Connecting Links for Reducing Risks: Understanding the impact of obesity on cancer development

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Objectives

1) Identify factors that contribute to the financial burden of cancer in the US
2) Recognize the pathological impact of obesity on malignancy development
3) Describe cancer treatment challenges related to obesity
The Landscape

- Aging population
- Rising demand
- Continued inequities
- Treatment advances in cancer care
- Emerging public health concerns
  - Obesity
  - Electronic cigarettes
Behavioral Modifications

- High body mass index
- Dietary Intake
- Physical activity
- Tobacco use
- Alcohol use

Approximately 1/3 of Cancer Development is Attributed to Behavioral Risks
Cost of Cancer Care

- United States
- Globally
THE FOLLOWING SLIDES ARE FROM THE AMERICAN CANCER SOCIETY CANCER FACTS AND FIGURES 2017

## Estimated New Cancer Cases* in the US in 2017

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>Males 836,150</th>
<th>Females 852,630</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate</td>
<td>19%</td>
<td>30%</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>14%</td>
<td>12%</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>9%</td>
<td>8%</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>Melanoma of skin</td>
<td>6%</td>
<td>4%</td>
</tr>
<tr>
<td>Kidney &amp; renal pelvis</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Leukemia</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Oral cavity &amp; pharynx</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Liver &amp; intrahepatic bile duct</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>All other sites</td>
<td>23%</td>
<td>22%</td>
</tr>
</tbody>
</table>

*Includes basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder.
<table>
<thead>
<tr>
<th>Site</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites*</td>
<td>1 in 2</td>
</tr>
<tr>
<td>Prostate</td>
<td>1 in 8</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>1 in 14</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>1 in 22</td>
</tr>
<tr>
<td>Urinary bladder†</td>
<td>1 in 26</td>
</tr>
<tr>
<td>Melanoma of the skin†</td>
<td>1 in 28</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>1 in 42</td>
</tr>
<tr>
<td>Kidney &amp; renal pelvis</td>
<td>1 in 48</td>
</tr>
<tr>
<td>Leukemia</td>
<td>1 in 57</td>
</tr>
<tr>
<td>Oral cavity &amp; pharynx</td>
<td>1 in 63</td>
</tr>
<tr>
<td>Pancreas</td>
<td>1 in 64</td>
</tr>
</tbody>
</table>

*All sites exclude basal cell and squamous cell skin cancers and in situ cancers except urinary bladder. †Includes invasive and in situ cancer cases. ‡Statistic for non-Hispanic whites.

Source: DerCan: Probability of Developing or Dying of Cancer Software, Version 6.7.4 Statistical Research and Applications Branch, National Cancer Institute, 2015.
## The Lifetime Probability of Developing Cancer for Females, 2011-2013

<table>
<thead>
<tr>
<th>Site</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites*</td>
<td>1 in 3</td>
</tr>
<tr>
<td>Breast</td>
<td>1 in 8</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>1 in 17</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>1 in 24</td>
</tr>
<tr>
<td>Uterine corpus</td>
<td>1 in 36</td>
</tr>
<tr>
<td>Melanoma of the skin†</td>
<td>1 in 44</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>1 in 54</td>
</tr>
<tr>
<td>Thyroid</td>
<td>1 in 57</td>
</tr>
<tr>
<td>Pancreas</td>
<td>1 in 66</td>
</tr>
<tr>
<td>Ovary</td>
<td>1 in 78</td>
</tr>
<tr>
<td>Leukemia</td>
<td>1 in 81</td>
</tr>
</tbody>
</table>

*All sites exclude basal cell and squamous cell skin cancers and in situ cancers except urinary bladder. †Statistic for non-Hispanic whites.

Trends in Overweight* Prevalence (%), Adults 18 and Older, US, 1992-2010

*Body mass index ≥ 25.0 kg/m². Source: Behavioral Risk Factor Surveillance System, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention.
Global Burden

- Estimated 640 million adults in 2014 (6-fold increase from 1975)
- Estimated 110 million children and adolescents were obese in 2013 (2-fold increase from 1980)

Prevalence:
Men 10.8%; Women 14.9%; Children 5%
World Health Organization (WHO)  
Definition of *Overweight & Obesity*

- BMI greater than or equal to 25 kg/m$^2$ is defined as **overweight** (25.0-29.9)
- BMI greater than or equal to 30 kg/m$^2$ is defined as **obesity** *(Class 1 30.0-34.9; Class 2 35.0-39.9; Class 3 >40.0)*

BMI provides the most useful population-level measure of overweight and obesity as it can be used with the same cut-off points for adults of both sexes and all ages. *However, it should be considered an approximate guide*  

# Obesity & Cancer Link

## Well-known link to:
1. Colo/rectal  
2. Esophageal  
3. Renal  
4. Breast  
5. Endometrial

## Recent links to:
6. Gastric  
7. Liver  
8. Gallbladder  
9. Pancreas  
10. Ovary  
11. Thyroid  
12. Meningioma  
13. Multiple Myeloma
Obesity, Cancer & Patient Care Considerations

- Development of cancer
- Recurrence and poorer survival (increased mortality; poorer quality of life - physical functioning; and inadequate response to cancer treatment)
- Therapeutic dosing of chemotherapy
- Management of toxicities
Obesity & Cancer: The Link

The hormone insulin-like growth factor (IGF-1) stimulates cell growth in obese people at possibly twice the rate of normal-weight people. Promotion tumor growth.
Obesity & Cancer: The Link

- People who are obese have higher amounts of the hormone leptin.
- Which appears to promote cell proliferation...
- Less of the hormone adiponectin - which may prevent cell growth.
Obesity & Cancer: The Link

Fat tissue produces high levels of the hormone estrogen, which has been associated with the risk of breast and uterine cancers.

Endogenous and exogenous hormones drive cell proliferation, and thus the opportunity for the accumulation of random genetic errors.

Hormone-related cancers:
- Breast
- Endometrium
- Ovary
- Prostate
- Testis
- Thyroid
- Osteosarcoma
Obesity & Cancer: The Link

Fat cells may affect other tumor growth regulators

i.e., mammalian target of rapamycin (mTOR) and AMP-activated protein kinase
Obesity & Cancer: The Link

People who are obese often have chronic low-level inflammation

Associated with increased cancer risk
Obesity & Cancer: The Link

GI microbes that live in obese people

Activates bacteria

Leads to tumor growth
Cancer

IGF-1

Growth Regulators

Leptin

Inflammation

Estrogen

Microbes
American Cancer Society Recommendations for Individual Choices

- Achieve and maintain a healthy weight throughout life
- Be as lean as possible throughout life without being underweight
- Avoid excess weight gain at all ages. For those who are overweight or obese, losing even a small amount of weight has health benefits and is a good place to start
- Get regular physical activity and limit intake of high-calorie foods and drinks as keys to help maintain a healthy weight
- Be physically active
American Cancer Society Recommendations for Community Action

Public, private, and community organizations should work together at national, state, and local levels to apply policy and environmental changes that result in the following:

1) Increase access to affordable, healthy foods in communities, places of work, and schools, and decrease access to and marketing of foods and drinks of low nutritional value, particularly to youth

2) Provide safe, enjoyable, and accessible environments for physical activity in schools and workplaces, and for transportation and recreation in communities


