Cancer – Magnitude of the Problem

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Roswell Park Cancer Institute
Malignant Progression of Human Cancer

Genetic Alteration
Environmental Exposure

Normal Tissue → Premalignant Lesions → Primary Tumor → Metastasis

- Normal Cell
- Premalignant Cell
- Malignant Cell without Metastatic Ability
- Malignant Cell with Metastatic Ability
Malignant Progression of Human Cancer

- Genetic Alteration
- Environmental Exposure
- Genetic Alteration

Normal Tissue → Premalignant Lesions → Primary Tumor → Metastasis

- Normal Cell
- Premalignant Cell
- Malignant Cell without Metastatic Ability
- Malignant Cell with Metastatic Ability
Cancer – Magnitude of the Problem

- Cancer Incidence
- Cancer Mortality
- Geographic Variation
- Racial Variation
- Risk Factors
- Screening
Cancer Incidence

- The number of newly diagnosed cases for a specific cancer or for all cancers combined during a specific time period
Cancer Prevalence

• The number of current cases for a specific cancer or for all cancers combined during a specific time period
Surveillance, Epidemiology, and End Results (SEER) Program
Estimated New Cancer Cases* in the US in 2013

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate</td>
<td>28%</td>
<td>29%</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>14%</td>
<td>14%</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>Melanoma of skin</td>
<td>5%</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>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Oral cavity</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Leukemia</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Pancreas</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>All Other Sites</td>
<td>20%</td>
<td>19%</td>
</tr>
</tbody>
</table>

*Excludes basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder.
Cancer Incidence Rates* by Sex, US, 1975-2009

*Age-adjusted to the 2000 US standard population and adjusted for delays in reporting.
Source: Surveillance, Epidemiology, and End Results Program, Delay-adjusted Incidence database:

*Age-adjusted to the 2000 US standard population and adjusted for delays in reporting.

*Age-adjusted to the 2000 US standard population and adjusted for delays in reporting.
The Lifetime Probability of Developing Cancer for Men, 2007-2009*

<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 6</td>
</tr>
<tr>
<td>Lung and bronchus</td>
<td>1 in 13</td>
</tr>
<tr>
<td>Colon and rectum</td>
<td>1 in 19</td>
</tr>
<tr>
<td>Urinary bladder‡</td>
<td>1 in 26</td>
</tr>
<tr>
<td>Melanoma§</td>
<td>1 in 35</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>1 in 43</td>
</tr>
<tr>
<td>Kidney</td>
<td>1 in 49</td>
</tr>
<tr>
<td>Leukemia</td>
<td>1 in 63</td>
</tr>
<tr>
<td>Oral Cavity</td>
<td>1 in 66</td>
</tr>
<tr>
<td>Stomach</td>
<td>1 in 92</td>
</tr>
</tbody>
</table>

* For those free of cancer at beginning of age interval.
† All sites exclude basal and squamous cell skin cancers and in situ cancers except urinary bladder.
‡ Includes invasive and in situ cancer cases
§ Statistic for white men.

The Lifetime Probability of Developing Cancer for Women, 2007-2009*

<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 16</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>1 in 21</td>
</tr>
<tr>
<td>Uterine corpus</td>
<td>1 in 38</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>1 in 52</td>
</tr>
<tr>
<td>Urinary bladder‡</td>
<td>1 in 87</td>
</tr>
<tr>
<td>Melanoma§</td>
<td>1 in 54</td>
</tr>
<tr>
<td>Ovary</td>
<td>1 in 72</td>
</tr>
<tr>
<td>Pancreas</td>
<td>1 in 69</td>
</tr>
<tr>
<td>Uterine cervix</td>
<td>1 in 147</td>
</tr>
</tbody>
</table>

* For those free of cancer at beginning of age interval.
† All sites exclude basal and squamous cell skin cancers and in situ cancers except urinary bladder.
‡ Includes invasive and in situ cancer cases
§ Statistic for white women.
Cancer Incidence & Death Rates* in Children 0-14 Years, 1975-2004

Rate Per 100,000

Incidence

Mortality

*Age-adjusted to the 2000 Standard population.
Cancer Incidence Rates Among Children, 2005-2009

All ICCC groups (excludes benign brain) 15.5 17.2
All ICCC groups (includes benign brain) 16.6 18.6
Leukemia 4.7 5.2
Brain & CNS* 4.3 4.2
Hodgkin lymphoma 0.6 1.3
Soft tissue sarcoma 1.2 1.1
Bone tumors 0.9 0.7
Non-Hodgkin lymphoma 0.9 0.6
Neuroblastoma† 0.8 1.0
Gonadal germ cell tumors 0.8 0.3
Wilms tumor (nephroblastoma) 0.6 0.8

ICCC=International Classification of Childhood Cancer
*CNS=central nervous system; includes benign brain and CNS tumors
†Includes other peripheral nervous system tumors
### US Mortality, 2005

<table>
<thead>
<tr>
<th>Rank</th>
<th>Cause of Death</th>
<th>No. of deaths</th>
<th>% of all deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Heart Diseases</td>
<td>652,091</td>
<td>26.6</td>
</tr>
<tr>
<td>2.</td>
<td>Cancer</td>
<td>559,312</td>
<td>22.8</td>
</tr>
<tr>
<td>3.</td>
<td>Cerebrovascular diseases</td>
<td>143,579</td>
<td>5.9</td>
</tr>
<tr>
<td>4.</td>
<td>Chronic lower respiratory diseases</td>
<td>130,933</td>
<td>5.3</td>
</tr>
<tr>
<td>5.</td>
<td>Accidents (unintentional injuries)</td>
<td>117,809</td>
<td>4.8</td>
</tr>
<tr>
<td>6.</td>
<td>Diabetes mellitus</td>
<td>75,119</td>
<td>3.1</td>
</tr>
<tr>
<td>7.</td>
<td>Alzheimer disease</td>
<td>71,599</td>
<td>2.9</td>
</tr>
<tr>
<td>8.</td>
<td>Influenza &amp; pneumonia</td>
<td>63,001</td>
<td>2.6</td>
</tr>
<tr>
<td>9.</td>
<td>Nephritis*</td>
<td>43,901</td>
<td>1.8</td>
</tr>
<tr>
<td>10.</td>
<td>Septicemia</td>
<td>34,136</td>
<td>1.4</td>
</tr>
</tbody>
</table>

*Includes nephrotic syndrome and nephrosis.

Cancer Mortality

- The number of deaths for a specific cancer or for all cancers combined during a specific time period
Incidence, Prevalence, or Mortality

- Assessment of NHL rates in Erie county from 1990 to 2010
- Evaluation of need for NHL oncologists in Erie county
- Epidemiological study of diet and NHL in Erie county
- Assessment of effectiveness of a new treatment for NHL
Change in the US Death Rates* by Cause, 1950 & 2005

* Age-adjusted to 2000 US standard population.
Sources: 1950 Mortality Data - CDC/NCHS, NVSS, Mortality Revised.
Estimated Cancer Deaths in the US in 2013

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung &amp; bronchus</td>
<td>306,920</td>
<td>273,430</td>
</tr>
<tr>
<td>Prostate</td>
<td>10%</td>
<td>14%</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Pancreas</td>
<td>6%</td>
<td>7%</td>
</tr>
<tr>
<td>Liver &amp; intrahepatic bile duct</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Leukemia</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Esophagus</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Kidney &amp; renal pelvis</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>All other sites</td>
<td>24%</td>
<td>25%</td>
</tr>
</tbody>
</table>
Cancer Death Rates* by Sex, US, 1975-2009

*Age-adjusted to the 2000 US standard population.
Cancer Death Rates* Among Men, US, 1930-2009

*Age-adjusted to the 2000 US standard population.
Cancer Death Rates* Among Women, US, 1930-2009

*Age-adjusted to the 2000 US standard population.
Total Number of Cancer Deaths Averted from 1991 to 2009 in Men and 1992 to 2009 in Women

The blue line represents the actual number of cancer deaths recorded in each year, and the red line represents the number of cancer deaths that would have been expected if cancer death rates had remained at their peak.
Trends in Five-year Relative Cancer Survival Rates (%), 1975-2008

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites</td>
<td>49</td>
<td>56</td>
<td>68</td>
</tr>
<tr>
<td>Breast (female)</td>
<td>75</td>
<td>84</td>
<td>90</td>
</tr>
<tr>
<td>Colon</td>
<td>51</td>
<td>61</td>
<td>65</td>
</tr>
<tr>
<td>Leukemia</td>
<td>34</td>
<td>43</td>
<td>58</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>12</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>Melanoma</td>
<td>82</td>
<td>88</td>
<td>93</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>47</td>
<td>51</td>
<td>71</td>
</tr>
<tr>
<td>Ovary</td>
<td>36</td>
<td>38</td>
<td>43</td>
</tr>
<tr>
<td>Pancreas</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Prostate</td>
<td>68</td>
<td>83</td>
<td>100</td>
</tr>
<tr>
<td>Rectum</td>
<td>48</td>
<td>58</td>
<td>68</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>73</td>
<td>79</td>
<td>80</td>
</tr>
</tbody>
</table>

5-year relative survival rates based on patients diagnosed from 2002 to 2008, all followed through 2009.
Cancer Incidence and Death Rates* in Children 0-19 Years, 1975-2009

*Age-adjusted to the 2000 Standard population.

### Cancer Death Rates* in Children, 2005-2009

<table>
<thead>
<tr>
<th>Site</th>
<th>0-14 years</th>
<th>0-19 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites</td>
<td>2.2</td>
<td>2.5</td>
</tr>
<tr>
<td>Leukemia</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Acute Lymphocytic</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Brain/ONS†</td>
<td>0.7</td>
<td>0.6</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Soft tissue</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Bone and Joint</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Kidney and Renal pelvis</td>
<td>0.1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

*Per 100,000, age-adjusted to the 2000 US standard population.
†Excludes benign brain tumors; ONS = other nervous system
Trends in 5-year Relative Survival Rates for Childhood Cancer, Ages 0-14 yrs, 1975-2008

<table>
<thead>
<tr>
<th>Year of Diagnosis</th>
<th>All sites</th>
<th>Leukemia</th>
<th>Brain/ONS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975 - 1977</td>
<td>58</td>
<td>50</td>
<td>57</td>
</tr>
<tr>
<td>2002 - 2008</td>
<td>83</td>
<td>87</td>
<td>75</td>
</tr>
</tbody>
</table>

Based on follow up of patients through 2009.
*Excludes benign brain tumors; ONS=other nervous system.
Trends in 5-year Relative Survival Rates for Childhood Cancer, Ages 0-19 yrs, 1975-2008

<table>
<thead>
<tr>
<th>Year of Diagnosis</th>
<th>All sites*</th>
<th>Leukemia</th>
<th>Non-Hodgkin lymphoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975 - 1977</td>
<td>62</td>
<td>46</td>
<td>45</td>
</tr>
<tr>
<td>2002 - 2008</td>
<td>83</td>
<td>84</td>
<td>84</td>
</tr>
</tbody>
</table>

Based on follow up of patients through 2009.
*Excludes benign brain tumors.
Geographic Variation
Estimated Numbers of New Cases and Deaths – by Sex and Site - 2000

Estimated Numbers of New Cases of the 12 Most Common Cancers in Developed and Developing Countries – Males - 2000

Estimated Numbers of New Cases of the 12 Most Common Cancers in Developed and Developing Countries – Females - 2000

Geographic Variation

Exposure to Carcinogens
Incidence of Lung Cancer:
Age-Standardized Rates Males -2000

Incidence of Lung Cancer: Age-Standardized Rates Females - 2000

Cancer Mortality Rates by County (Age-adjusted 1970 US Population)
Lung, Trachea, Bronchus, and Pleura: White Males, 1970-94

US = 69.40/100,000

- 91.04-150.47 (highest 10%)
- 83.81- 91.03
- 78.16- 83.80
- 73.80- 78.15
- 69.41- 73.79
- 65.15- 69.40
- 60.75- 65.14
- 54.51- 60.74
- 46.12- 54.50
- 13.17- 46.11 (lowest 10%)
- Sparse data (43 counties: 0.01% of deaths)
Incidence of Liver Cancer: Age-Standardized Rates - 2000


Prevalence of Hepatitis B Virus Surface Antigen Carriers
Geographic Variation

Lifestyle Factors
Incidence of Breast Cancer: Age-Standardized Rates - 2000

Cancer Mortality Rates by County (Age-adjusted 1970 US Population)

US = 26.89/100,000

29.33-50.75 (highest 10%)
27.50-29.32
26.18-27.49
24.91-26.17
23.80-24.90
22.75-23.79
21.56-22.74
20.08-21.55
17.98-20.07
8.57-17.97 (lowest 10%)
Sparse data (151 counties; 0.11% of deaths)
Incidence of Colorectal Cancer: Age-Standardized Rates - 2000

Relative risk of mortality from cancer of the stomach, liver, and colon among Japanese men in Japan, Japanese men in California, and sons of Japanese immigrants compared with white men in California.
Geographic Variation

Screening
Incidence of Cervical Cancer: Age-Standardized Rates - 2000

Racial Variation
Cancer Incidence Rates* by Race and Ethnicity, 2000-2004

*Age-adjusted to the 2000 US standard population.
†Person of Hispanic origin may be of any race.
Cancer Incidence Rates* by Sex and Race, US, 1975-2004

*Age-adjusted to the 2000 US standard population.
Cancer Death Rates* by Race and Ethnicity, US, 2000-2004

*Per 100,000, age-adjusted to the 2000 US standard population.
† Persons of Hispanic origin may be of any race.
Cancer Death Rates* by Sex and Race, US, 1975-2004

Rate Per 100,000

African American men

White men

African American women

White women

*Age-adjusted to the 2000 US standard population.
## Cancer Sites in Men for Which African American Death Rates* Exceed White Death Rates*, US, 2000-2004

<table>
<thead>
<tr>
<th>Site</th>
<th>African American</th>
<th>White</th>
<th>Ratio of African American/White</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites</td>
<td>321.8</td>
<td>234.7</td>
<td>1.4</td>
</tr>
<tr>
<td>Prostate</td>
<td>62.3</td>
<td>25.6</td>
<td>2.4</td>
</tr>
<tr>
<td>Larynx</td>
<td>5.0</td>
<td>2.2</td>
<td>2.3</td>
</tr>
<tr>
<td>Stomach</td>
<td>11.9</td>
<td>5.2</td>
<td>2.3</td>
</tr>
<tr>
<td>Myeloma</td>
<td>8.5</td>
<td>4.4</td>
<td>1.9</td>
</tr>
<tr>
<td>Oral cavity and pharynx</td>
<td>6.8</td>
<td>3.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Small intestine</td>
<td>0.7</td>
<td>0.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Liver and intrahepatic bile duct</td>
<td>10.0</td>
<td>6.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Colon and rectum</td>
<td>32.7</td>
<td>22.9</td>
<td>1.4</td>
</tr>
<tr>
<td>Esophagus</td>
<td>10.2</td>
<td>7.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Lung and bronchus</td>
<td>95.8</td>
<td>72.6</td>
<td>1.3</td>
</tr>
<tr>
<td>Pancreas</td>
<td>15.5</td>
<td>12.0</td>
<td>1.3</td>
</tr>
</tbody>
</table>

*Per 100,000, age-adjusted to the 2000 US standard population.
# Cancer Sites in Women for Which African American Death Rates* Exceed White Death Rates*, US, 2000-2004

*Per 100,000, age-adjusted to the 2000 US standard population.


<table>
<thead>
<tr>
<th>Site</th>
<th>African American</th>
<th>White</th>
<th>Ratio of African American/White</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites</td>
<td>189.3</td>
<td>161.4</td>
<td>1.2</td>
</tr>
<tr>
<td>Myeloma</td>
<td>6.3</td>
<td>2.8</td>
<td>2.3</td>
</tr>
<tr>
<td>Stomach</td>
<td>5.8</td>
<td>2.6</td>
<td>2.2</td>
</tr>
<tr>
<td>Uterine cervix</td>
<td>4.9</td>
<td>2.3</td>
<td>2.1</td>
</tr>
<tr>
<td>Esophagus</td>
<td>3.0</td>
<td>1.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Uterine corpus</td>
<td>7.1</td>
<td>3.9</td>
<td>1.8</td>
</tr>
<tr>
<td>Small intestine</td>
<td>0.5</td>
<td>0.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Pancreas</td>
<td>12.4</td>
<td>9.0</td>
<td>1.4</td>
</tr>
<tr>
<td>Colon and rectum</td>
<td>22.9</td>
<td>15.9</td>
<td>1.4</td>
</tr>
<tr>
<td>Liver and intrahepatic bile duct</td>
<td>3.9</td>
<td>2.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Breast</td>
<td>33.8</td>
<td>25.0</td>
<td>1.4</td>
</tr>
</tbody>
</table>
Study Designs in Cancer Epidemiology

Exposure → Disease
Cross-Sectional Study

Exposure ← Disease
Case-Control Study (Retrospective)

Exposure → Disease
Cohort Study (Prospective)
Risk Factors

Un-modifiable
Age and Disease

- # 1 risk factor for most diseases, including cancer
  - chronic exposure to etiologic agent
  - exposure to multiple etiologic agents
  - latent period
  - decreased immune function
  - increased comorbidity
Age and Cancer Incidence

![Graph showing the relationship between age and cancer incidence. The graph indicates a steady increase in cancer incidence with age, peaking at around age 80.](image-url)
Projections of Cancer Cases between 2000 and 2050

Source: SEER program, NCI and US Census Bureau
Risk Factors – Un-modifiable

• Family history of cancer
• Reproductive factors
• Physical / ethnic characteristics
• Residential or occupational characteristics
Risk Factors – Un-modifiable

• Family history of cancer
  – Colon cancer
    • Adenomous polyposis coli (APC), hereditary non-polyposis colon cancer (HNPCC)
  – Breast cancer
    • BRCA1, BRCA2, ATM
  – Ovarian cancer
    • BRCA1, BRCA2
  – Prostate Cancer
Risk Factors – Un-modifiable

- Reproductive factors
  - Breast cancer
    - Age at menarche, age at menopause, age at first birth, parity, breastfeeding
  - Ovarian cancer
    - Parity, breast feeding
  - Endometrial cancer
    - Age at menopause, infertility, breast feeding
Risk Factors – Un-modifiable

• Physical / ethnic characteristics
  – Melanoma
    • Skin type, eye color
  – Breast and ovarian cancer
    • Ashkenazi Jewish ethnicity
  – Prostate cancer
    • African-American ethnicity
Risk Factors – Un-modifiable

- Residential or occupational characteristics
  - Leukemia, thyroid cancer, breast cancer, lung cancer
    - Radiation exposure
  - Bladder cancer
    - Dye workers (Benzidine)
  - Lung cancer
    - Asbestos workers
  - Liver cancer
    - Vinyl chloride manufacture
Risk Factors

Modifiable
Tobacco Use

- Major preventable cause of disease and premature death in the United States
- Increased risk for cancer of the lung, mouth, larynx, pharynx, esophagus, pancreas, kidney, bladder, and uterine cervix
- 30% of all cancer deaths and 87% of lung cancer deaths can be attributed to tobacco
- American Cancer Society estimates that, in 2003, 170,000 cancer deaths will be attributable to tobacco use
  - 154,900 of these from lung cancer
Tobacco Use in the US, 1900-2004

*Age-adjusted to 2000 US standard population.
Trends in Cigarette Smoking, Adults 18 and Older, US, 1965-2011


*Smoked cigarettes on one or more of the 30 days preceding the survey. Whites and African Americans are non-Hispanic.

Source: Youth Risk Behavior Surveillance System, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 2012.

*Smoked cigarettes on one or more of the 30 days preceding the survey. Whites and African Americans are non-Hispanic.

Source: Youth Risk Behavior Surveillance System, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 2012.
• Eat a variety of healthful foods, with an emphasis on plant sources
  – Eat five or more servings of vegetables and fruit each day
  – Choose whole grains in preference to processed (refined) grains and sugars
  – Limit consumption of red meats, especially high-fat and processed meats
  – Choose foods that help maintain a healthful weight
Trends in Consumption of Five or More Recommended Vegetable and Fruit Servings for Cancer Prevention, Adults 18 and Older, US, 1994-2005

Note: Data from participating states and the District of Columbia were aggregated to represent the United States.
American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention

• Adopt a physically active lifestyle

  – Engage in at least moderate activity for 30 minutes or more on 5 or more days of the week

  – 45 minutes or more of moderate to vigorous activity on 5 or more days per week may further enhance reductions in the risk of breast and colon cancer
Trends in Prevalence (%) of No Leisure-Time Physical Activity, by Educational Attainment, Adults 18 and Older, US, 1992-2006

Note: Data from participating states and the District of Columbia were aggregated to represent the United States. Educational attainment is for adults 25 and older.


American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention

- Maintain a healthful weight throughout life
  - Balance caloric intake with physical activity
  - Lose weight if currently overweight or obese
## Obesity Definition

<table>
<thead>
<tr>
<th>Category</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>BMI &lt;18.5</td>
</tr>
<tr>
<td>Normal weight</td>
<td>BMI 18.5 - 24.9</td>
</tr>
<tr>
<td>Overweight</td>
<td>BMI 25.0 – 29.9</td>
</tr>
<tr>
<td>Obese class I</td>
<td>BMI 30.0 – 34.9</td>
</tr>
<tr>
<td>Obese class II</td>
<td>BMI 35.0 – 39.9</td>
</tr>
<tr>
<td>Obese class III</td>
<td>BMI &gt;40</td>
</tr>
</tbody>
</table>

Obesity Trends* Among U.S. Adults
(*BMI ≥30, or about 30 lbs. overweight for 5’4” person)
Trends in Obesity* Prevalence, Adults Aged 20 to 74, US, 1960-2010

*Obesity=body mass index ≥ 30 kg/m²; estimates are age adjusted to the 2000 US standard population. Source: National Health and Nutrition Examination Survey, National Center for Health Statistics, Centers for Disease Control and Prevention.

Overweight is defined as at or above the 95th percentile for body mass index by age and sex based on reference data.

Secular Changes in Environment

- Food eaten outside of home
- Food availability
- Portion size shifts
- Food marketing
- Transportation
- Neighborhood safety
- City planning
- TV, video, computer work
- Economy and employment shifts
Verboten

Forced Upon

- Chocolate cookies
- Watching TV
- Broccoli
- Running and cycling
Health Consequences

- Overweight & Obesity is associated with:
  - Heart disease & cerebrovascular accidents
  - Type 2 Diabetes
  - Gallstones or gallbladder disease
  - Osteoarthritis
  - Gout
  - Sleep apnea
  - Hypertension
  - Hyperlipidemia
  - Pregnancy complications
  - Irregular menses

JADA 104(6): 984-1001, 2004
Overweight, Obesity, and Mortality from Cancer in a Prospectively Studied Cohort of U.S. Adults

Eugenia E. Calle, Ph.D., Carmen Rodriguez, M.D., M.P.H., Kimberly Walker-Thurmond, B.A., and Michael J. Thun, M.D.

Body-mass index associated with higher rates of death due to cancer of the esophagus, colon and rectum, liver, gallbladder, pancreas, and kidney, non-Hodgkin’s lymphoma, multiple myeloma, stomach, prostate, breast, uterus, cervix, and ovary.

Current patterns of overweight and obesity in the United States could account for 14 percent of all deaths from cancer in men and 20 percent of those in women.
Screening
Malignant Progression of Human Cancer

Genetic Alteration
Environmental Exposure

Normal Tissue → Premalignant Lesions → Genetic Alteration → Primary Tumor → Genetic Alteration → Metastasis

- Normal Cell
- Premalignant Cell
- Malignant Cell without Metastatic Ability
- Malignant Cell with Metastatic Ability
Screening Guidelines for the Early Detection of Breast Cancer, American Cancer Society

- Yearly mammograms are recommended starting at age 40.

- A clinical breast exam should be part of a periodic health exam, about every 3 years for women in their 20s and 30s, and every year for women 40 and older.

- Women should know how their breasts normally feel and report any breast changes promptly to their health care providers. Breast self-exam is an option for women starting in their 20s.

- Screening MRI is recommended for women with an approximately 20%-25% or greater lifetime risk of breast cancer, including women with a strong family history of breast or ovarian cancer and women who were treated for Hodgkin disease.

* A mammogram within the past year. Note: Data from participating states and the District of Columbia were aggregated to represent the United States.

Screening Guidelines for the Early Detection of Cervical Cancer, American Cancer Society

- Screening should begin approximately three years after a woman begins having vaginal intercourse, but no later than 21 years of age.

- Screening should be done every year with regular Pap tests or every two years using liquid-based tests.

- At or after age 30, women who have had three normal test results in a row may get screened every 2-3 years. However, doctors may suggest a woman get screened more frequently if she has certain risk factors, such as HIV infection or a weakened immune system.

- Women 70 and older who have had three or more consecutive Pap tests in the last ten years may choose to stop cervical cancer screening.

- Screening after a total hysterectomy (with removal of the cervix) is not necessary unless the surgery was done as a treatment for cervical cancer.
Trends in Recent* Pap Test Prevalence (%), by Educational Attainment and Health Insurance Status, Women 18 and Older, US, 1992-2006

Beginning at age 50, men and women should follow one of the following examination schedules:

- A flexible sigmoidoscopy (FSIG) every five years
- A colonoscopy every ten years
- A double-contrast barium enema every five years
- A Computerized Tomographic (CT) colonography every five years
- A guaiac-based fecal occult blood test (FOBT) or a fecal immunochemical test (FIT) every year
- A stool DNA test (interval uncertain)

People who are at moderate or high risk for colorectal cancer should talk with a doctor about a different testing schedule.
Trends in Recent* Fecal Occult Blood Test Prevalence (%), by Educational Attainment and Health Insurance Status, Adults 50 Years and Older, US, 1997-2006

*A fecal occult blood test within the past year. Note: Data from participating states and the District of Columbia were aggregated to represent the United States.

Trends in Recent* Flexible Sigmoidoscopy or Colonoscopy Prevalence (%), by Educational Attainment and Health Insurance Status, Adults 50 Years and Older, US, 1997-2006

*A flexible sigmoidoscopy or colonoscopy within the past ten years. Note: Data from participating states and the District of Columbia were aggregated to represent the United States.

Screening Guidelines for the Early Detection of Prostate Cancer, American Cancer Society

• The prostate-specific antigen (PSA) test and the digital rectal examination (DRE) should be offered annually, beginning at age 50, to men who have a life expectancy of at least 10 years.

• Men at high risk (African-American men and men with a strong family history of one or more first-degree relatives diagnosed with prostate cancer at an early age) should begin testing at age 45.

• For men at average risk and high risk, information should be provided about what is known and what is uncertain about the benefits and limitations of early detection and treatment of prostate cancer so that they can make an informed decision about testing.
Recent* Prostate-Specific Antigen (PSA) Test Prevalence (%), by Educational Attainment and Health Insurance Status, Men 50 Years and Older, US, 2001-2006

*A prostate-specific antigen (PSA) test within the past year. Note: Data from participating states and the District of Columbia were aggregated to represent the United States.

Recent* Digital Rectal Examination (DRE) Prevalence (%), by Educational Attainment and Health Insurance Status, Men 50 Years and Older, US, 2001-2006

* A digital rectal examination (DRE) within the past year. Note: Data from participating states and the District of Columbia were aggregated to represent the United States.

Interested?
RPN 525 Cancer Epidemiology
Spring 2009 – Monday PM

Exam?
Study your notes and hopefully you paid attention!