Chapter 15: Cancer

What is Cancer?
- Condition characterized by the uncontrolled growth of cells
- Develops from a single cell that goes awry, but a combination of events must occur before the cell turns into a tumor
- Clonal growth: replication of a single cell that produces thousands of copies of itself in an uncontrolled manner

Leading Sites of New Cancer Cases and Deaths, 2011

<table>
<thead>
<tr>
<th></th>
<th>Estimated New Cases</th>
<th>Estimated Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Prostate</td>
<td>236,595 (23%)</td>
<td>232,340 (23%)</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>110,110 (14%)</td>
<td>87,300 (13%)</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>73,680 (9%)</td>
<td>69,140 (9%)</td>
</tr>
<tr>
<td>Uterine corpus</td>
<td>54,610 (6%)</td>
<td>62,560 (6%)</td>
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<tr>
<td>Melanoma of the skin</td>
<td>49,560 (6%)</td>
<td>57,450 (6%)</td>
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<tr>
<td>Kidney &amp; renal pelvis</td>
<td>32,140 (4%)</td>
<td>32,140 (4%)</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>21,500 (4%)</td>
<td>21,500 (4%)</td>
</tr>
<tr>
<td>All sites</td>
<td>5,700 (0%)</td>
<td>5,700 (0%)</td>
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</tbody>
</table>

*Includes basal and squamous cell skin cancers and in situ carcinomas except uterine corpus.

Healthy Cell Growth
- Healthy cells have a complicated system of checks and balances that control cell growth and division
- Healthy cells divide when needed to replace cells that have died or been sloughed off
- Each time a cell divides, there is a possibility of mutation or an error in DNA replication
  - Cell are programmed to only divide a certain number of times

Healthy Cell Growth
- Because stem cells do not have predetermined number of cell divisions they pose a risk for cancer
- Stem cells are located deep within tissues and are protected from factors that increase the risk of genetic mutations (exposure to the sun, chemicals, and irritation)

Summary:
### Cancer Cell Growth
- Cancer starts from a single cell that undergoes a critical mutation caused by:
  - An error in duplication
  - Exposure to a *carcinogen* (cancer-causing substance)
  - Radiation
- **Oncogene**: gene that drives a cell to grow and divide regardless of signals from surrounding cells
- **Tumor**: a mass of extra tissues that may form into either a benign (slow growth) or *malignant* (capable of spreading to surrounding tissues) tumor
- **Metastasis**: secondary tumor that appears when cancerous cells spread to other parts of the body

### Classifying Cancers
- Cancers are classified according to the tissue in which they originate, called the *primary site*:
  - Most common sites of metastases are brain, liver, bone marrow
- Cancer still at its primary site is *localized*
- When metastasized, it is *invasive*
- Extent of metastasis determines prognosis
- Stage of the disease: how far it has spread:
  - Stage 0: cancer *in situ*
  - Stage I: small and localized
  - Stages II and III: locally advanced, may involve lymph nodes
  - Stage IV: metastasized to distant sites

### Types of Cancer
- Four broad types of cancer:
  - **Carcinomas**: arise from *epithelial tissue* (skin, lining of the intestines and body cavities, surface of body organs, outer portion of glands)
  - **Sarcomas**: arise from *connective tissue* (bone, tendon, cartilage, muscle, fat tissues)
  - **Leukemias**: cancers of the blood which originate in the bone marrow or the lymphatic system
  - **Lymphomas**: cancers that originate in lymph nodes and glands

### Risk Factors for Cancer
- Family history
  - A family history of cancer alters some cancer screening recommendations
  - Genes interact with environmental exposures and lifestyle behaviors to alter risk

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**Summary:**
Risk Factors for Cancer

● Lifestyle factors
  ○ Tobacco use
  ○ Nutrition and physical activity
  ○ Overweight and obesity
  ○ Alcohol consumption

Risk Factors for Cancer

● Social and economic factors
  ○ Social determinants of health influence risk behaviors, access to health care, and quality of health care

Risk Factors for Cancer

● Environmental factors
  ○ Sunlight and other sources of ultraviolet radiation
  ○ Other forms of radiation
  ○ Chemical and physical carcinogens
  ○ Infectious agents

Cancer Death Rates by Site

Lung Cancer

● Leading cause of cancer death in the U.S.
● Second most commonly diagnosed cancer
● Risk factors:
  ○ Use of tobacco products in any form
  ○ Exposure to carcinogenic chemicals, arsenic, radon, asbestos, radiation, air pollution, and environmental tobacco smoke

Summary:
Lung Cancer

- Symptoms:
  - Coughing
  - Blood-streaked sputum
  - Chest pain
  - Difficulty breathing
  - Recurrent lung infections
- Prevention: remove exposure to tobacco smoke or other types of smoke
- Treatment: surgery, radiation, chemotherapy; radiation and chemotherapy combination

Colon and Rectal Cancer

- Third leading cause of cancer death
- Third most commonly diagnosed cancer
- Risk factors:
  - Age
  - Genetic and dietary habits
  - Personal or family history of colon polyps, inflammatory bowel disease, colorectal cancer
  - Smoking, obesity, physical inactivity, diet high in fat or red or processed meat, diet inadequate in fruit and vegetables

Colon and Rectal Cancer

- Warning signs
  - Change in bowel movements
  - Change in stool size or shape
  - Pain in the abdomen or blood in the stool
- Early detection:
  - Rectal exams, stool test, sigmoidoscopy, colonoscopy, double-contrast barium enema, CT colonography
- Treatment
  - Surgery, radiation and/or chemotherapy

Summary:
<table>
<thead>
<tr>
<th><strong>Breast Cancer</strong></th>
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<tbody>
<tr>
<td>● Second leading cause of cancer death in women</td>
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<tr>
<td>● Risk factors:</td>
</tr>
<tr>
<td>○ Early first menstruation</td>
</tr>
<tr>
<td>○ Late onset of menopause</td>
</tr>
<tr>
<td>○ Family history</td>
</tr>
<tr>
<td>○ Older age</td>
</tr>
<tr>
<td>○ Higher socioeconomic class</td>
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<tr>
<td>○ Women with no children or having children after 30</td>
</tr>
<tr>
<td>○ Obesity after menopause</td>
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<td>○ Hormone replacement therapy use</td>
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<td>○ Drinking more than two alcoholic beverages a day</td>
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<table>
<thead>
<tr>
<th><strong>Breast Cancer</strong></th>
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<tbody>
<tr>
<td>● Prevention:</td>
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<tr>
<td>○ Diet, exercise</td>
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<tr>
<td>○ Maintaining healthy body weight</td>
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<tr>
<td>○ Pregnancy and breastfeeding decisions</td>
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<tr>
<td>● Detection:</td>
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<tr>
<td>○ Breast self-exam</td>
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<tr>
<td>○ Mammography</td>
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<tr>
<td>● Treatment:</td>
</tr>
<tr>
<td>○ Lumpectomy</td>
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<tr>
<td>○ Mastectomy</td>
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<tr>
<td>○ Radiation and/or chemotherapy treatments</td>
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<thead>
<tr>
<th><strong>Prostate Cancer</strong></th>
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<tr>
<td>● Second most common cause of cancer death in men</td>
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<tr>
<td>● Most commonly diagnosed cancer for men</td>
</tr>
<tr>
<td>● Risk factors</td>
</tr>
<tr>
<td>○ Age, family history</td>
</tr>
<tr>
<td>○ Race</td>
</tr>
<tr>
<td>○ High-fat diet</td>
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<tr>
<td>● Symptoms during the advanced stage</td>
</tr>
<tr>
<td>○ Difficulty urinating</td>
</tr>
<tr>
<td>○ Pain in the pelvic region</td>
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<tr>
<td>○ Pain with urination</td>
</tr>
<tr>
<td>○ Blood in the urine</td>
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</tbody>
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<table>
<thead>
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<th><strong>Prostate Cancer</strong></th>
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</thead>
<tbody>
<tr>
<td>● Early detection</td>
</tr>
<tr>
<td>○ Digital rectal exam</td>
</tr>
<tr>
<td>○ Prostate-specific antigen (PSA) screenings</td>
</tr>
<tr>
<td>● Treatment</td>
</tr>
<tr>
<td>○ Surgery</td>
</tr>
<tr>
<td>○ Radiation, sometimes in combination with chemotherapy</td>
</tr>
<tr>
<td>○ Hormonal medications</td>
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**Summary:**
Cervical Cancer

- **Risk factors:**
  - HPV infection, tobacco use, immunosuppression, multiple births, early sexual activity, multiple sex partners, socioeconomic status, and nutritional status
- Early detection through Pap test has significantly reduced the rates of cervical cancer and mortality
- Treatment: removal or destruction of precursor cells
  - Invasive cervical cancer treated with combination of surgery, local radiation, and chemotherapy

Uterine Cancer (Endometrial Cancer)

- **Risk factors:**
  - Exposure to estrogen: Obesity, estrogen replacement therapy without progesterone
  - Early menarche, late-onset menopause, irregular ovulation, infrequent periods
- Prevention:
  - Minimize high levels of estrogen and have regular physician care
- Treatment:
  - Hysterectomy; radiation, chemotherapy, hormonal treatment

Ovarian Cancer

- The leading gynecological cause of cancer death and the fifth overall cause of cancer death in women
- Risk factors: family history; personal history of breast, colon, or endometrial cancer
- Prevention:
  - Using oral contraception
  - Pregnancy, breastfeeding
  - Avoiding postmenopausal hormone replacement therapy
- Treatment: surgery, chemotherapy, drug therapy

Skin Cancer

- **Risk factors**
  - Cumulative sun exposure
  - Large number of moles
  - Family history
- Prevention: reduce exposure to sun
- Treatment: surgery, local removal, radiation

- Three forms of skin cancer:
  - **Basal cell carcinoma:** lesions and sores
  - **Squamous cell carcinoma:** raised bumps and sores
  - **Melanoma:** spreads quickly
Testicular Cancer
- Most common cancer for men aged 20–35
- Risk factors:
  - Family history, personal history of testicular cancer in other testicle, abnormal development of the testes, and infertility or abnormal sperm
- Detection:
  - Self-exams
  - Medical exams
- Treatment:
  - Surgery, chemotherapy, and radiation

Oral Cancer
- Cancers that develop in the mouth or the pharynx
- Risk factors:
  - Use of cigarettes, cigars, pipes, and/or smokeless tobacco
  - High levels of alcohol consumption
  - HPV
- Early signs include:
  - Persistent sore in the mouth
  - Lump or bump that won’t heal
  - Patch of white or red along the gums or cheeks
- Treatment: surgery, chemotherapy, radiation

Leukemia
- Group of cancers that originate in the bone marrow or other parts of the body where white blood cells form
- Involves the overproduction of one type of white blood cell and can lead to increased risk of infection, anemia, and bleeding
- Risk factors:
  - Cigarette smoking and exposure to chemicals
  - Ionizing radiation exposure
  - Infection with a virus
- Treatment: chemotherapy, possible bone marrow transplant

Summary:
Lymphoma

- Cancers that originate in the lymph system, part of the body’s immune system
  - Hodgkin’s lymphoma; non-Hodgkin’s lymphoma
- Risk factors:
  - Infections, medications, or genetic change that weakens the immune system
  - Radiation, herbicides, insecticides, and some chemical exposures
- Treatment:
  - Often includes a combination of surgery, chemotherapy, and radiation
  - Can sometimes involve immunotherapy or bone marrow transplant

The Lymph System

Cancer Screening

- Early detection is the key to successful treatment
- Screening tests are the key to early detection
- No test thus far has been shown to improve detection of some cancers, including ovarian cancers, without increasing harm

Cancer Treatments

- Surgery: removal of tissue
- Chemotherapy: drug treatment that interferes with rapid cell division
- Radiation: destroy cancer cells with minimal damage to surrounding slower-dividing tissues
- Biological therapies: immunotherapy medications
- Bone marrow transplantation
- Gene therapy and genetic testing
- Clinical trials
- Complementary and alternative medicine

Summary:
Living with Cancer

- If you or a family member is diagnosed with cancer:
  - Participate in decisions about treatment
  - Be an informed consumer
  - Consider how you will interact with others
  - Consider school or work obligations
  - Enlist support
  - Know what physical changes are likely to occur
  - Consider sperm or egg donation and freezing
  - Spiritual beliefs and practices can be important
  - Don’t think about cancer all the time

In Review

- What is cancer?

- What causes cancer?

- What are the most common cancers?

- How is cancer detected and treated?

Summary: