**Epidemiology, Prevention & Early Detection (Cancer Control)**

Nancy Thompson, MSN, RN, AOCNS
Swedish Cancer Institute

---

**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 2017

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20 yrs</td>
<td>19%</td>
<td>30%</td>
</tr>
<tr>
<td>20-49 yrs</td>
<td>14%</td>
<td>12%</td>
</tr>
<tr>
<td>50-64 yrs</td>
<td>9%</td>
<td>8%</td>
</tr>
<tr>
<td>65-74 yrs</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>75+ years</td>
<td>6%</td>
<td>5%</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>3%</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 men with no reported age with gender reported as male or a female sexUnavailable.

**Trends in Cancer Incidence Rates Among Males, US, 1975-2013**

- Prostate
- Lung & bronchus
- Colon & rectum
- Urinary bladder
- Melanoma of skin
- Kidney & renal pelvis
- Non-Hodgkin lymphoma
- Leukemia
- Oral cavity & pharynx
- Liver & intrahepatic bile duct
- All other sites

**Trends in Cancer Incidence Rates Among Females, US, 1975-2013**

- Breast
- Colon & rectum
- Lung & bronchus
- Uterine corpus
- Melanoma of the skin
- Thyroid
- Liver

**Cancer Incidence by Age: 2013**

- < 20 yrs
- 20-49 yrs
- 50-64 yrs
- 65-74 yrs
- 75+ years

*Includes men with no reported age with gender reported as male or a female sexUnavailable.

**Note:** Data exclude the (2001-03) SEER program and for 2017, includes the prostate, liver, and selected other cancers. 2017 SEER incidence data. 2017. National Cancer Institute.

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

Male
- Melanoma
- Myeloma
- Testis
- Oropharynx

Female
- Anus
- Vulva
- Uterine
- Thyroid
World 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 20% of global cancer deaths & 70% of global lung cancer deaths
- Cancer causing viral infections: HBV/HCV & HPV are responsible for 20% of cancer deaths
- 60% of new cases occur in Africa, Asia & Latin America. These regions account for 70% of the world’s cancer deaths

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

Cancer Deaths Worldwide

30% of cancer deaths could be prevented by modifying:

- Tobacco use
- Being overweight or obese
- Unhealthy diet with low fruit & vegetable intake
- Lack of physical activity
- Alcohol use
- Sexually transmitted HPV infection
- Urban air pollution
- Infection by HBV
- Ionizing and non-ionizing radiation
- Indoor smoke from household use of solid fuels

Tobacco

- Accounts for at least 30% cancer deaths & 87% of lung cancer deaths
- 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: Tables are age-adjusted to the 2000 US standard population.
Smokeless Tobacco

Dissolvable tobacco products
- Similar to breath strips or Tic Tac’s
- Lack of regulation
- Marketed as less harmful, evidence still lacking
- Easy for youth to hide their use

E-cigarettes
Electronic Nicotine Delivery Systems (ENDS)

Original Pack
The pack that started the e-cig revolution.
- Charges your batteries on the go
- Sleek design is easy to carry
- Holds 5 cartridges
Pros and Cons of ENDS

Pros
- Vaporize a nicotine solution with flavoring
- No tobacco or other carcinogenic additives
- No second hand smoke
- Safer smoking alternative
- Can help smokers quit
- Look cool...

Cons
- Lack of health studies
- No evidence actually helps people quit and may encourage increased nicotine use
- Gets kids addicted to nicotine
- Increase in poison center calls for nicotine liquids
- Interferes with tobacco control efforts
- Marketing techniques the same as for other tobacco products

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

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

Combination of Alcohol and Cigarettes Increases Risk for Cancer of the Esophagus
### How much is too much?

[Image of a person drinking wine]

### 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, 2013**

<table>
<thead>
<tr>
<th>State</th>
<th>Percentage of Adults Meeting Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>20%</td>
</tr>
<tr>
<td>Texas</td>
<td>15%</td>
</tr>
<tr>
<td>New York</td>
<td>25%</td>
</tr>
<tr>
<td>Ohio</td>
<td>20%</td>
</tr>
</tbody>
</table>

*Includes cooked or canned beans, dark green vegetables, orange colored vegetables or other vegetables (excludes fried potatoes)

---

**Fruit Consumption (2+ servings per day) by State, Adults 18 Years and Older, US, 2013**

<table>
<thead>
<tr>
<th>State</th>
<th>Percentage of Adults Meeting Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>30%</td>
</tr>
<tr>
<td>Texas</td>
<td>25%</td>
</tr>
<tr>
<td>New York</td>
<td>35%</td>
</tr>
<tr>
<td>Ohio</td>
<td>30%</td>
</tr>
</tbody>
</table>

*Source: Behavioral Risk Factor Surveillance System National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 2013*
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>

NCI, Jan 17, 2017

Trends in Obesity* Prevalence by Gender, Adults 20 to 74 Years, US, 1960-2014

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

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 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

Prevalence of Human Papillomavirus Vaccination*, Adolescents 13 to 17 Years, by Gender and Race/Ethnicity*, US, 2014

- Girls
- Boys

Overall White Black Hispanic Asian Asian

*NHANES data is weighted to account for non-response. Data includes non-Hispanics. Data are from the National Health and Nutrition Examination Survey (NHANES) 2011-2014. For further information, see Appendix A. The data are then ehanced and integrated at: http://www.cdc.gov/managedcare/policies/managedcare/policies/2419/factsheets/AppA.pdf.
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>Age 20+</th>
<th>Breast self exam optional Clinical breast exam preferred every 3 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 40+</td>
<td>Breast self exam optional Clinical breast exam preferred annually Mammogram annually</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>American Cancer Society</th>
<th>US Preventive Services Task Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 40 – 49</td>
<td>No routine mammograms for low risk women Individual decisions about every 2 year mammograms</td>
</tr>
<tr>
<td>Age 50 – 74</td>
<td>Biennial mammograms</td>
</tr>
<tr>
<td>Age 75 +</td>
<td>No benefits to screening</td>
</tr>
<tr>
<td>Clinical Breast exams</td>
<td>No benefit beyond mammography</td>
</tr>
<tr>
<td>Breast self exam</td>
<td>Do not reduce breast cancer mortality</td>
</tr>
</tbody>
</table>
Cervical Cancer Screening Guidelines

**American Cancer Society**
- Ages 21 – 29 PAP every 3 years
- Ages 30 – 65 PAP & HPV every 5 years
- Over 65 – no screening unless high risk
- No screening after hysterectomy

**US Preventive Services Task Force**
- Ages 21 – 65 PAP every 3 years
- Ages 30 – 65 may have PAP and HPV testing every 5 years
- Over 65 – no screening unless high risk
- No screening after hysterectomy

---

**Prevalence of Mammography** by Race/Ethnicity, Women 40 Years and Older, US, 2013

**Prevalence of Pap Testing** by Race/Ethnicity, Women 21 to 65 Years, US, 2013
ACS Screening Guidelines: Colon & Rectal Cancer

- Age 50+. Stop at 75 or 80
- 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
- Start earlier than age 50 if personal or family history of colon cancer, polyps, chronic inflammatory bowel disease

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 & 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.
**The Prostate Exam**

**Prostate Exam Guidelines:**
- 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 - No PSA screening
  - "Many men are harmed, few if any, benefit"

---

**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
- No current recommendations for ovarian cancer

---

**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 - No PSA screening
  - "Many men are harmed, few if any, benefit"

---

**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