



## Excess weight gain during youth and the future risk of cancer

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### Excess weight as an adult is a risk factor for many cancers

In the U.S. and worldwide, many adults struggle with excess weight. Nearly 70% of U.S. adults are overweight or obese, putting them at risk for a lifetime of compromised health. Excess weight contributes to the development of high blood pressure, insulin resistance and the metabolic syndrome, and is a leading cause of non-communicable disease such as diabetes and cardiovascular disease. Many people may not realize, however, that excess weight is also a risk factor for several cancers.<sup>1</sup> Excess weight has been identified as a risk factor for postmenopausal breast, endometrial, colon, rectal, renal, pancreatic, gallbladder, liver, esophageal and thyroid cancers. Excess weight may also increase the risk of aggressive prostate cancer, non-Hodgkin lymphoma and meningioma. The contribution of excess weight to cancer development varies by cancer type. For example, in 2007 it was estimated that obesity was partially attributable for 6% of pancreatic, 25% of kidney and 41% of endometrial cancer cases.<sup>2</sup> In addition to increasing the risk of developing various cancers, excess weight is also related to a poor cancer prognosis: overweight and obese individuals are often diagnosed at a more advanced stage of disease, excess weight complicates cancer treatments, and excess weight increases the risk of recurrence for some cancers. Not surprisingly, mortality

rates from all cancers are greater among those who are overweight or obese.<sup>1</sup>

Why is being overweight or obese a risk factor for developing some cancers? Excess weight often leads to higher levels of insulin and insulin-like growth factor-1 (IGF1) in the blood, which are two growth hormones that can stimulate tumor growth. Adipose tissue, or body fat, increases the concentrations of estrogen in the body, which in turn may encourage the growth of certain tumors. Adipose tissue also produces several other hormones collectively referred to as adipokines. Adipokines contribute to inflammation in the body,<sup>3</sup> and inflammation stimulates tumor growth.<sup>4</sup>

### Excess weight during youth and future risk of cancer

Similar to adults, more and more children and adolescents in the U.S. are becoming overweight. In 2012, one out of three children and adolescents in the U.S. were overweight, including 23% of 2-5 year olds. Being overweight at an early age can have a lasting impact on one's weight over their lifetime, and there is a growing concern that excess weight during youth may be a risk factor for future cancer. Weight status 'tracks' from childhood to adulthood. Children and adolescents who are overweight will likely remain overweight or become obese as adults,<sup>5</sup> which in turn, places them at an increased risk for cancer as adults. Excess weight gain during youth could also impact the future

risk of cancer because of the development cancer-related risk factors during childhood (e.g., insulin resistance, metabolic syndrome, non-alcoholic fatty liver disease). Importantly, children who are overweight are exposed to the negative effects of adipose tissue at an early age, which might translate into an earlier age of cancer development.

Several studies have reported that excess weight during youth is a risk factor for several future cancers, including future premenopausal ovarian, endometrial, bladder, colon, rectal, renal, pancreatic, liver, esophageal, thyroid and fatal prostate cancers. Overall, it appears that excess weight during youth increases the risk for future cancers that have been linked to excess weight among adults. Because weight during childhood is such a strong predictor of weight as an adult, it is difficult to tease out the separate effects of childhood weight and adult weight on future cancer risk. For example, excess weight during youth has been related to an increased future risk of endometrial cancer, yet effects appear driven by adult weight.<sup>6,7</sup> However, for some cancers, weight gain specifically during youth may matter. For example, in one study excess weight at age 18 was related to an increased risk of premenopausal ovarian cancer while weight gain as an adult was not.<sup>8</sup>

### What's next?

It is clear that excess weight gain during youth is a risk factor for future cancer; however, it is a preventable risk factor. Weight gain is caused by multiple factors at the individual, family, school, community and even policy levels. For example, at the individual level, a child's biological makeup may predispose him or her to becoming overweight or obese. At the family level, many parents find themselves lacking the time, access or financial resources to purchase and prepare healthy food. There is also a growing awareness that TV and other electronic media can negatively affect sleep quality and quantity among children, which in turn can lead to weight gain. In many communities, unhealthy foods such as junk food and fast food are readily available and affordable, which may facilitate a poor dietary pattern and lead to excess weight gain. Additionally, many children do not have safe places to play in their communities, and instead may remain inside engaged in sedentary activities (e.g., TV, video games, social media). Finally, exposure to food advertising has been shown to influence a child's food preferences and requests,<sup>9</sup> and the extensive food marketing that occurs in the U.S. may ultimately have an effect on a child's dietary intake and weight status. In 2009, food companies spent more than \$1.04 billion in the U.S. to market food and beverages directly to children aged 2-11,<sup>9</sup> and the majority of such ads were for foods of poor dietary quality (e.g., fast food, snack foods, sugar-sweetened beverages) that may lead to excess eating. Importantly, it is difficult to reverse the trajectory of excess weight gain once children become overweight. Therefore, to improve the weight

status of our children, treatment efforts must address the multiple barriers for leading a healthy lifestyle, and public health programs and initiatives are needed to remove those barriers to prevent excess weight gain among children in the first place.

Several agencies, organizations and foundations are committed to improving the health of children by reducing and preventing excess weight gain. For example, the national Let's Move campaign helps local community leaders create environments that make the healthy choice the easy choice for children. There are also several local resources available to health care providers and families to help reverse and prevent excess weight gain among childhood (See Box 1). Additionally, innovative research is being conducted at the Norris Cotton Cancer Center and the Geisel School of Medicine at Dartmouth to better understand risk factors for excess weight gain among children, including novel research approaches to understand how exposure to food marketing may impact a child's dietary preferences and behaviors.

Excess weight gain during childhood threatens one's quality of life and relates to a reduced lifespan. Preventing and reversing excess weight gain among children is a difficult undertaking yet is vitally important. Prevention programs need support across multiple disciplines, including cancer prevention, to improve the lifelong health of our children.

### BOX 1

Foundation for Healthy Communities supports many initiatives to prevent and reverse childhood obesity, including the Healthy Eating Active Living (HEAL) initiative. <http://www.healthynh.org>

Health Connections of the Upper Valley conducts many regional programs to encourage healthy living, including programs to increase nutritional knowledge among children and their families. <http://www.myhealthconnections.org>

Vital Communities is an organization that services the Upper Valley area and is dedicated to promoting healthy living among residents. <http://www.vitalcommunities.org>

The Pediatric Lipid and Weight Management Center at the Children's Hospital at Dartmouth-Hitchcock is a program to help children and families dealing with childhood obesity. Children who are obese (at or above a 95th percentile for BMI) with one obesity-related comorbidity are eligible for treatment. The clinic has offices in Bedford, NH (603-695-2790) and Lebanon, NH (603-653-9666).

A more detailed listing of national, statewide and local resources is available on the Child Care Aware of New Hampshire website: <http://nh.childcareaware.org/community/community-resources>

### KEY POINTS

- Obesity is related to an increased risk of many cancers.
- Excess weight may influence cancer risk by altering normal concentrations of sex-hormones such as estrogen, growth hormones including insulin and IGF1, and adiponectins in the blood.
- Children who are overweight are likely to remain overweight throughout life, resulting in an increased future risk of certain cancers.
- Research is needed to understand how excess weight during youth may impact future cancer risk independently of weight status as an adult.
- Primary cancer prevention efforts must include programs to prevent and reverse childhood overweight and obesity.

### References:

1. Calle EE, Rodriguez C, Walker-Thurmond K, Thun MJ. Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. *New Engl J Med.* 2003;348:1625-1638.
2. Polednak AP. Estimating the number of U.S. incident cancers attributable to obesity and the impact on temporal trends in incidence rates for obesity-related cancers. *Cancer Detect Prev.* 2008;32:190-199.
3. Jung UJ, Choi MS. Obesity and its metabolic complications: the role of adipokines and the relationship between obesity, inflammation, insulin resistance, dyslipidemia and nonalcoholic fatty liver disease. *Int J Mol Sci.* 2014;15:6184-6223.
4. Vucenik I, Stains JP. Obesity and cancer risk: evidence, mechanisms, and recommendations. *Ann NY Acad Sci.* 2012;1271:37-43.
5. Singh AS, Mulder C, Twisk JW, van Mechelen W, Chinapaw MJ. Tracking of childhood overweight into adulthood: a systematic review of the literature. *Obes Rev.* 2008;9:474-488.
6. Xu WH, Xiang YB, Zheng W, et al. Weight history and risk of endometrial cancer among Chinese women. *Int J Epidemiol.* 2006;35:159-166.
7. Weiderpass E, Persson I, Adami HO, Magnusson C, Lindgren A, Baron JA. Body size in different periods of life, diabetes mellitus, hypertension, and risk of postmenopausal endometrial cancer (Sweden). *Cancer Causes Control.* 2000;11:185-92.
8. Fairfield KM, Willett WC, Rosner BA, Manson JE, Speizer FE, Hankinson SE. Obesity, weight gain, and ovarian cancer. *Obstet Gynecol.* 2002;100:288-296.
9. Botha S, Fentonmiller K, Jennings C, et al. A review of food marketing to children and adolescents. In: Commission FT, ed. Washington DC: Federal Trade Commission; 2012:356.