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Cancer in the Medically Underserved Population

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Synopsis

Cancer is a group of diseases characterized by uncontrolled growth and spread of abnormal cells in the body. It is the second most common cause of death in the United States and a significant proportion can be prevented. An Institute of Medicine (IOM) report revealed that under-represented and underserved populations are less likely to receive routine medical procedures and experience a lower quality of health services. Despite the increase in cancer screening, there are still disparities in the incidence and mortality of various cancers. These disparities are not fully explained by the correlations between minority race and lower economic status (SES), or minority race and insurance status. Considerations for global cancer control in low-resource settings are presented.

Keywords

Cancer; Incidence; Mortality; Underserved; Screening; Prevention; Health disparities; Global Health

Introduction

Cancer is a group of diseases characterized by uncontrolled growth and spread of abnormal cells. If the spread is not controlled it can result in death.[1] Cancer is the second most common cause of death in the United States. It accounts for nearly 1 in 4 deaths. In the U.S., the life time risk of developing cancer is 1 in 2 in men (42%) and 1 in 3 in women (38%) According to the American Cancer Society, 1,685,210 new cases of cancer will be diagnosed in 2016 and an estimated 595,690 deaths will occur as a result of cancer. A significant proportion of cancer can be prevented. In 2016, about 188,800 of the estimated 595,690 cancer deaths in the US will be caused by cigarette smoking, according to a recent study by

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American Cancer Society (ACS) epidemiologists. In addition, the World Cancer Research Fund estimates that about 20% of all cancers diagnosed in the US are related to body fatness, physical inactivity, excess alcohol consumption, and/or poor nutrition, and thus could also be prevented.[2] Cancers that are related to infectious agents, such as human papillomavirus (HPV), hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), and *Helicobacter pylori (H. pylori)* could be avoided by preventing these infections through behavioral changes or vaccination, or by treating the infection.[1]

An Institute of Medicine (IOM) report titled "Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care" mentioned that one of the core aims of healthcare is the provision of care that does not vary in quality because of race, ethnicity, sex, socioeconomic status and geographic considerations. This report showed compelling evidence that demonstrated significant variation in the rates of medical procedures by race, even when insurance status, income, age, and severity of conditions are comparable.[3] This report revealed that under-represented and underserved populations are less likely to receive routine medical procedures and experience a lower quality of health services. As defined by Vincent Morelli in the introduction of this book medically underserved areas (MUAs) and medically underserved populations (MUPs) are determined by the Health Resources and Services Administration (HRSA) by measuring four variables: 1) ratio of primary care physicians (PCPs) per 1,000 population; 2) infant mortality rate; 3) percentage of the population below the poverty level; and 4) percentage of the population age 65 or over. It has been estimated that over 100 million Americans are medically underserved. [5]

Otis Brawley, Chief Medical and Scientific Officer and Executive Vice President of the American Cancer Society (ACS) observed in his study on colorectal cancer that there were similar age-adjusted mortality rates in blacks and whites in the 1970s. Significant disparities in mortality began in the early 1980s. This coincided with the advent of large-scale screening programs and coverage for colonoscopies. Although overall mortality rates have declined for all racial/ethnic populations and socioeconomic levels, the rate of decrease among whites was faster, thus exacerbating the disparity over time.[4,5]

There are two predominant hypotheses that have formed the basis for why inequities exist. Current data do not support or refute either one. Genomic sequencing has not supported a definite biologic construct on which to base disparities. However, there is some evidence that raise questions about possible differences in treatment response, and the need to consider interaction of tumor and host biology.[6]

Others have attributed disparities solely to societal and healthcare system factors as they relate to unequal access to care. Observed disparities are not fully explained by the correlations between minority race and lower socioeconomic status (SES), or minority race and insurance status (Uninsured or publically insured).[7] It seems that underserved patients with Medicaid or no insurance present with more advanced cancer and are less likely to receive definitive cancer-directed surgery and/or radiation therapy. In addition, these patients have far worse survival rates.[8]

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There is growing evidence to support different outcomes as a result of inequities in the structure of the health care system.[9] Patients from disadvantaged populations tend to receive care in settings that differ in terms of quality. For example, patients with breast and colon cancer treated at hospitals with large minority populations had higher mortality rate regardless of race.[10] Patient preferences in treatment and other clinical management options should be considered by providers; however, they must distinguish between deeply rooted values and transient beliefs that may be amenable to information and intervention.[5]

Etiology of cancer

Factors associated with increased risk for cancer include:

1. Genetics: Some types of cancer run in certain families, but most causes are not clearly linked to genes we inherit from our parents.
2. Tobacco smoke: There are over 70 carcinogens in tobacco smoke.
3. Diet and Physical activity: Poor diet and not being active are two key factors that can increase a person's cancer risk. World Cancer Research Fund International guidelines for cancer prevention include being physically active for at least 30 min every day, limiting consumption of energy-dense foods, eating a variety of vegetables, fruits, wholegrains, and limiting consumption of red and processed meats.[2]
4. Sun and Ultraviolet rays exposure: Exposure to ultraviolet (UV) light from the sun has been shown to have carcinogenic effect. Low skin exposure to UVB radiation from the sun or due to specific individual behavior may also have a negative effect.[11]
5. Radiation: Exposure to ionizing radiation increases the risk of cancer throughout the lifespan. Cancer risk increases after exposure to moderate and high doses of radiation (more than 0.1–0.2 Gy).[12] The largest number of radiotherapy related second cancers are lung, esophageal and female breast cancer. The highest percentages of second cancers related to radiotherapy are among survivors of Hodgkin's disease and cancers of the oral cavity, pharynx and cervix uteri.[13]
6. Other carcinogens: Environmental (e.g. asbestos), infectious agents (e.g. Herpes simplex virus): The global burden of cancer attributable to infectious agents is estimated to be about 18 per cent. The main infectious agents responsible for the global cancer burden are Helicobacter pylori (HP), human papilloma viruses (HPV), hepatitis B (HBV), human immunodeficiency virus (HIV) and human herpes virus (HHV).[14]

Epidemiology

Overall, age adjusted cancer incidence rate for all cancers combined decreased by 0.5% per year for both sexes from 2002 to 2011 ($p<0.001$) (Figure 1). This is based on trend analysis of the SEER-13 data. Among men, cancer incidence rates decreased on average by 1.8% annually from 2007 to 2011 ($p=0.003$). Overall cancer incidence rates among women

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increased 0.8% annually from 1992 to 1998 (p= 0.003), but were stable from 1998 to 2011. Among children, ages 0–14 and 0–19 years, rates have increased by 0.8% per year over the past decade, continuing a trend dating from 1992 (p<0.001).[15]

The observed rates of all cancers combined in all racial groups were lower among women than men between 2007 and 2011 (412.8 vs 526.1 per 100,000). Black men had the overall highest incidence of cancer among men of any racial/ethnic group (587.7 per 100,000). Among women, Whites had the overall highest incidence of cancer (418.6 per 100,000). In each of the racial/ethnic groups prostate cancer remains the most common cancer among men. This is followed by lung and colorectal cancer among all racial/ethnic groups respectively. However, these ranks are reversed in Hispanic men. Among women, breast cancer is the most common cancer among all racial/ethnic groups. Lung and colorectal cancer are the second and third most common cancers among all racial/ethnic groups, except among Asian and Pacific Islanders (API) and Hispanics where the ranks are reversed again.[15]

Cancer death rate for all cancer sites combined (2007–2011) was higher for men than women (211.6 vs 147.4 deaths per 100,000). Of any racial or ethnic group, Black men had the highest cancer death rate (269.3 deaths per 100 000 men). Lung cancer was the leading cause of death in both men and women. Among men, Lung, prostate, and colorectal cancers were the leading causes of cancer death in every racial and ethnic group except API men, for whom lung, liver, and colorectal ranked highest. The leading causes of cancer death in women were lung, breast, and colorectal cancers, although the rank order of these top three cancers varied for American Indian/Alaska Native (AI/AN) and Hispanic women.[15]

The 2015 report to the nation on the status of cancer used national data to determine the incidence of the four major molecular subtypes of breast cancer by age, race/ethnicity, poverty level and other factors. The four molecular subtypes, which can be approximated by their hormone receptor (HR) status and expression of the HER2 gene are: Luminal A (HR+/HER2−), Luminal B (HR+/HER2+), HER2-enriched (HR−/HER2+), and triple negative (HR−/HER2−). The four subtypes respond differently to treatment and have different survival rates. Non-Hispanic blacks had the highest rates of late-stage disease and of poorly/undifferentiated pathology among all the subtypes. All of these factors are associated with lower survival among blacks; resulting in the highest rates of breast cancer deaths.[16] (Fig 2).

Screening

Healthy people (HP) initiative was initiated in 1979 as a Surgeon General's report. It tracks 10-year national objectives for improving the health of all Americans.[17] One of the goals of HP is a reduction in cancer deaths and a reduction in the incidence of late-stage cancers that may be reduced by screening (cervical, breast, colorectal, and prostate).[18] Brown et al in their study observed marked disparities in cancer screening and provider counseling rates for certain population subgroups, including the uninsured and those with low income or no usual source of health care. The access to care of Hispanics and those below 200% Federal poverty level (FPL) were the most compromised as measured by not having health insurance and not having usual source of care.[18]

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From 2008 to 2013, self-reported cervical cancer screening overall declined by 3.8 percentage points, and breast cancer screening declined by 1.5 percentage points overall. The reason for the fall is not certain. However, it could be due to the economic recession between 2008 and 2010. There is a link between economic recession and decreased health care coverage[19] There was a significant increase of 6.1 percentage points for colorectal cancer screening in the overall population from 2008 to 2013 (Table 1). The evidence is insufficient to determine whether screening for prostate cancer with Prostatic Specific Antigen (PSA) or Digital Rectal Examination (DRE) reduces mortality from prostate cancer.[20]

Barriers to screening

Ogedegbe et al[21] in their study identified 3 categories of barriers to screening in low income minority women in community health centers. The categories are:

1. Patients' Attitude and Beliefs: Examples are competing priorities, loss of privacy, lack of cancer screening knowledge, perception of good health; fear of pain and of cancer diagnosis.
2. Social Network experience: This includes family discouragement, lack of medical recommendation, and knowledge of someone harmed by test.
3. Accessibility: This includes cost of test, lack of transportation, and language barrier.

United States Preventive Services Task Force (USPSTF) screening recommendations

Breast cancer—Biennial screening mammography for women age 50 to 74 years. The decision to start screening mammography before age 50 years should be an individual one.

Cervical Cancer—Screening recommended in women ages 21 to 65 years with cytology every 3 years. Women ages 30 to 65 years who want to lengthen screening interval, are required to have a combination of cytology and Human Papilloma virus testing (HPV) testing every 5 years.

Colorectal cancer—Fecal occult blood testing, sigmoidoscopy or colonoscopy in adult beginning at age 50 to 75 years.

Lung cancer—For adults' age 55 to 80 years with a history of smoking, the USPSTF recommends annual screening for lung cancer with low-dose computed tomography (LDCT) in adults aged 55 to 80 years who have a 30 pack-year smoking history and currently smoke or have quit within the past 15 years. Screening should be discontinued 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.

Prostate cancer—The USPSTF recommends against Prostate Specific Antigen (PSA) based screening for prostate cancer.[22]

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Prevention

The second edition of *The Cancer Atlas* released by the American Cancer Society and the International Agency for Research on Cancer argues that many cancers are largely preventable and prevention is cost effective.[23] There is evidence to suggest that a diagnosis or suspicion of cancer can be a financial stressor. In a population-based study in western Washington, 197,840 cancer patients were matched with an equal number of controls by age, sex, and zip code. Cancer patients were 2.6 times more to file for bankruptcy than cancer free controls ($p< 0.05$).[24] Observational epidemiologic studies have shown associations between the following modifiable lifestyle factors or environmental exposures and specific cancers.

Cigarette smoking/tobacco use

Research has consistently shown the association between tobacco use and cancers of many sites. Specifically, cigarette smoking has been established as a cause of cancers of the lung, oral cavity, esophagus, bladder, kidney, pancreas, stomach, cervix, and acute myelogenous leukemia. It is estimated that cigarette smoking causes 30% of all cancer deaths in the United States. Smoking avoidance and cessation result in decreased incidence and mortality from cancer.[25] In addition, Andersen et al found that meeting ACS cancer prevention guidelines, especially regarding tobacco and alcohol consumption was associated with a lower cancer risk in underserved populations.[26]

Infections

Infectious agents have been estimated to cause 18% of all cancers globally.[14] The burden of cancers caused by infections is much greater in developing nations (26%) than in developed nations (8%). Infection with an oncogenic strain of human papillomavirus (HPV) is considered a necessary event for subsequent cervical cancer. Immunity conferred by vaccines result in marked decrease in precancerous lesions. Oncogenic strains of HPV are also linked with cancers of the penis, vagina, anus and oropharynx. Other examples of infectious agents that cause cancer are hepatitis B and hepatitis C viruses (liver cancer), and helicobacter pylori (gastric cancer).[14]

Radiation

Exposure to UV radiation and ionizing radiation are established cause of cancer. Non-melanoma skin cancers are caused by exposure to solar UV radiation.[27] There is extensive epidemiologic and biologic evidence that links exposure to ionizing radiation with the development of cancer, especially those that involve the hematological system, breast, lungs and thyroid. The National Research Council of the National Academies, Committee to Assess the Health Risks from Exposure to Low Levels of Ionizing Radiation, the Biologic Effects of Ionizing Radiation VII report concluded that no dose of radiation should be considered completely safe.[28] The major sources of population exposure to ionizing radiation are medical radiation (including x-rays, computed tomography [CT], fluoroscopy) and naturally occurring radon gas in the basements of homes. There is a significant and negative correlation between income and radon levels.[29] Reducing radiation exposure and

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limiting unnecessary CT scans and other diagnostic studies are important prevention strategies.[30, 31]

Diet

The World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR concluded that both fruits and non-starchy vegetables were associated with “probable decreased risk” for cancers of the mouth, esophagus and stomach. Fruits were also associated with “probable decreased risk” of lung cancer.[32, 33]

Alcohol

WCRF/AICR report judged the evidence “convincing” that drinking alcohol increased the risks of cancers of the mouth, esophagus, breast, and colorectum. Further, the evidence was judged to be “probable” that drinking alcohol increased the risk of liver cancer, and colorectal in women.[32, 33]

Physical activity

In the WCRF/AICR report, the evidence was judged “convincing” that increased physical activity protects against colorectal cancer. The evidence was “probable” that physical activity was associated with lower risk of postmenopausal breast and endometrial cancer. As with dietary factors, physical activity seems to play a role in selected malignancies.[32, 33]

Obesity

The WCRF/AICR report concluded that obesity is convincingly linked to postmenopausal breast cancer and cancers of the esophagus, pancreas, colorectum, endometrium, and kidney.

Chemoprevention

Chemoprevention refers to the use of natural or synthetic compounds to interfere with early stages of carcinogenesis before invasive cancer appears.[34] Daily use of selective estrogen receptor modulators (tamoxifen or raloxifene) for up to five years reduces the incidence of breast cancer by about 50% in high risk women. Dutasteride (alpha reductase inhibitor) has been shown to reduce the incidence of prostate cancer.[35] Other chemopreventive candidates include COX-2 inhibitors and aspirin. Secondary analyses from pooled data whose primary endpoints were vascular events showed that aspirin taken daily for 4 years was associated with an 18% reduction in overall cancer death.[36]

Vitamin and Dietary supplement use

The evidence is insufficient to support the use of multivitamin and mineral supplements or single vitamins or minerals to prevent cancer.[37]

Global Health

Cancer is a leading cause of death worldwide. The number of cases and deaths is expected to grow as populations grow, age and adopt lifestyle behaviors that increase cancer risk.[38] In 2012, an estimated 14.1 million new cases and 8.2 million cancer deaths occurred

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worldwide.[39] The highest rates are in North America, Oceania and Europe for both sexes. Prostate cancer is most commonly diagnosed cancer among males in North and South America, Northern, Western and Southern Europe and Oceania. In Eastern Europe lung cancer is the most common. The leading cancers among men in Africa include prostate, lung, colorectum, liver, esophagus, Kaposi sarcoma, leukemia, stomach, and non-Hodgkin lymphoma. However, in Asia, they include lung, lip, and oral cavity, liver, stomach, colorectal and prostate cancers. Breast cancer is the most common among women in North America, Europe, and Oceania. Breast and cervical cancers are the most frequently diagnosed cancers in Latin America and the Caribbean, Africa, and most of Asia. In addition, common female cancers in Asia include lung (China, Korea), liver (Mongolia) and thyroid (South Korea).[39]

Eight major cancers account for more than 60% of total global cases and deaths. This includes lung and bronchus, colon and rectum, female breast, prostate, stomach, liver, esophagus, and cervix uteri.[39]

The incidence and mortality rate of cancer is dropping in Western countries through decreasing prevalence of known risk factors, early detection, and improved treatment. However, rates of lung, breast and colorectal cancers are rising in low and middle income countries. This is due to increased risk of smoking, excess body weight, physical inactivity, and changing reproductive patterns. In addition, these countries also bear a disproportionate burden of infection-related cancers such as cervix, liver and stomach.[39]

Conclusion

The incidence and mortality rates of cancer in the United States have been falling over the last few years. This is largely due to appropriate and timely screening, prevention and better treatment. Despite this downward trend, disparities persist among the various ethnic and racial groups in the United States. The disparities can be minimized or eliminated by encouraging equitable distribution and utilization of resources. A sincere commitment by individual governments, international agencies, donors and the private sector will be required to reduce the burden of cancer globally.

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Key Points

1. In the U.S., the life time risk of developing cancer is about 1 in 2 in men and 1 in 3 in women. Liver cancer is increasing among all population groups.
2. World Cancer Research Fund estimates that about 20% of all cancers diagnosed in the U.S. are related to body fatness, physical inactivity, excess alcohol consumption, and/or poor nutrition.
3. There was a decline in breast and cervical cancer screening between 2008 and 2013. However, there was significant increase in colorectal cancer screening during the same period.
4. Disparities in cancer incidence and mortality not fully explained by correlations of race and lower economic status (SES), or minority race and insurance status.
5. The incidence and mortality rate of cancer is dropping in Western countries through decreasing prevalence of known risk factors, early detection, and improved treatment.

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Figure 1. Cancer incidence 2002 to 2011
From National Cancer Institute. Available at: https://www.cancer.gov/.

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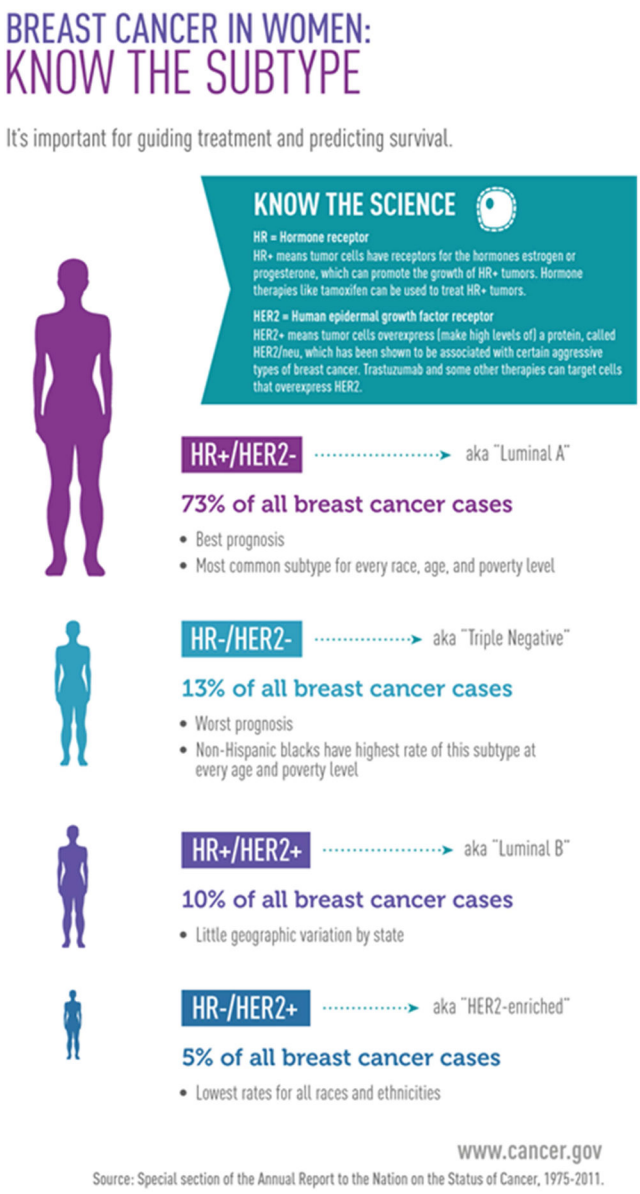

Figure 2. Breast Cancer subtypes

From National Cancer Institute. Available at: https://www.cancer.gov/.

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Table 1

Cervical, Breast and Colorectal Cancer Screening 2008 to 2013

Race/Ethnicity	Cancer Type					
	Breast		Cervix		Colorectal	
	2008	2013	2008	2013	2008	2013
Total	73.7	72.6	84.5	80.7	52.1	58.2
Asian	76.2	72.2	71.5	70.5	47.5	50.6
Black or African American	76.5	72.9	86.1	82.2	48.0	59.1
White	73.3	72.6	85.1	81.4	53.3	58.6
Hispanic or Latino	68.3	66.7	81.3	77.1	34.9	43.0

Data from National Health Interview Survey (NHIS), Centers for Disease Control and Prevention, National Center for Health Statistics (CDC/NCHS).