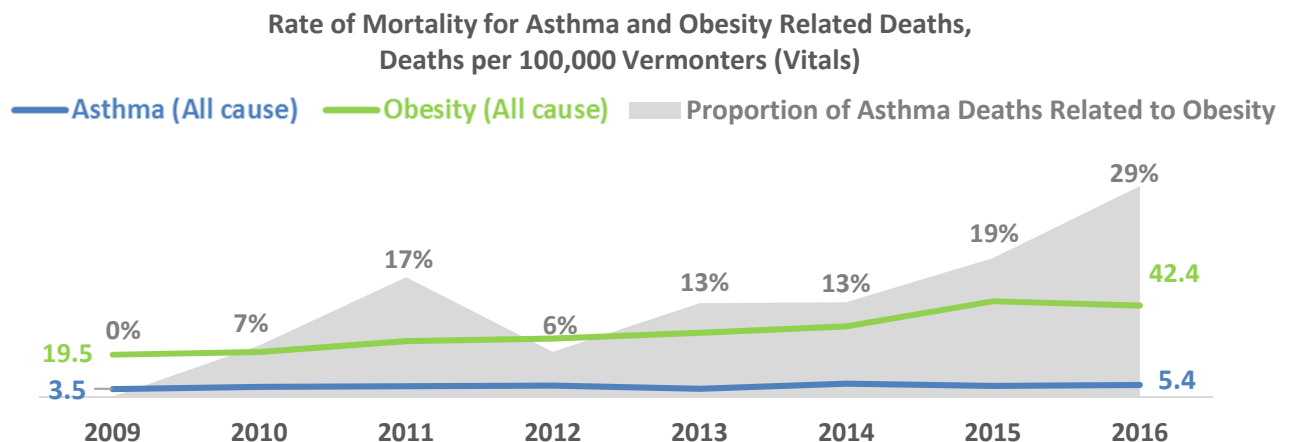
* Significantly different

Although the total number of inpatient hospitalizations with a *primary diagnosis (Dx1)* of **asthma** decreased from 355 in 2006 to 271 in 2015, the proportion of hospitalizations having a primary diagnosis of asthma that also included a diagnosis of obesity (Dx2-20) has risen from 11% to 29% over this time period. The diagnoses codes for obesity were used less frequently in the ED, with obesity-related ED visits for asthma increasing from 1% in 2006 to 3% in 2015. Increased awareness of obesity as a disease may contribute in part to the increased usage of obesity diagnostic codes.



Mortality

Uncontrolled asthma can be a life-threatening condition and increased BMI correlates with poorer asthma control and increased severity. The mortality rate due to asthma as the direct underlying cause of death has fluctuated in recent years due to the small number of events. In 2016, the rate was 2.1 per 100,000 Vermonters and has ranged from 1.1 to 2.6 per 100,000 over the last 8 years (data not shown). The mortality rate for all asthma-related causes was 2 to 3 times higher and ranged from 3.5/100,000 Vermonters in 2009 to 5.4/100,000 in 2016. Meanwhile, the mortality rate due to a direct underlying cause of obesity was 6.4 in 2016 (data not shown) and the mortality rate for all obesity-related causes was roughly 10 times higher and has steadily increased from 19.5/100,000 in 2009 to 42.4/100,000 in 2016. Since 2009, an increasing proportion of deaths related to asthma indicated obesity as a contributing factor. Of those deaths related to asthma in 2016, nearly one third (29%) also had an obesity-related cause of death.



Discussion

Many Vermonters with asthma are managing additional chronic conditions that lead to complexity in disease management, poorer asthma control, decreased quality of life, and financial burden. Having asthma and also being obese increases one's likelihood of having additional co-occurring conditions, particularly arthritis, disability, cognitive decline, chronic kidney disease, depression, diabetes, COPD, or hypertension.

As high BMI is associated with poorer asthma control, increased utilization of healthcare services, and an increasing proportion of asthma-related deaths, weight management is an important component of asthma control for those with a high BMI. Controlling weight can improve asthma symptoms and one's quality of life. Though obesity has been on the rise both nationally and in Vermont, many efforts are underway to increase awareness of the impact of obesity on one's health and quality of life. The **Vermont Physical Activity and Nutrition Program** works to encourage eating healthful foods, increasing levels of physical activity through evidence-based policy, and promoting systems and environmental changes that help **make the healthy choice the easy choice** (<http://www.healthvermont.gov/wellness/physical-activity-nutrition>).

In addition, the **Vermont Asthma Program** is working to reduce the burden of asthma among all Vermonters through promoting evidence-based strategies for asthma management including home visiting, in-depth asthma education for patients and providers, and sharing tools such as the Asthma Action Plan to improve guidelines-based care (<http://www.healthvermont.gov/wellness/asthma>).

Resources to Reduce the Burden of Asthma and Obesity among Vermonters

- ① Information for those ready to eat healthier and become more physically active: <http://www.healthvermont.gov/mymoment/>
- ② Free self-management classes for Vermonters including Chronic Disease management and the National Diabetes Prevention Program, a proven weight loss program: <https://myhealthyvt.org/>
- ③ Gain strategic direction to assist patients in their self-management with the Physician's Guide to Managing and Diagnosing Asthma: http://www.nhlbi.nih.gov/guidelines/asthma/asthma_qrg.pdf

For More Information

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Data Sources and Notes

¹ Sattiel, A., and Olefsky, J. J of Clin Invest. Inflammatory Mechanisms Linking Obesity and Metabolic Disease. 2017 127 (1): 1-4.

² American Lung Association: <http://www.lung.org/about-us/blog/2016/07/the-link-between-asthma-weight.html>

³ Neidich, et al., Increased Risk of Influenza among Vaccinated Adults Who Are Obese, Int J Obes, 2017 41 (9).

⁴ Research Report: A Heavy Burden: The Individual Costs of Being Overweight and Obese in the United States, George Washington University, Sept 21, 2010. <http://www.weightlossscience.com/wp-content/uploads/2017/08/A-Heavy-Burden-The-Individual-Costs-of-Being-Overweight-and-Obese-in-the-United-States.pdf>

⁵ Obesity is Top Cause of Preventable Life-Years Lost. <https://www.sciencedaily.com/releases/2017/04/170422101614.htm>

Vermont Asthma Callback Survey (ACBS).

Vermont Behavioral Risk Factor Surveillance System (BRFSS). A change in BRFSS methodology occurred between 2010 and 2011; therefore, comparison of 2011 and onward data to 2010 and prior data should be made with caution.

Vermont Uniform Hospital Discharge Data Set (VUHDDS): Hospital and emergency department discharge data are collected from in-state hospitals and from hospitals in bordering states. The VUHDDS data set was narrowed to only include VT residents. Patients admitted to the hospital from the emergency department are included in only the hospital discharge data set and are not included in the emergency discharge data. NH changed the way in which they process their data in 2009 which may contribute to any difference observed between 2010 and prior year data. In addition, beginning in 2014 data from MA are no longer included. This change had negligible impact on these statewide analyses. A primary diagnosis refers to asthma (ICD-9 493; ICD-10 J45, J46) being listed as the first diagnosis code. Obesity-related visits were identified by (ICD-9 278 or ICD-10 E65-E67) as a diagnostic code. Vermont Vital Statistics System (Vitals) - A cause of death due to asthma was identified as (ICD-10 J45-J46) and Obesity (ICD-10 E65-E68).

‡ Data are age adjusted to the 2000 U.S. Standard population per U.S. Healthy People methodology.

^ Cognitive decline data from 2016 BRFSS and asked only of those Vermonters 45 years of age and older.

* Indicates statistically significant difference.

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