Epidemiology

Study of the distribution & determinants of cancer in population groups

**Incidence:** The number of new cancers of a specific site or type occurring in a specified population group during 1 year

**Prevalence:** The number or percent of people alive on a certain date in a population group who previously had a diagnosis of cancer

Eric is a member of a research team that conducts an epidemiologic study. They determine that in a given year approximately 1 out of every 12,000 American men has prostate cancer. This figure represents:

A. An incident rate  
B. A mortality  
C. A prevalence rate  
D. A survival rate
Estimated New Cancer Cases* in the US in 2019

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20 yrs</td>
<td>870,870</td>
<td>891,480</td>
</tr>
<tr>
<td>20-49 yrs</td>
<td>13%</td>
<td>15%</td>
</tr>
<tr>
<td>50-54 yrs</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>65-74 yrs</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>75 + years</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>All other sites</td>
<td>22%</td>
<td>21%</td>
</tr>
</tbody>
</table>

*Includes head and neck cancers with skin considered and all site categories except primary site.


Cancer Incidence by Age: 2013

Age Groups:
- < 20 yrs
- 20-49 yrs
- 50-54 yrs
- 65-74 yrs
- 75 + years

Source:

- Tongue & Tonsil
- Small Intestine
- Liver
- Pancreas
- Kidney
- Thyroid

Cancer Facts and Figures, 2016

**Male**
- Melanoma
- Myeloma
- Testis
- Oropharynx

**Female**
- Anus
- Vulva
- Uterine
- Thyroid

Global Cancer Statistics

- Cancer incidence will rise by 70% in 20 years
- One third of cancer deaths are due to the 5 leading lifestyle risks:
  - high body mass index
  - low fruit & vegetable intake
  - lack of physical activity
  - tobacco
  - alcohol use
- Tobacco use causes 22% of global cancer deaths & 70% of global lung cancer deaths
- Cancer causing viral infections: HBV/HCV & HPV are responsible for 25% of cancer deaths in middle and low income countries

Primary Prevention

- Involves the identification of:
  - genetic, biologic and environmental factors
  - that are etiologic or pathogenic in the development of cancer and
  - subsequent complete or significant interference with their effects on carcinogenesis.
- Prevention strategies focus on modifying environmental & lifestyle risk factors which promote cancer.

Risk

The likelihood that exposure to a certain factor will influence the chance of developing a particular cancer based on the national average

Risk factor: An identifiable trait or habit that is statistically associated with an increased susceptibility for disease, disability or death.
Principles Guiding Prevention

- Cancer is caused by complex interactions between genes and external factors
- Mechanisms of carcinogenesis predict that individual susceptibility to cancer may result from several factors
- Recognizing risk factors identifies individuals at greater risk for cancer and provides the opportunity to intervene early to prevent disease
- Changes in lifestyle have the potential to reduce cancer risks
- Reducing exposure to carcinogens may reduce cancer risk

Global Cancer Risk Factors

- tobacco use including cigarettes and smokeless tobacco
- being overweight or obese
- unhealthy diet with low fruit and vegetable intake
- lack of physical activity
- alcohol use
- sexually transmitted HPV-infection
- infection by hepatitis or other carcinogenic infections
- ionizing and ultraviolet radiation
- urban air pollution
- indoor smoke from household use of solid fuels

Tobacco use is the single most important risk factor for cancer and is responsible for approximately 22% of cancer-related deaths globally

Tobacco

- Accounts for at least 30% cancer deaths & 87% of lung cancer deaths in the U.S.
- Increases the risk of: mouth, lips, nose and sinuses, larynx (voice box), pharynx (throat), esophagus (swallowing tube), stomach, pancreas, kidney, bladder, uterus, cervix, colon/rectum, ovary (mucinous), and acute myeloid leukemia
- Cigars contain most of the same carcinogens as cigarettes

Trends in Tobacco Use and Lung Cancer Death Rates in the US

Note: Rates are age-adjusted to the 2000 US standard population. Due to changes in ICD coding, survivor information has changed over time. Rates for versions of this chart and chart are affected by these coding changes.
Smokeless Tobacco

Dissolvable tobacco products

- Lozenges, strips or sticks that contain nicotine and other constituents
- Included in the 2016 regulatory rule. Required to have nicotine addictiveness warning statement.
- Marketed to youth
- Easy for youth to hide their use
The Bottom Line on E-cigarettes

- E-cigarettes contain nicotine and other cancer causing chemicals which are addictive, toxic to fetus and harmful to developing adolescent brains.
- E-cigarettes are safer than cigarettes but are not safe.
- USPTFS insufficient evidence about their use in smoking cessation. Not approved by the FDA as a way to quit smoking
- E-cigarettes are not safe for youth, young adults, pregnant women, or adults who do not currently use tobacco products.
- Hook kids onto nicotine who then go on to use cigarettes

FDA New Tobacco Rule - 2016

- Extends regulatory authority to all tobacco products including e-cigarettes, cigars, hookah and pipe tobacco, nicotine gels & dissolvables.
- Requires health warnings on roll your own tobacco, cigarette tobacco and newly regulated tobacco products
- Bans free samples
- Prohibits selling to people under age 18
- Prohibits selling in vending machines
- Requires all products to go through an FDA safety and approval review
Alcohol Consumption

- Somewhat controversial in breast cancer
- Associated with higher risk of:
  - mouth
  - throat
  - voice box
  - esophagus
  - liver
  - colorectal
  - breast cancer
- Synergistic effect with tobacco

How much is too much?

Combination of Alcohol and Cigarettes Increases Risk for Cancer of the Esophagus

<table>
<thead>
<tr>
<th>Risk Increase</th>
<th>0</th>
<th>4+</th>
<th>0</th>
<th>4+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol Drinks consumed per day</td>
<td>0</td>
<td>0</td>
<td>2+</td>
<td>2+</td>
</tr>
<tr>
<td>Pack of Cigarettes consumed per day</td>
<td>0</td>
<td>0</td>
<td>2+</td>
<td>2+</td>
</tr>
</tbody>
</table>

Diet & Nutritional Factors

- Accounts for 20-42% cancer deaths
- Animal (saturated fat) & red meat associated with cancers of colon, rectum, prostate
- Obesity associated with cancer development
- Cruciferous Vegetables and antioxidants associated with decreased risk
- Vitamin D - no conclusive evidence

Vegetable Consumption (3+ servings per day) by State, Adults 18 Years and Older, US, 2015

*Includes fresh, canned, and frozen vegetables. Some states may not have complete data.
Increased Cancer Risk in Obese Individuals

<table>
<thead>
<tr>
<th>Cancer</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endometrial</td>
<td>2 – 4 times</td>
</tr>
<tr>
<td>Esophageal Adenocarcinoma</td>
<td>2 times</td>
</tr>
<tr>
<td>Gastric</td>
<td>2 times</td>
</tr>
<tr>
<td>Liver</td>
<td>2 times</td>
</tr>
<tr>
<td>Kidney</td>
<td>2 times</td>
</tr>
<tr>
<td>Meningioma</td>
<td>50%</td>
</tr>
<tr>
<td>Pancreatic</td>
<td>1.5 times</td>
</tr>
<tr>
<td>Colorectal Cancer</td>
<td>30%</td>
</tr>
<tr>
<td>Gall Bladder</td>
<td>60%</td>
</tr>
<tr>
<td>Breast, Postmenopausal</td>
<td>20 – 40%</td>
</tr>
<tr>
<td>Ovarian</td>
<td>10%</td>
</tr>
<tr>
<td>Thyroid</td>
<td>10%</td>
</tr>
</tbody>
</table>

Occupational Cancer Risks

- Account for about 4% cancers
- **Asbestos**
  - Single most important known occupational carcinogen
  - Asbestos-related lung cancer peaked during middle to late 1980's secondary to extensive occupational exposure in shipyards during WWII
  - Synergistic with Cigarette smoking
- 240 agents listed as carcinogens on the list by National Toxicology Program (some are chemotherapy agents)
Environmental Risk Factors

- Contribute to 4% cancer deaths (global)
- UV light (sunlight)
  - Contributes to about 90% skin cancers, including melanoma
  - History of blistering sunburns are of particular risk for melanoma
  - Cumulative sun exposure has more impact on non-melanoma cancers
- Electromagnetic field exposures
- Cell phones - inconclusive evidence
  - Classified by the International Agency for Research on Cancer as possibly carcinogenic to humans

Indoor Tanning Beds

- Cause melanomas & non-melanoma skin cancers
- Listed as a carcinogen
- The risk is greater in clients under age 25
- Australia, Canada (some provinces) & Europe have banned tanning beds for non-adults.
- Some states in the US have banned for non-adults
- FDA states that "UVA radiation poses serious health risks"

Viral Exposures

- Associated with 22% of cancers in developing world, 6% in industrialized countries
- Hepatitis B & C is linked with hepatocellular carcinoma
- HIV infection linked to Kaposi’s sarcoma & B-cell lymphomas
- Epstein-Barr virus (EBV) linked to Burkett’s lymphoma
- Human papilloma virus (HPV) related to cervical cancer, anus, vagina, penis and squamous cell cancers of the head and neck
- Helicobacter pylori linked to stomach cancer

HPV Vaccine

- CDC Recommends HPV vaccine for girls and boys 11 or 12 years of age
- It may be given starting at age 9
- HPV infection is easily acquired, even with only one sex partner
- HPV vaccine recommended before any sexual contact
- Response to the vaccine is better at a younger ages (11-12)
- 2 dose series before age 15, 6 months apart
Screening & Early Detection (Secondary Prevention)

• Emphasis on early diagnosis
  - Strategies to detect abnormalities before they are clinically apparent
    - Allows for intervention before cancer develops
    - Detect at an early stage when treatment is most effective
  - In asymptomatic individuals
    - Disease presumed to be localized

Screening Guidelines

• Have to be common enough of a disease to justify screening
• Has to have substantial mortality and morbidity
• Has to have an effective treatment
• Has to have a presymptomatic period
• Has to be easy and acceptable to clients
• Has to be sensitive and specific to the disease

Who Makes The Recommendations?

• U.S. Government Agencies
  - U.S. Preventive Services Task Force (USPSTF)
  - Centers for Disease Control
  - National Cancer Institute
• Community Organizations
  - American Cancer Society
  - Susan Komen Breast Cancer Foundation
• Professional Organizations
  - American College of Radiology
**Breast Cancer Screening Guidelines**

<table>
<thead>
<tr>
<th>American Cancer Society</th>
<th>US Preventive Services Task Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 40 – 44</td>
<td>Age 40 – 49</td>
</tr>
<tr>
<td>Mammograms optional</td>
<td>No routine mammograms for low risk women</td>
</tr>
<tr>
<td>Age 44 – 54</td>
<td>Individual decisions about every 2 year mammograms</td>
</tr>
<tr>
<td>Mammogram annually</td>
<td>Age 50 – 74</td>
</tr>
<tr>
<td>Age 55 + Every 2 years or may have annually</td>
<td>Biennial mammograms</td>
</tr>
<tr>
<td>All women should report changes in their breasts</td>
<td>Age 75 + No benefits to screening</td>
</tr>
</tbody>
</table>

**Cervical Cancer Screening Guidelines**

<table>
<thead>
<tr>
<th>American Cancer Society</th>
<th>US Preventive Services Task Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ages 21 – 29 PAP every 3 years</td>
<td>Age 21 – 29 every 3 years with cervical cytology alone</td>
</tr>
<tr>
<td>Ages 30 – 65 PAP &amp; HPV every 5 years</td>
<td>Ages 30 – 65</td>
</tr>
<tr>
<td>Over 65 – no screening unless high risk</td>
<td>• every 3 years with cervical cytology alone,</td>
</tr>
<tr>
<td>No screening after hysterectomy</td>
<td>• every 5 years with high-risk human papillomavirus (hrHPV) testing alone,</td>
</tr>
<tr>
<td>Vaccination does not alter the screening recommendations</td>
<td>• or every 5 years with hrHPV testing in combination with cytology (cotesting).</td>
</tr>
</tbody>
</table>

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**Prevalence of Mammography by Race/Ethnicity and Insurance Status, Women 40 Years and Older, US, 2015**

**Prevalence of Cervical Cancer Screening by Race/Ethnicity and Insurance Status, Women 21 to 64 Years, US, 2015**
ACS Screening Guidelines: Colon & Rectal Cancer

- Age 45–75 Regular screening
- Age 75 – 85 Optional depends on health
- One of the following 5 testing methods recommended
  - Annually fecal occult blood test (FOBT)
  - Flexible sigmoidoscopy every 5 years
  - FOBT + sigmoidoscopy every 5 years
  - Double-contrast barium enema every 5 years
  - Colonoscopy every 10 years
  - CT colonography every 5 years

USPSTF - Start at age 50

ACS 2018

Lung Cancer Screening with Low Dose Computerized Tomography (CT)

U.S. Preventive Services Task Force (USPSTF)
- Annual screening
  - Adults ages 55 to 80 years who have a 30 pack-year smoking history and currently smoke or have quit within the past 15 years
  - Discontinue
  - Once a person has not smoked for 15 years or develops a health problem that substantially limits life expectancy or the ability or willingness to have curative lung surgery.

American Cancer Society
- Smoking cessation counseling should accompany screenings.

Dec. 2013
The Prostate Exam

Prostate Screening Guidelines: PSA and Digital Rectal Exam

- American Cancer Society
  - Age 50 - 70
  - Men with at least a 10 year life expectancy should make an informed decision with their health care team

- American Urological Association
  - Age 70+ not recommended by the AUA
  - Shared decision making about screening 55 - 70

- USPSTF
  - Aged 55 to 69 years – Shared decision making
  - Age 70+ Not recommended.

Ovarian Cancer Screening

- CA-125 ineffective as a screening tool
- Misses 50% of early ovarian cancers
  - MANY false elevations, particularly in pre-menopausal women
- Indications:
  - Screening in high risk women
  - With abnormal findings on exam or US
  - Detect recurrent disease
  - Monitor treatment
  - Predict outcome
- Education of symptoms to report
- PAP test does not test for ovarian cancer
- USPSTF against screening in asymptomatic women

Prevention and Cancer Vaccine Development:
Target unique or signature genetic changes with cancer vaccines, such as those cancers caused by viruses whereby vaccination can prevent the cancer from occurring.

Early Cancer Detection:
More sensitive diagnostic tests for cancer using genomic and proteomic technologies to detect cancer markers to be used in screening and early detection.
Summary

• Lifestyle changes have the biggest impact in cancer prevention

• Cancer screening is effective but the guidelines are controversial

• Oncology nurses need to promote and model healthy lifestyles and participation in screening