# Cancer: An Overview

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**Abstract:** Now a day's cancer is the most prevalent life threatening disease which is spreading because of the lifestyle we are living. Cancer is due to uncontrolled growth of cell which can be cured if diagnosed in early stage of life. Treatment of cancer depends on the various internal and external factors causing cancer. Cancer is screened by different screening test and a number of treatments are now available these days such as gene therapy, chemotherapy, surgery, radiation therapy, immunotherapy etc. In future up to 2030 around 22.2 million cases are expected to be diagnosed for cancer.

**Key words:** Cancer · Carcinogens · Prevalence

## INTRODUCTION

Cancers are a group of diseases characterized by uncontrolled growth and spread of abnormal cells. If the spread of cancer cells this stage is known as metastasis is not controlled, it can result in death. Cancer is caused by many external factors (tobacco, chemicals, radiation and infectious organisms) as well as some internal factors (inherited mutations, hormones, immune conditions and random mutations). The causes of cancer are diverse, complex and only partially understood. Many things are known to increase the risk of cancer, including dietary factors, certain infections, lack of physical activity, obesity and environmental pollutants [1]. These factors may act together to initiate or promote carcinogenesis in human body and thus cancer is leading cause of death.

Cancer has become one of the causes of death in India. It is estimated that there are nearly 2 to 2.5 million cancer cases at any given point of time. Over 7 lakhs new cases and 3 lakhs Deaths occur annually due to cancer. Nearly 15 lakh patients require facilities for diagnosis, treatment and follow up at a given time [2].

**Carcinogens:** Carcinogens are a class of substances that are directly responsible for damaging DNA, promoting or aiding cancer. Tobacco, asbestos, arsenic, radiation such as gamma and x-rays, the sun and compounds in car exhaust fumes are all examples of carcinogens. When our bodies are exposed to carcinogens, free radicals are formed that try to steal electrons from other molecules in the body. Theses free radicals damage cells and affect their ability to function normally [3].

**Prevalence of Cancer All over the World:** Worldwide Population Measures and Cancer Incidence and Mortality, Regions of the World, Estimates between 2005 and 2010.

An estimated 12.66 million people were diagnosed with cancer across the world in 2008 (Table 1) [4]. This equates to around 188 cases for every 100,000 people (using the crude rate). The number of new cases ranged from 67,000 in Middle Africa to 3.72 million in Eastern Asia. As expected from the size of Asia's population, the majority of cases (48%) occurred there [4, 5]. Just four cancer sites – lung, female breast, colorectum and stomach – accounted for two-fifths (41%) of the world's total (Figure One)[4]. The most common cancer sites in the UK are breast, lung, colorectum and prostate; together, these sites accounted for more than half (54%) of the UK's total in 2008 [4].

Cancer incidence worldwide is more than a fifth higher in men than in women, with World age-standardized incidence rates of 204 and 165 per 100,000, respectively, in 2008 [4, 6]. Male incidence rates vary almost four-fold across the different regions of the world; in 2008, rates ranged from 88 per 100,000 in Middle Africa to 334 and 335 per 100,000 in Northern America and Western Europe, respectively. There is slightly less

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Table 1: Prevalence of Cancer All Over World

| | Population (2008 estimates [total]) (2010 estimates [by age]) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Total (thousands) | Under 15 | Over 60 | Years of Life Expectancy (2005-2010 estimates) | Number of New Cases of Cancer* (2008 estimates) | % of | Number of Cancer Deaths* (2008 estimates) | % of |
| Africa | 987092 | 40% | 5% | 54 | 715,571 | 6 | 541,779 | 7 |
| East Africa | 310570 | 44% | 5% | 53 | 221,076 | 2 | 173,676 | 2 |
| Middle Africa | 122,501 | 45% | 5% | 48 | 66,895 | 1 | 53,229 | 1 |
| Northern Africa | 205,814 | 31% | 7% | 68 | 164,350 | 1 | 120,801 | 2 |
| Southern Africa | 56,936 | 31% | 7% | 52 | 79,179 | 1 | 54,818 | 12 |
| Western Africa | 291,270 | 43% | 5% | 51 | 184,071 | 1 | 139,255 | 54 |
| Asia | 4,075,309 | 26% | 10% | 69 | 6,092,359 | 48 | 4,072,332 | 32 |
| South-Central Asia | 1,728,752 | 31% | 7% | 64 | 1,423,213 | 11 | 979,914 | 7 |
| Eastern Asia | 1,546,825 | 19% | 14% | 74 | 3,720,658 | 29 | 2,440,351 | 13 |
| South-Eastern Asia | 575,626 | 27% | 9% | 70 | 725,446 | 6 | 501,046 | 2 |
| Western Asia | 224,106 | 32% | 7% | 71 | 223,042 | 2 | 151,021 | 2 |
| Europe | 731,568 | 15% | 22% | 75 | 3,208,882 | 25 | 1,715,240 | 23 |
| Central and Eastern Europe | 293,488 | 15% | 19% | 69 | 983,408 | 8 | 626,007 | 8 |
| Northern Europe | 97,918 | 17% | 23% | 79 | 482,080 | 4 | 242,422 | 3 |
| Southern Europe | 152,316 | 15% | 24% | 80 | 713,401 | 6 | 382,773 | 5 |
| Western Europe | 187,846 | 16% | 24% | 80 | 1,029,993 | 8 | 464,038 | 6 |
| America | 384,892 | 27% | 10% | 73 | 650,097 | 5 | 385,881 | 5 |
| South America | 345,053 | 20% | 18% | 79 | 1,603,870 | 13 | 638,328 | 8 |
| Northern America | 34,937 | 24% | 15% | 76 | 135,864 | 1 | 55,072 | 1 |

Table 2: Estimated Cases for Childhood and Adolescent Cancers, US, 2014

| Children (Ages 0-14) | Adolescents (Ages 15-9) |
|---|---|
| Acute lymphocytic leukemia | Hodgkin lymphoma |
| 2,670 (26%) | 800 (15%) |
| Brain and CNS | Thyroid carcinoma |
| 2,240 (21%) | 570 (11%) |
| Neuroblastoma* | Brain and CNS |
| 710 (7%) | 540 (10%) |
| Non-Hodgkin lymphoma | Testicular germ cell tumors |
| 620 (6%) | 430 (8%) |
| Wilms tumor | Non-Hodgkin lymphoma |
| 510 (5%) | 420 (8%) |
| Acute myeloid leukemia | Acute lymphocytic leukemia |
| 500 (5%) | 410 (8%) |
| Bone tumors† | Bone tumors† |
| 450 (4%) | 370 (7%) |
| Hodgkin lymphoma | Melanoma |
| 380 (4%) | 310 (6%) |
| Rhabdomyosarcoma | Acute myeloid leukemia |
| 340 (3%) | 230 (4%) |
| Retinoblastoma | Ovarian germ cell tumors |
| 280 (3%) | 110 (2%) |
| All sites | All sites |
| 10,450 | 5,330 |

Estimates are for malignant cancers only and are rounded to the nearest 10. In addition, 730 children and 630 adolescents will be diagnosed with benign and borderline brain tumors in 2014.

CNS = central nervous system

* Includes ganglioneuroblastoma.

variation in female incidence rates across the different regions of the world (almost three-fold); in 2008, rates ranged from 97 per 100,000 in Middle Africa to 274 per 100,000 in Northern America.

**Types of Cancer:**
**On the Basis of Tissue Effected:**

- Carcinomas are characterized by cells that cover internal and external parts of the body such as lung, breast and colon cancer.
- Sarcomas are characterized by cells that are located in bone, cartilage, fat, connective tissue, muscle and other supportive tissues.
- Lymphomas are cancers that begin in the lymph nodes and immune system tissues.
- Leukemia's are cancers that begin in the bone marrow and often accumulate in the bloodstream.
- Adenomas are cancers that arise in the thyroid, the pituitary gland, the adrenal gland and other glandular tissues [3].

**On the Basis of Organ Effected:**

- Colorectal cancer
- Lung Cancer
- Liver Cancer
- Stomach Cancer
- Cervical Cancer
- Bladder Cancer
- Esophageal Cancer
- Non-Hodgkin Lymphoma
- Cancers of the Lip and Oral Cavity
- Nasopharyngeal Cancer
- Kaposi Sarcoma

**Symptoms:** Symptoms of cancer depend on the type and location of the cancer. For example, lung cancer can cause coughing, shortness of breath, or chest pain. Colon cancer often causes diarrhea, constipation and blood.

Some cancers may not have any symptoms at all. In certain cancers, such as pancreatic cancer, symptoms often do not start until the disease has reached an advanced stage.

The following symptoms can occur with most cancers:

- Chills
- Fatigue

- Fever
- Loss of appetite
- Malaise
- Night sweats
- Weight loss
- Thickening or lump in the body
- Cough or hoarseness that does not go away
- Obvious change in a wart or mole
- Changes in bowel or bladder habits
- Unexplained bleeding or discharge
- Any sore that does not heal
- Unusual upset stomach or difficulty
- Swallowing [7,8]

**Causes:** Cancer grows out of normal cells in the body. Normal cells multiply when the body needs them and die when the body doesn't need them. Cancer appears to occur when the growth of cells in the body is out of control and cells divide too quickly. It can also occur when cells forget how to die.

There are many different kinds of cancer. Cancer can develop in almost any organ or tissue, such as the lung, colon, breast, skin, bones, or nerve tissue. There are many causes of cancer, including:

- Benzene and other chemicals
- Drinking excess alcohol
- Environmental toxins, such as certain poisonous mushrooms and a type of poison that can grow on peanut plants (aflatoxins)
- Excessive sunlight exposure
- Genetic problems
- Obesity
- Viruses [7, 8].

**Screening:** The term screening refers to the regular use of certain examinations or tests in people who do not have any symptoms of cancer, but are at high risk for developing certain types of cancer. For many types of cancer, progress in the area of cancer screening has offered promise for earlier detection, which often results in higher cure rates [9].

**Types of Screening Tests:**

- Imaging Tests
- Laboratory Tests
- Other Testing Information

Table 3: Some of the Factors Causing Cancer

| Name of cancer | Causes |
|---|---|
| 1.Brain Cancer | Ionizing radiation [Strong], Chromium [Good], methylene chloride [Good] |
| 2. Melanoma | UV radiation [Strong] |
| 3. Thyroid Cancer | Ionizing radiation [Strong], ethylene thiourea (ETU) [Good] |
| 4. Bone Cancer | radium [Strong], Pesticides [Good] |
| 5.Colo-rectalCancer | 1,1-dichloroethane [Good], alachlor [Good], Aromatic amines [Good], Chlorination by-products [Good], Ionizing radiation [Good], Solvents [Good] |
| 6. Prostate Cancer | Agent Orange [Good], Aromatic amines [Good], methyl bromide [Good], Organ chlorine pesticides [Good], PAHs [Good], Pesticides [Good], Solvents [Good] |
| 7. Leukemia's | benzene [Strong], Ionizing radiation [Strong], Agent Orange [Good], carbon tetrachloride [Good], Chlorinated solvents [Good], Metal dusts [Good], Pesticides [Good], Secondhand smoke [Good], trichloroethylene (TCE) [Good] |
| 8. Liver Cancer | aflatoxin B1 (Aflatoxins) [Strong] androgens [Strong], ethyl alcohol (ethanol) [Strong], Hydrocarbons [Strong], N-nitrosodimethylamine [Strong], arsenic [Good], captafol [Good], PCBs [Good], thorium dioxide (Thorostat) [Good], trichloroethylene (TCE) [Good], vinyl chloride [Good] |

**Imaging Tests:**

**Mammograms***:* A fact sheet that defines screening and diagnostic mammograms and outlines mammography screening guidelines. Discusses the benefits and some potential harms of screening mammograms.

**Computed Tomography (CT):** Questions and Answers*:* A fact sheet that describes the CT scan procedure and technology and its uses in diagnosis and treatment.

**Laboratory Tests**

**Interpreting Laboratory Test Results:** A fact sheet that describes the role of screening and diagnostic laboratory tests. Includes a brief discussion of factors affecting the results.

**Pap and HPV Testing :** A fact sheet that describes cervical cancer screening, which includes the Pap test and HPV testing. The fact sheet includes information about cervical cancer screening guidelines.

**Prostate-Specific Antigen (PSA) Test:** A fact sheet that describes the PSA screening test for prostate cancer and explains the benefits and limitations of the test.

**Other Testing Information**

**Understanding Cancer Series: Gene Testing:** This tutorial illustrates what genes are, explains how mutations occur and are identified within genes and discusses the benefits of gene testing for cancer and other disorders.

**What You Need to Know About™ Cancer Index :**Learn the symptoms of cancer - and symptoms of many cancer types [10].

**Treatments:**

**Gene Therapy:** Several projects relating to gene therapy for cancer are in the works. One of these projects as explained in the Chinese Medical Journal (2002) involves a team of researchers from shanghai Second Medical University successfully inserting a gene into human tumor cells via a retrovirus [11]. Usually tumor cells contain antigens on its surface that can separate them from normal cells. Though analogous noncancerous cells also contain these antibodies, they do so on a much smaller level. Therefore, probability of the retrovirus attaching to a noncancerous cell is low in the presence of the cancer cells. If these cancer antigens are specific, a retrovirus can be modified to contain an antibody which will bind to the antigen, enabling the virus to lodge itself on the cell and inject its viral DNA into the cell [11]. The team inserted a functional tumor suppressor gene into the viral vector, which is then incorporated into the when the virus injected its DNA [11]. The tumor suppressor gene was taken in by the cell and included in its DNA allowing the cell to regain the function of self-regulation and apoptosis.

**Surgery:** Surgery can be used to diagnose, treat, or even help prevent cancer in some cases. Most people with cancer will have some type of surgery. It often offers the greatest chance for cure, especially if the cancer has not spread to other parts of the body. Learn more about surgery here.

**Chemotherapy:** Chemotherapy (chemo) is the use of medicines or drugs to treat cancer. The thought of having chemotherapy frightens many people. But knowing what chemotherapy is, how it works and what to expect can often help calm your fears. It can also give you a better sense of control over your cancer treatment.

**Radiation Therapy:** Radiation therapy uses high-energy particles or waves to destroy or damage cancer cells. It is one of the most common treatments for cancer, either by itself or along with other forms of treatment. Learn more about radiation therapy in this section.

**Targeted Therapy:** Targeted therapy is a newer type of cancer treatment that uses drugs or other substances to more precisely identify and attack cancer cells, usually while doing little damage to normal cells. Targeted therapy is a growing part of many cancer treatment regimens. Find out more about it here.

**Immunotherapy:** Immunotherapy is treatment that uses your body's own immune system to help fight cancer. Get information about the different types of immunotherapy and the types of cancer they are used to treat.

**Hyperthermia:** The idea of using heat to treat cancer has been around for some time, but early attempts had mixed results. Today, newer tools allow more precise delivery of heat and hyperthermia is being studied for use against many types of cancer.

**Stem Cell Transplant (Peripheral Blood, Bone Marrow and Cord Blood Transplants):** Here we offer a review of bone marrow transplants and other types of stem cell transplants that are used to treat cancer. We outline what a transplant is like for most people and discuss some of the issues that come with it.

**Photodynamic Therapy:** Photodynamic therapy or PDT is a treatment that uses special drugs, called photosensitizing agents, along with light to kill cancer cells. The drugs only work after they have been activated or "turned on" by certain kinds of light.

**Lasers in Cancer Treatment:** Lasers, which are very powerful, precise beams of light, can be used instead of blades (scalpels) for very careful surgical work, including treating some cancers.

**Blood Product Donation and Transfusion:** Transfusions of blood and blood products temporarily replace parts of the blood when a person's body can't make its own or has lost them from bleeding. Here, we describe blood and its components and why they are important. We also explain how blood is donated and transfused and how this relates to people with cancer [12].

**Cancer Statistics:** Data given for different types of cancer:

**Female Breast Cancer:** Breast cancer is the most frequently diagnosed cancer and the leading cause of cancer death in females worldwide, accounting for 23% (1.38 million) of the total new cancer cases and 14% (458,400) of the total cancer deaths in 2008. About half the breast cancer cases and 60% of the deaths are estimated to occur in economically developing countries. In general, incidence rates are high in Western and Northern Europe, Australia/New Zealand and North America; intermediate in South America, the Caribbean and Northern Africa; and low in sub-Saharan.

**Africa and Asia:** The factors that contribute to the international variation in incidence rates largely stem from differences in reproductive and hormonal factors and the availability of early detection services [13, 14]. Reproductive factors that increase risk include a long menstrual history, nulliparity, recent use of postmenopausal hormone therapy or oral contraceptives and late age at first birth [15]. Alcohol consumption also increases the risk of breast cancer [16, 17]. The breast cancer incidence increases observed in many Western countries in the late 1980s and 1990s Likely result from changes in reproductive factors including the increased use of postmenopausal hormone therapy) as well as an increased screening intensity [18].

Incidence rates in some of these counties, including the United States, United Kingdom, France, And Australia, sharply decreased from the beginning of the millennium, partly due to lower use of combined postmenopausal hormone therapy [19-24].

**Colorectal Cancer:** Colorectal cancer is the third most commonly diagnosed cancer in males and the second in females, with over 1.2 million new cancer cases and 608,700 deaths estimated to have occurred in 2008. The highest incidence rates are found in Australia and New Zealand, Europe and North America, whereas the lowest rates are found in Africa and have been decreasing in several Western countries, Center *et al.* [25] largely resulting from improved treatment and increased awareness and early detection, [21, 26-28] rates continue to increase in many countries with more limited resources and health infrastructure, particularly in Central and South America and Eastern Europe [25].

**Lung Cancer:** Lung cancer was the most commonly diagnosed cancer as well as the leading cause of cancer death in Males in 2008 globally. Among females, it was the fourth most commonly diagnosed cancer and the second leading cause of cancer death. Lung cancer accounts for 13% (1.6 million) of the total cases and 18% (1.4 million) of the deaths in 2008. In males, the highest lung cancer incidence rates are in Eastern and Southern Europe, North America, Micronesia and Polynesia and Eastern Asia, while rates are low in sub-Saharan Africa. In females, the highest lung cancer incidence rates are found in North America, Northern Europe and Australia/ New Zealand. Despite their lower prevalence of smoking (less than 4% adult smokers),

Mackay *et al.* [29] Chinese females have higher lung cancer rates (21.3 cases per 100,000 females) than those in certain European countries such as Germany (16.4) and Italy (11.4), with an adult smoking prevalence of about 20% [29]. The relatively high burden of lung cancer in women is thought to reflect indoor air pollution from unventilated coal-fueled stoves and from cooking fumes in China [30-32].

**Prostate Cancer:** Prostate cancer is the second most frequently diagnosed cancer and the sixth leading cause of cancer death in males, accounting for 14% (903,500) of the total new cancer cases and 6% (258,400) of the total cancer deaths in males in 2008. Incidence rates vary by more than 25-fold worldwide, with the highest rates recorded primarily in the developed countries of Oceania, Europe and North America, largely because of the wide utilization of prostate- specific antigen (PSA) testing that detects clinically important tumors as well as other slow-growing cancers that might otherwise escape diagnosis. In contrast, males of African descent in the Caribbean region have the highest prostate cancer mortality rates in the world, which is thought to reflect partly difference in genetic susceptibility [33-34].

**Cancers of the Lip and Oral Cavity:** An estimated 263,900 new cases and 128,000 deaths from oral cavity cancer (including lip cancer) occurred in 2008 worldwide. Generally, the highest oral cavity cancer rates are found in Melanesia, South-Central Asia and Central and Eastern Europe and the lowest in Africa, Central America and Eastern Asia for both males and females. Smoking, alcohol use, smokeless tobacco products and HPV infections are the major risk factors for oral cavity cancer, with smoking and alcohol having synergistic effects. [35-36]. The contribution of each of these risk factors to the burden varies across regions [36,37-40]. Worldwide, smoking

accounts for 42% of deaths from cancers of the oral cavity (including the pharynx) and heavy alcohol consumption for 16% of the deaths; the corresponding percentages in high-income countries are about 70% and 30%, respectively [41]. Smokeless tobacco products and betel quid with or without tobacco are the major risk factors for oral cavity cancer in Taiwan, India and other neighboring countries [37,43,44]. The rise in the incidence rate of oral cancer in Taiwan may have been in part due to the increased consumption of betel quid and alcohol [44].

**Prevalence of Cancer:** The Prevalence of a particular cancer is the number of persons in a defined population who have been diagnosed during a fixed time in the past with that type of cancer and who are still alive at the end of a given year. Usually given as a number and a proportion per 100,000 persons Almost 29 million people diagnosed with cancer within the five years previously were alive at the end of 2008.

Most were women after their breast cancer diagnosis (5.2 million), men and women after their colorectal cancer diagnosis (3.3 million) and men after their prostate cancer diagnosis (3.2 million) [45, 46].

**Future Trends:** As the world's population continues to grow and age, the burden of cancer will inevitably increase, even if current incidence rates remain the same. More than half of all cancers worldwide are already diagnosed in the developing countries and without intervention this proportion is predicted to rise in the coming decades [47].

It is estimated there will be almost 22.2 million new cases diagnosed annually worldwide by 2030. These projections are based on demographic changes in populations using UN figures along with crude assumptions about the likely trends in incidence rates for six cancers. Further details are available in the World Cancer factsheet [48].

Based solely on current estimated mortality rates for 2008 and population projections, it is estimated there will be over 13.2 million deaths from cancer [49].

In 2008, the World Health Organization (WHO) identified cancer as one of the four leading threats to human health and development (along with cardiovascular diseases, chronic respiratory diseases and diabetes). The WHO states that the global burden of cancer can be reduced and controlled by implementing three evidence-based strategies: preventing cancer from occurring in the first place, detecting cancer earlier and managing patients with cancer [50].

In September 2011, the United Nations General Assembly held a high-level meeting on non-communicable diseases to address the threat posed to low- and middle-income countries [51]. While it is clear that tackling cancer worldwide will remain one of the major challenges in the 21st century, this high-level meeting will finally put cancer on the global agenda, providing the biggest and best opportunity to drive forward major change in this area.

Recently in 2014, US-FDA committee members recommended detection of high risk HPV, as first line primary screening test for cervical cancer.

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