Epidemiology, Prevention and Early Detection

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Outline
- Epidemiology terminology
- Cancer statistics
- Prevention guidelines
- Screening guidelines

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 during 1 year.
- Prevalence - the number or percent of people alive on a certain date in a population who previously had a diagnosis of cancer.
2011 Cancer Facts & Figures
(American Cancer Society based on SEER Data)

- Cancer incidence stable in men and declining slightly in women
- Cancer death rates declining in U.S.
- **Cancer death rates for individuals with the least education are more than twice than those of the most educated**

Cancer with increasing incidence
Trends in the US: 1999 - 2008

- HPV Related Oropharynx
- Esophageal Adenocarcinoma
- Pancreas
- Liver and Intrahepatic bile duct
- Thyroid
- Kidney and renal pelvis
- Melanoma of the skin

World Cancer Statistics
(WHO 2012)

- Cancer caused 13% of all deaths worldwide in 2008
- Lung, stomach, liver, colon and breast cancer cause the most cancer deaths
- Tobacco use causes 22% of global cancer deaths
- Cancer causing viral infections are responsible for 20% of cancer deaths
- 70% of cancer deaths occurred in low and middle income countries
- Deaths from cancer worldwide are continuing to rise with 13 million deaths in 2030
- Statistics for mortality and incidence of all cancers vary by race, socioeconomic disparities and unequal access to medical care.
Prevention

- Primary – 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 and 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.

“The US is failing to take advantage of proven methods of preventing cancer”

30% of cancer deaths worldwide could be prevented by modifying:

- Tobacco use
- Being overweight or obese
- Unhealthy diet with low fruit and vegetable intake
- Lack of Physical activity
- Alcohol use
- Sexually transmitted HPV infection
- Urban air pollution
- Indoor smoke from household use of solid fuels

WHO Feb 2012

1/3 of Cancers Caused by Lifestyle Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Cancers Attributed to Risk Factor in Men (%)</th>
<th>Cancers Attributed to Risk Factor in Women (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco</td>
<td>23</td>
<td>15.6</td>
</tr>
<tr>
<td>Lack of fruit and vegetables</td>
<td>6.1</td>
<td>3.4</td>
</tr>
<tr>
<td>Occupational exposure</td>
<td>Occupational exposure 4.9</td>
<td>Infections (e.g. HPV) 3.7</td>
</tr>
<tr>
<td>Alcohol</td>
<td>4.6</td>
<td>3.3</td>
</tr>
<tr>
<td>Overweight and Obesity</td>
<td>4.1</td>
<td>6.9</td>
</tr>
<tr>
<td>Excessive sun exposure and</td>
<td>3.6</td>
<td>3.6</td>
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<tr>
<td>sunbeds</td>
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</table>

Tobacco

- Accounts for at least 30% cancer deaths and 87% of lung cancer deaths
- Increases the risk of: nasopharynx, nasal cavity and paranasal sinuses, lip, oral cavity, throat, voice box, lung, esophagus, pancreas, uterine cervix, ovary, kidney, bladder, stomach, colorectal, AML
- Between 1965 and 2004, cigarette use declined by half
- Between 2005 and 2011 light smokers (less than 10/day) increased but heavy smokers decreased
- Most common among the least educated

2012 US Surgeon General's report

- “Preventing Tobacco Use Among Youth and Young Adults”
- 90% of smokers start before age 18
- Tobacco companies spend more than $1,000,000 per hour in the USA to market their products.
- Cigarette sized cigars contain candy and fruit flavoring
- Smokeless tobacco rates are increasing
The “new” Smokeless tobacco

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

Alcohol Consumption

- Somewhat controversial in breast cancer
- Associated with higher risk of mouth, throat, voice box, esophagus, liver, colorectal and breast cancer
- Synergistic effect with tobacco
Diet & Nutritional Factors

- Accounts for 20-42% cancer deaths
- Animal (saturated fat) & red meat associated with cancers of colon, rectum, prostate
- Obesity associated with cancers of
  - Colon, rectum, prostate, gallbladder, biliary tract
  - Breast, cervix, endometrium, & ovary
- Cruciferous Vegetables associated with decreased risk

Summary of Evidence: Obesity and Cancer

<table>
<thead>
<tr>
<th>Convincing</th>
<th>Possible</th>
<th>Limited Data or No association</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colon</td>
<td>Ovarian</td>
<td>Stomach</td>
</tr>
<tr>
<td>Breast (postmenopausal)</td>
<td>Liver</td>
<td>Lung</td>
</tr>
<tr>
<td>Endometrial</td>
<td>Pancreas</td>
<td>Carcinoma</td>
</tr>
<tr>
<td>Kidney</td>
<td>Leukemia</td>
<td>Bladder</td>
</tr>
<tr>
<td>Esophageal (adenocarcinoma)</td>
<td>Gall Bladder</td>
<td>Lymphoma</td>
</tr>
<tr>
<td>Advanced Prostate</td>
<td></td>
<td>Multiple Myeloma</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thyroid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Testicular</td>
</tr>
</tbody>
</table>

2011 USDA Dietary guidelines

- Emphasis on managing body weight
- Maintain calorie balance and achieve and sustain a healthy weight
- Focus on nutrient dense foods and beverages: vegetables, fruits, whole grains, low fat dairy, seafood, lean meats, eggs, beans and peas, nuts and seeds.
- Limit sodium, solid fats, added sugar and refined grains
Vitamin D

- May reduce the risk of colorectal and prostate cancer.
- Studies inconsistent in breast and pancreatic cancer
- Endocrine Society recommends Vit D levels of 30 ng/ml (spring 2011)
- NCI does not recommend for or against

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 – classified by the International Agency for Research on Cancer as possibly carcinogenic to humans (WHO June 2011)
“Biggest study ever reports on mobiles and brain cancer” - 5/16/2010
- No increase in risk of glioma or meningioma with mobile phones
- Long term use of mobile phones requires further investigation

“Carcinogenicity of radiofrequency electromagnetic fields” - Lancet 2011
- Too recent wide spread use to get good data
- Increased brain glucose metabolism noted in the areas of the brain closest to the antenna of the phone.

National Cancer Institute - 6/18/2012
- Studies have not shown a consistent link between cell phone use and cancers of the brain, nerves or other tissues of the head or neck.

Viral Exposures
- Associated with 22% of cancers in developing world, 6% in industrialized countries
- Hepatitis B and C is linked with hepatocellular carcinoma.
- HIV infection linked to Kaposi’s sarcoma & B-cell lymphomas
- Epstein-Barr virus (EBV) linked to Burkitt’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 routine use of HPV vaccine in boys aged 11 to 12 with 3 doses of HPV4 (Gardasil). The series can be started beginning at age 9” - Oct. 2011
- Approved for 9 – 26 year old girls in 2006.
- Most effective if used prior to exposure to the virus
- Adoption of the recommendation has been poor
- “Within 4 years of vaccine introduction, the HPV prevalence decreased among females 14 – 19 years of age by 56% despite the low adoption rate” - June 2013, Journal of Infectious Disease.

Medication Risk Factors
- Hormonal agents
  - Estrogen therapy in menopausal women associated with endometrial cancer
  - Estrogen exposure in fetus (from DES) associated with vaginal cancer in adulthood
  - Anabolic steroids may be associated with liver cancer
- Immunosuppressive agents
  - Organ recipients – increased risk of NHL
- Antineoplastic agents
  - Alkylating agents increase risk of secondary malignancies
Socioeconomic Factors

- SES is associated with living conditions and behaviors associated with cancer risk.
- Poverty – under-recognized factor that contributes to cancer, lack health insurance, are medically underserved
- Illiteracy compromises access to health education messages for prevention, screening, early detection
- Unemployment, inadequate nutritional status may place survival priorities over prevention, screening, early detection

Screening & Early Detection (Secondary Prevention)

- Emphasis on early diagnosis
- Selective screening strategies to detect abnormalities before they are clinically apparent, allowing for intervention before cancer develops or at an early stage when treatment is most effective.
- Screening is 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
- Community Organizations
  - American Cancer Society
  - Susan Komen Breast Cancer Foundation
- Professional Organizations
ACS Screening Guidelines: Cancer-Related Checkup

- Ages 20-40: exams every 3 years
- Ages 40+: exams annually
- Health counseling
  - Tobacco
  - Sun exposure
  - Diet & nutrition
  - Risk factors
  - Sexual practices
  - Environmental & occupational exposures
- Examination for cancers of the thyroid, testicles, ovaries, lymph nodes, oral cavity, skin

Breast Cancer Screening Guidelines

<table>
<thead>
<tr>
<th>American Cancer Society</th>
<th>US Preventive Services Task Force</th>
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<tbody>
<tr>
<td>Age 20+</td>
<td>Age 40 - 49 No routine mammograms for low risk women</td>
</tr>
<tr>
<td>Monthly self-exam</td>
<td>Individual decisions about every 2 year mammograms</td>
</tr>
<tr>
<td>Age 40+</td>
<td>Age 50 - 74 Biennial mammograms</td>
</tr>
<tr>
<td>Monthly self-exam</td>
<td>Age 75+ No benefits to screening</td>
</tr>
<tr>
<td>Clinical breast exam every year preferred</td>
<td>Breast self exam Do not reduce breast cancer mortality</td>
</tr>
<tr>
<td>Mammography every year</td>
<td></td>
</tr>
</tbody>
</table>

Cervical Cancer Screening Guidelines

<table>
<thead>
<tr>
<th>American Cancer Society</th>
<th>US Preventive Services Task Force</th>
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</thead>
<tbody>
<tr>
<td>Begin at 21 with PAP</td>
<td>Ages 21 - 65 PAP every 3 years Or 30 - 65 may have PAP and HPV testing every 5 years</td>
</tr>
<tr>
<td>31 - 29 every 3 years</td>
<td>No screening in women older than 65 unless high risk</td>
</tr>
<tr>
<td>30 - 65 pap and HPV every 5 years</td>
<td>No screening after hysterectomy</td>
</tr>
<tr>
<td>Over 65 - no screening unless high risk</td>
<td>No screening after hysterectomy</td>
</tr>
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ACS Screening Guidelines: Colon & Rectal Cancer

- Age 50+
  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 recommend stopping at age 75

*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)

NCCN (2013)
In high risk patients:
- 55-74 years and 30 pack year history of smoking.
- Start at 50 if 20 pack year history and are still smoking or have other risk factors.

U.S. Preventive Services Task Force (USPSTF) DRAFT recommends annual screening for high risk patients.
- Ages 55 – 79
- Significant cumulative tobacco smoke exposure
- Have smoked within the last 15 years

(August 6, 2013)

ACS Screening Guidelines: Prostate

- Age 50+ (40 - 45 if at high risk)
  - There is insufficient data to recommend for or against screening
  - 2010: Men should only be screened after they received information about the uncertainties, risks and potential benefits of screening
  - PSA testing with or without DRE. DRE doesn’t add any evidence
  - PSA of 4.0 is a “reasonable threshold” for evaluation
  - Consider risk assessment for men 2.5 to 4.0. 25% of men harbor PCA in this range. Race, history, previous biopsies and PSA.
  - American Urological Assn: feels all PSA’s should be evaluated.
  - Oct 2011 USPSTF recommended AGAINST regular PSA screening.

* Some elevations in PSA may be due to benign conditions of the prostate.

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
“Cost of cancer care in the United States to Go Up, Up, Up”

- “The best bet for the future is in prevention and early detection. This is the only reasonable long term solution.”
- “The majority of cancers in the adult population are either preventable or diagnosable at an early stage of disease when treatment is associated with much less toxicity and cost.”
  - Gary Lyman, MD, MPH
  - Duke Center for Clinical Health Policy Research
  - Jan 2011, Journal of NCI
- Affect of Health care reform ????

Take Home Message

- Cancer incidence is stable
- Mortality is decreasing in US but not worldwide
- 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