

# Obesity Associated Cancers – Data Brief

## Vermont Cancer Registry

### Background

Overweight and obesity has been associated with risk for 13 types of cancer and may contribute to as much as 40% of newly diagnosed cancers in the U.S. each year\*. While prevalence of adult current smokers (age 18+) in Vermont has declined from 20% in 2005 to 17% in 2017, the prevalence of obesity (BMI 30+)† has increased from 21% in 2005 to 28% in 2017 (BRFSS, 2017). An additional 35% of Vermonters were considered overweight (BMI between 25 and 29) in 2017. In total, 63% of Vermont adults were either overweight or obese placing them at increased risk of conditions such as type 2 diabetes, hypertension, heart disease, stroke, osteoarthritis, and cancer.

### Incidence of Obesity Associated Cancers

Research has consistently found that excess weight is associated with increased risk for cancers of the esophagus (adenocarcinoma), breast (in postmenopausal women), colorectal, endometrium (cancer of the lining of the uterus), gallbladder, gastric cardia (upper part of the stomach nearest the esophagus), kidney, liver, ovary, pancreas, thyroid, as well as meningioma and multiple myeloma. While these cancers are categorized as obesity associated cancers, not all cases of these cancers can be solely attributed to obesity.

**Obesity Associated Cancers, Vermont and U.S., 2011-2015**

	Male				Female			
	U.S. Rate	VT Rate		VT Cases (per year)	U.S. Rate	VT Rate		VT Cases (per year)
All Obesity Associated Sites	113.9	104.7	↓	394	217.1	222.0		972
Esophageal Adenocarcinoma	5.4	6.9	↑	28	0.8	1.3		5
Gastric cardia	3.6	3.2		12	0.8	0.8		3
Colorectal	44.4	38.7	↓	144	33.8	33.4		145
Liver	10.6	7.9	↓	33	3.2	1.8	↓	7
Gallbladder	0.8	0.7		3	1.3	1.6		7
Pancreas	13.7	14.5		54	10.6	10.3		45
Kidney	20.6	18.0	↓	67	10.6	8.5	↓	35
Meningioma	0.1	--		--	0.1	--		--
Thyroid	7.2	7.6		27	21.4	19.7		66
Multiple myeloma	7.4	7.2		26	4.9	3.6	↓	16
Post-menopausal Female Breast	--	--		--	334.6	346.6		446
Endometrial (Uterine)	--	--		--	26.1	33.5	↑	148
Ovary	--	--		--	11.1	11.7		48

↑ Higher ↓ Lower than U.S.

-- Rates based on five or fewer cases are not individually calculated.

Source: VCR

Between 2011 and 2015 there were approximately 1,366 cases of obesity associated cancers diagnosed in Vermont each year, accounting for approximately 37 percent of all cancers diagnosed. Vermont men have lower rates of cancers of the colon and rectum, liver, kidney, and all obesity sites combined and higher rates of esophageal (adenocarcinoma) cancers compared to the U.S. rates. Vermont women have lower rates of liver and kidney cancers as well as multiple myeloma and higher rates of endometrial (uterine) cancers compared to U.S. rates.

## Mortality from Obesity Associated Cancers

In addition to being associated with higher rates of cancer, excess weight has also been associated with poor prognosis including later stage of diagnosis, complications from treatments, and increased recurrence of cancers, and increased mortality. Cancer is a leading cause of death in Vermont. Excess body weight, poor nutrition, and physical inactivity may contribute to as much as one-third of cancer deaths in the U.S.

### Obesity Associated Cancer Deaths, Vermont and U.S., 2011-2015

	Male			Female		
	U.S. Rate	VT Rate	VT Deaths (per year)	U.S. Rate	VT Rate	VT Deaths (per year)
All Cancer Sites	196.8	198.9	715	139.6	146.1	↑ 648
All Obesity Associated Sites	61.6	57.7	213	65.1	63.2	↓ 288

↑ Higher ↓ Lower than U.S.

Source: VCR

## Obesity and Risk of Cancer

Excess weight may increase cancer risk through several mechanisms including influencing immune system function and inflammation, increased levels of hormones (insulin, insulin-like growth factor-1 (IGF-1), and estrogen) that encourage the development of certain tumors, and proteins that influence how hormones are used by the body. Studies have demonstrated that weight loss reduces the risk of developing chronic diseases including diabetes and cardiovascular disease as well as some cancers.

The exact relationship between obesity and cancer risk continue to be explored; however, obesity may contribute to cancer risk in multiple ways.

	Mechanism	Estimated level of risk compared to “normal-weight” †
Esophageal Adenocarcinoma	Inflammation	Two to four times (extremely obese) as likely
Gastric cardia	***	Twice as likely
Colorectal	Insulin and insulin-like growth factors	30% increased risk, higher in men
Liver	Inflammation	Twice as likely, higher in men
Gallbladder	Inflammation	20% (overweight) and 60% (obese), higher in women
Pancreas	***	One and a half as likely
Kidney	Insulin and insulin-like growth factors	Twice as likely
Meningioma	***	20% (overweight), 50% (obese)
Thyroid	***	10% increase associated with 5-unit higher BMI
Multiple myeloma	***	10% to 20% increased risk
Endometrial (Uterine)	Hormone, insulin and insulin-like growth factors	Two to four times and seven times (extremely obese) as likely, associated with weight gain in adulthood
Ovary	Hormone	10% increase associated with 5-unit higher BMI among women who have never used menopausal hormone therapy
Post-menopausal Female Breast	Hormone	12% increase associated with 5-unit higher BMI, 20%-40% (obese). Higher risks among women who have never used menopausal hormone therapy

\*\*\* Unclear mechanisms possibly include hormonal factors, inflammatory response, and levels of insulin or insulin-like growth factors.

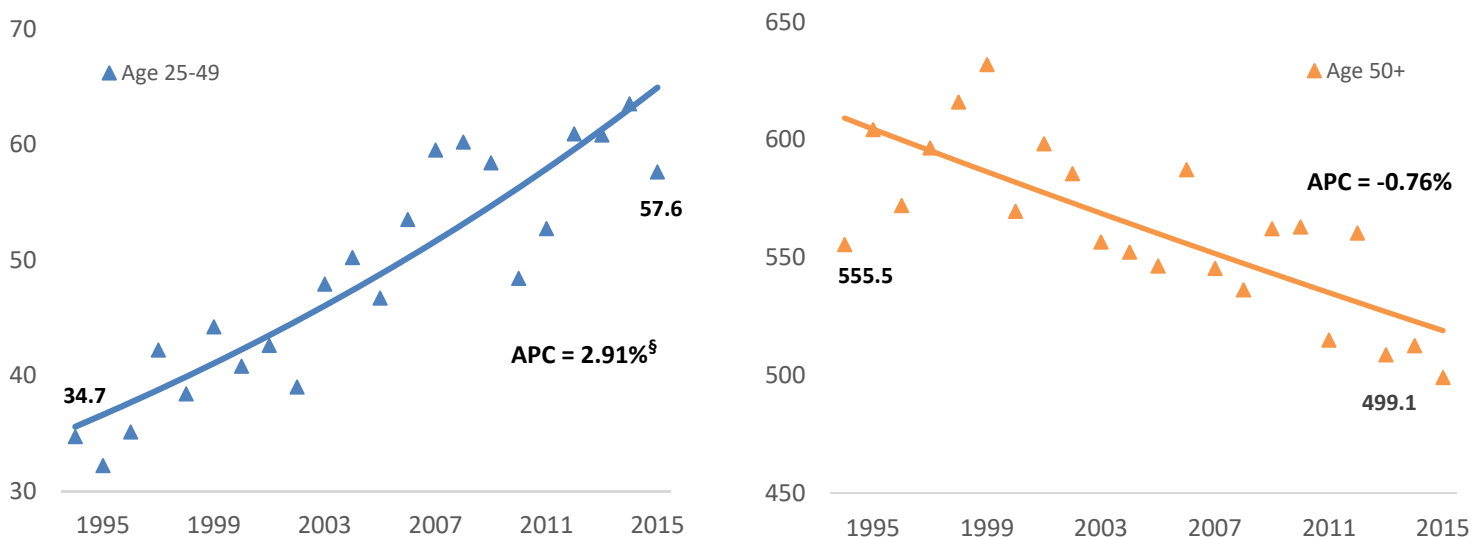
Source: NCI

The exact explanation for the relationship between obesity and cancer risk remains unclear, but it is known that fat tissue is highly active, producing large amounts of hormones like estrogen, insulin and insulin-like growth factors. High estrogen levels have been associated with increased risks of breast, endometrial, ovarian and some other cancers. High levels of insulin and insulin-like growth factors can promote the development of colon, kidney, prostate and endometrial cancers. Fat cells also produce adipokines, hormones that can affect cell growth. It has also been proven that people with obesity often have chronic low-level inflammation which can cause DNA damage to cells over time, leading to cancer. Chronic inflammation caused by gastroesophageal reflux disease is a likely cause of esophageal adenocarcinoma. In addition, chronic ulcerative colitis (a chronic inflammatory condition) and hepatitis (disease of the liver causing inflammation) are risk factors for liver cancer. Obesity is also a risk factor for gallstones, which are related to chronic gallbladder inflammation. A history of gallstones is a strong risk factor for gallbladder cancer.

Vermont adults age 25 and older are more likely than younger adults to be obese (BRFSS 2017). Results from the 2015-2016 National Health and Nutrition Examination Survey (NHANES<sup>II</sup>) found that the prevalence of overweight and obesity in the U.S. between 1980 and 2016 increased among children and adolescents (age 2-19) by over 150% and among adults (age 20-74) by over 60%.

The risk of being diagnosed with cancer increases with age, and most cancers occur in adults who are middle age or older. Approximately 88 percent of all new cancers diagnosed each year occur among Vermonters age 50 and older. Cancer trends among adults under age 50 can reflect exposure to cancer risk factors, and recent analysis has found that cancer incidence for some obesity-association cancers appear to be increasing disproportionately in younger adults (age 25-49) compared to older adults typically associated with a greater cancer burden<sup>1</sup>.

**Age-adjusted obesity-associated cancer by age 25-49 and 50+, Vermont, 1994-2015**

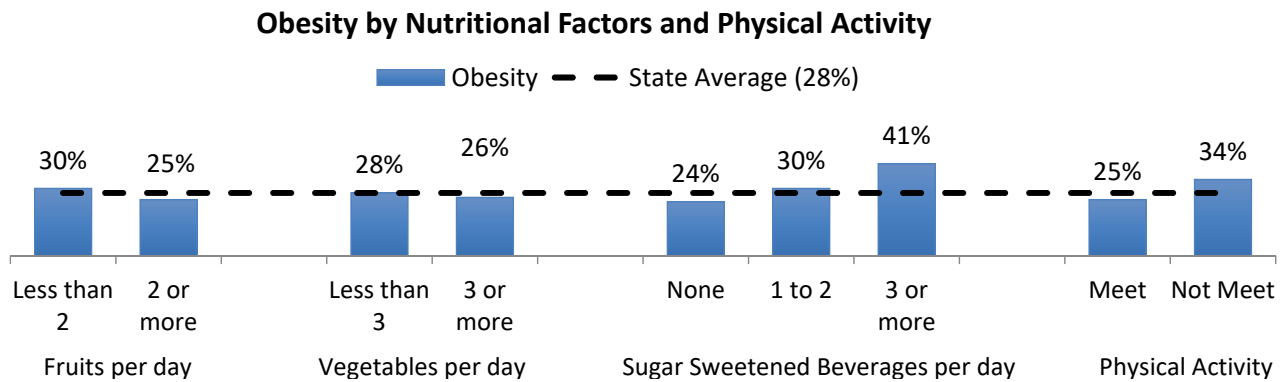


Source: VCR

Between 1994 and 2015, for Vermonters age 25-49 the incidence of obesity-associated cancers increased annually<sup>§</sup> by almost three percent while Vermonters age 50 and older experienced a decrease of almost one percent annually. Additionally, incidence increased for several obesity-associated cancers among younger Vermonters including colorectal (2.5%) which declined for older Vermonters (-3.6%), pancreatic (3.0%), and kidney (4.8%) cancers. Incidence increased among older Vermonters for liver cancer (4.4%) and across both age groups for thyroid cancer by approximately five percent. Current obesity and cancer trends may be predictive of future cancer trends for older adults.

## Obesity, Nutrition, and Physical Activity

Nearly two-thirds of cancer deaths in the U.S. can be linked to [tobacco](#) use, [poor diet, obesity, and lack of exercise](#). Nutritional factors such as fruit and vegetable consumption and drinking sugar sweetened beverages can contribute to weight and body mass index. Participation in physical activity also can influence body weight and obesity. Six in ten Vermont adults met [aerobic physical activity recommendations](#)\*\* , higher than the 50% reported by U.S. adults. However, adults who did not meet aerobic physical activity recommendations were significantly more likely to report being [obese](#) than those who met recommendations.



Source: BRFSS

### Technical Notes and Sources:

These data were collected by the Vermont Cancer Registry participating in the National Program of Cancer Registries (NPCR) of the Centers for Disease Control and Prevention (CDC). Incidence rates are per 100,000 and are age adjusted to the 2000 U.S. standard population. Incidence rates exclude in situ carcinomas except urinary bladder. Incidence was coded using the International Classification of Disease (ICD) for Oncology (ICD-O). Vermont cases include Vermont residents only. A reporting delay by Department of Veterans Affairs (VA) has resulted in incomplete reporting of Vermont VA incident cases in 2011- 2014.

In December 2017, the methodology for computing risk factor-associated cancers changed to be consistent with CDC methodology, updated October 2017. The CDC [document](#) defines cancers associated with certain risk factors, including tobacco, alcohol, human papillomavirus (HPV), obesity, and physical-inactivity. Rates for risk factor-associated cancers published prior to December 2017 should not be compared to rates for risk factor-associated cancers published December 2017 or later. In addition, rates published later than May 2018 should not be compared to rates for risk factor-associated cancers published earlier due to additional methodological changes (excluding non-microscopically confirmed cases). Differences between rates in older versus current publications are likely due to methodological changes rather than changes in the rates or underlying risks for developing risk factor-associated cancers.

The Vermont and U.S. incidence rates are based on the Vermont Cancer Registry, Vermont Department of Health (1994-2015) and the NPCR and SEER Incidence - U.S. Cancer Statistics Public Use Database, Nov 2017 submission (2001-2015). The Vermont and the U.S. mortality rates are based on the Vermont Vital Statistics System, Vermont Department of Health (1994-2015) and the SEER Program Mortality - Aggregated Total U.S. (1990-2015).

[United States](#) and [Vermont](#) Behavioral Risk Factor Surveillance System (BRFSS), 2005-2017.

We acknowledge the Centers for Disease Control and Prevention, for its support of the Vermont Cancer Registry, and the printing and distribution of this document under cooperative agreement NU58DP006322 awarded to the Vermont Cancer Registry. The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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\*Steele CB, Thomas CC, Henley SJ, et al. *Vital Signs: Trends in Incidence of Cancers Associated with Overweight and Obesity — United States, 2005–2014*. MMWR Morb Mortal Wkly Rep 2017;66:1052–1058. DOI:

<http://dx.doi.org/10.15585/mmwr.mm6639e1>.

†**Body Mass Index** (BMI) is a measure of body fat based on height and weight that applies to adult males and females and is often used as a measure of obesity because it is more accurate measure than just weight alone. BMI is calculated by dividing an individual's weight (in kilograms) by their height (in meters) squared ( $\text{kg}/\text{m}^2$ ). BMI for adults age 20 years or older include: underweight (<18.5), normal (18.5-24.9), overweight (25.0-29.9), obese (30.0-39.9), and severely obese (40.0+).

‡ National Cancer Institute, Obesity and Cancer. (2017, January 17). Retrieved August 14, 2018, from <https://www.cancer.gov/about-cancer/causes-prevention/risk/obesity/obesity-fact-sheet>.

\*\* **Aerobic physical activity recommendations** are defined as 150 minutes of moderate activity or 75 minutes of vigorous activity per week.

§ Annual Percent Change (APC) is reported when it is significantly different from zero ( $\alpha = 0.05$ ). APC is used to measure trends in cancer rates over time where cancer rates are assumed to change at a constant percentage of the rate of the previous year.

|| Centers for Disease Control and Prevention, National Health and Nutrition Examination Survey (NHANES). [Prevalence of Overweight, Obesity, and Extreme Obesity Among Adults Aged 20 and Over: United States, 1960-1962 Through 2015-2016](#) and [Prevalence of Overweight, Obesity, and Severe Obesity Among Children and Adolescents Aged 2-19 Years: United States, 1963-1965 Through 2015-2016](#) (accessed February 28, 2019).

¶ Sung, H., Siegel, R. L., Rosenberg, P. S., & Jemal, A. (2019). [Emerging cancer trends among young adults in the USA: Analysis of a population-based cancer registry](#). *The Lancet*, 2468-2667. doi:10.1016/S2468-2667(18)30267-6.