Cancer A Literature Overview

Dr. Galanki Vasantha1* Saragadam pooja pranathi 2 SSS Sri Poojitha3, Pyla yasvita4
1*Associate Professor, Vignan Institute of Pharmaceutical Technology Vishakapatnam.
2,3,4 IV B.Pharmacy students, Vignan Institute of Pharmaceutical Technology Vishakapatnam.

ABSTRACT
Cancer is a disease in which some of the body’s cells grow uncontrollably and spread to other parts of the body. Cancer can start almost anywhere in the human body, which is made up of trillions of cells. Cancer comes in many forms and types. Cancer is the collective name given to the disease where certain cells of the person’s body start dividing continuously, refusing to stop. The main thing that causes cancer is a substance we know as carcinogens. But how these develop or enters a person’s body will depend on many factors. Early diagnosis and immediate medical care are of utmost importance in cancer. When diagnosed in the early stages, then the treatment becomes easier and has more chances of success. All treatment plans, however, have various side-effects. And aftercare is one of the most important aspects of cancer treatment. The objective of the present review is to search types, causes, prevention, treatment and diagnostic methods of cancer and the incorporated information might be useful for the scientists to concentrate on the priority area of research yet to be discovered.

Keywords: Cancer, Malignancy, Treatment, Melanoma

INTRODUCTION
Cancer can take several forms, such as malignancy (malignancy tumours) or neoplasms (new growth). Despite the fact that there are many different types of cancer, they all arise due to the uncontrolled expansion of aberrant cells. Cancer is the second leading causative factor for death rate worldwide. Globally about 9.6 million deaths were estimated in cancer. The commonest cancers are prostate cancer (1.28 million), female breast cancer (2.09 million), colorectal cancer (1.1 million), stomach cancer (1.03 million) and non-melanoma skin malignancies (1.04 million). Cancer-related deaths, from most to least frequent, are due to lung cancer (1.76 million), colorectal cancer (862,000) and stomach cancer (783,000), liver cancer (782,000). Over 100 types of cancers affect humans. It was predicted by Global demographic characteristics that about 420 million new cases of cancer by 2025 annually, which means increasing cancer incidence in years.
CAUSES

1) **Diet**— Diet is considered to be responsible for one-third of all cancer cases in the United States. For most forms of cancer, the quarter of the population with the lowest dietary intake of fruits and vegetables has nearly twice the cancer incidence as the quarter with the greatest consumption (lung, larynx, oral cavity, esophagus, stomach, colon and rectum, bladder, pancreas, cervix, and ovary).

2) **Chemical or toxic compound exposures**: Benzene, asbestos, nickel, cadmium, vinyl chloride, benizidine, N-nitrosamines, tobacco or cigarette smoke (contains at least 66 known potential carcinogenic chemicals and toxins), asbestos, and aflatoxin.

3) **Ionizing radiation**: Uranium, radon, ultraviolet rays from sunlight, alpha, beta, gamma, and X-ray-emitting sources, and radiation from alpha, beta, gamma, and X-ray-emitting sources.

4) **Pathogens**: HPV, EPV (Epstein-Barr virus), hepatitis B and C, Kaposi's sarcoma-related herpes virus (KSHV), Merkel mobileular polyomavirus, Schistosoma spp., and Helicobacter pylori are the various microorganisms being investigated as in all likelihood culprits.

5) **Genetics**: Human genes have been related to a variety of particular malignancies, including: Breast, ovarian, colorectal, prostate, skin, and melanoma cancers are among the most common.

6) **Alcoholic beverages**: Inflammation of the liver, cirrhosis, and liver cancer are all possible side effects. Oral and esophageal cancers are both linked to alcohol use. Alcohol use has also been linked to breast cancer.

7) **Tobacco**: Smoking causes a lot of oxidative stress, and it includes a lot of mutagens and rodent carcinogens. The body's antioxidants are depleted by the oxidants in cigarette smoke (mostly nitrogen oxides).

TYPES

Cancers are divided into various types that are: 15

a) **Carcinoma**—carcinomas begin in the tissue or skin that covers the glands and the surface of internal organs. It develops into a solid tumour. Breast cancer, prostate cancer, colorectal cancer, and lung cancer are all types of cancer.
b) **Sarcomas**: Sarcomas begin in the connective and supportive tissues of the body. Nerves, tendons, joints, fat, blood vessels, bone, lymph vessels, muscles, and cartilage may all produce it.\(^{(16)}\)

c) **Leukemia's Symptoms**: Leukemia is a kind of blood cancer. It starts when healthy blood cells expand and alter uncontrolled. Acute myeloid leukaemia, acute lymphocytic leukaemia, chronic myeloid leukaemia, and chronic lymphocytic leukaemia are the four kinds of Lymphomas: Lymphoma is cancer that begins in the lymphatic system and it is a network of glands and vessels that helps to fight with infection\(^{(17)(18)}\) Hodgkin lymphoma and Non-Hodgkin lymphoma.\(^{(19)}\)

e) **Cancers of the Central Nervous System**: "Brain and spinal wire cancers," further to primary CNS lymphomas, gliomas, pituitary adenomas, primitive neuro-ectodermal tumours, meningiomas, and vestibular schwannomas.\(^{(20)}\)

f) **Multiple Myeloma**: Multiple myeloma is an immune mobileular malignancy that starts off evolved in plasma cells.\(^{(21)}\) Myeloma cells, which is probably plasma cells, accumulate with inside the bone marrow and reason malignancies. Plasma mobileular myeloma and Kahler disease are terms for the same thing.\(^{(22)}\)

g) **Melanoma**: Melanoma begins off evolved in cells that emerge as melanocytes.\(^{(23)}\) These are specialised cells that produce melanin, the pigment that gives the pores and pores and skin its colour. Melanomas are most typically positioned on the pores and pores and skin, despite the fact that they can also appear in distinct pigmented tissues, which encompass the eye.\(^{(24)}\)

h) **Tumors of Other Types: Germ Cell Tumors**: These are tumours that begin in the cells that produce eggs or sperm.\(^{(25)}\) This can happen anywhere in the body and might be cancerous or benign. Neuroendocrine Tumors: Neuroendocrine tumours are made up of cells that release hormones into the bloodstream in response to nerve signals.\(^{(26)}\) It is made up of cells that release hormones into the bloodstream in response to nerve signals. These tumours can produce higher-than-normal levels of hormones, resulting in a variety of symptoms. It might be benign or cancerous.\(^{(3)}\)
Table 1: Ten types of cancers and their sample sizes.

<table>
<thead>
<tr>
<th>Cancer Type</th>
<th>Cancer Abbreviation</th>
<th>Cancer Name</th>
<th>Sample size</th>
<th>Number of training samples</th>
<th>Number of test samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BLCA</td>
<td>Bladder Urothelial Carcinoma</td>
<td>127</td>
<td>102</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>BRCA</td>
<td>Breast invasive carcinoma</td>
<td>747</td>
<td>598</td>
<td>149</td>
</tr>
<tr>
<td>3</td>
<td>COAD/READ</td>
<td>Colon adenocarcinoma and Rectum adenocarcinoma</td>
<td>464</td>
<td>371</td>
<td>93</td>
</tr>
<tr>
<td>4</td>
<td>GBM</td>
<td>Glioblastoma multiforme</td>
<td>215</td>
<td>172</td>
<td>43</td>
</tr>
<tr>
<td>5</td>
<td>HNSC</td>
<td>Head and Neck squamous cell carcinoma</td>
<td>212</td>
<td>170</td>
<td>42</td>
</tr>
<tr>
<td>6</td>
<td>KIRC</td>
<td>Kidney renal clear cell carcinoma</td>
<td>454</td>
<td>363</td>
<td>91</td>
</tr>
<tr>
<td>7</td>
<td>LUAD</td>
<td>Lung adenocarcinoma</td>
<td>237</td>
<td>190</td>
<td>47</td>
</tr>
<tr>
<td>8</td>
<td>LUSC</td>
<td>Lung squamous cell carcinoma</td>
<td>195</td>
<td>156</td>
<td>39</td>
</tr>
<tr>
<td>9</td>
<td>OV</td>
<td>Ovarian serous cystadenocarcinoma</td>
<td>412</td>
<td>330</td>
<td>82</td>
</tr>
<tr>
<td>10</td>
<td>UCEC</td>
<td>Uterine Corpus Endometrioid Carcinoma</td>
<td>404</td>
<td>323</td>
<td>81</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>3467</td>
<td>2775</td>
<td>692</td>
</tr>
</tbody>
</table>

(adapted from 28)
Growth of Cancer Cells

(A)
Cancer progenitor cells and progression of metastatic cancer. a: hexagons with yellow dots represent normal cells; b: faded green, distorted hexagons with yellow dots represent cancer progenitor cells; c: progenitor cells are increasing in number; d: star-like brown cells represent the metastatic form of cancer cells, a mixed population of progenitor and adult cells; e: overgrowth of metastatic cells; f: both metastatic and adult progenitor cells leave site. Progression: Cancer progenitor cells develop from normal cells (a to b); After growth (b to c), they undergo EMT (c to d); Differentiation signals decrease and growth signals increase, producing a combination of progenitor and adult metastatic cancer cells (d to e); After the outgrowth of metastatic cells, translocation to a distant location occurs (e to f); (B) Model for the development of grade-specific cancers. Cancer progenitor cells pause at each grade of differentiation and proliferate from that grade while maintaining the ability to differentiate further; and (C) Model of the development of grade-specific cancers. Some cells progress further through differentiation than others, stop differentiation, and then proliferate, giving rise to clonal populations of cancer cells at distinct grades.\(^{26}\)

Figure 1
(Adapted from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3821660/figure/f1-ijms-14-21087/)
Cancer Diagnosis

Cancer may be detected at some stage in a bodily examination: The presence of a lump or tumour, a alternate in pores and skin colour, or the growth of an organ are all symptoms and symptoms that something is wrong. Urine and blood tests, together with a complete blood picture, are examples of laboratory testing. Computerized Tomography (CT) scan, Bone scan, Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET) scan, ultrasound and X-ray, and Biopsy are a number of the imaging strategies available. (29)

Lab tests employ urine, blood, and other bodily fluids to determine the compounds that cause cancer in our bodies, such as low and high quantities of substances that can cause cancer. Malignancy cells and other cells develop tumour markers in response to cancer. (30) Because lab tests alone do not provide a reliable diagnosis of cancer, a clinician must supplement these results with other cancer testing. (31)

Imaging Tests: In this test, an photo of the vicinity within the frame is made, which aids in figuring out whether or not or now no longer a tumour is present. It consists of exams such as: (32)

CT Scanning: X-ray device linked to the laptop are utilised to provide three-dimensional pics of your organs from numerous angles during this examination. (33) Before scanning, you could want to use a dye or different evaluation fabric to make it less complicated to perceive positive frame components within the photo. The picturegraph turned into taken through journeying across the frame within the donut-fashioned scanning device. (34)

MRI: This scan may also be used to build a detailed view of the human organs by capturing photos in slices. (35) The slices are taken using radio waves and a strong magnet. This scan clearly distinguishes between sick and healthy tissues. Before an MRI scan, you must take a dye for the subsequent scan, just as you do before a CT scan. (36)

Nuclear Scan Because radioactive material is utilised to capture pictures of bodily organs, the nuclear scan is also known as a radionuclide scan. (37) A little quantity of radioactive material in the injectable form known as a tracer is required for a CT and MRI scan. By passing via the blood, it gathers in the bones. It contains two scans: a pet scan and a bone scan. (38)

Bone Scan: It's used to screen for bone injury or abnormalities. (39) Before the scan, the patient must inject a tiny amount of radioactive material into his or her vein. The radioactive material passes through the blood and settles in an abnormal location of the bones. (40) The substance where it gathers was imaged using a special scanner, and these locations are known as hot spots. (41)

Pet Scan Because cancer cells require more glucose than healthy cells, a radioactive glucose substance is employed in this scan to provide a 3-D image of bodily organs. (42)

Ultrasound: Ultrasound uses high-energy sound waves to echo tissues because individuals cannot hear these vibrations. (43) The computer utilises these echoes to construct a sonogram, which is an image of bodily organs created by a device called a transducer moving slowly over the skin. (44)

X-rays In an X-ray scan, low-dose x-rays are used to make an image of bodily organs, and you must remain motionless and hold your breath for 1-2 seconds while the beam is directed on the body part. (3)

Fluorescence lifetime imaging (FLI):-Women with breast cancer can benefit from fluorescence lifetime imaging (FLI). (45) A scan will reveal whether you have proteins that aid in the growth of cancer cells. If you do, you may be able to recommend a therapy that can slow or stop the development. (46)

Biopsies are used in oncology to diagnose cancer, determine tumour histology, and confirm the existence of metastases for staging. A biopsy sample can be collected in a number of ways:

- Using the Needle
- Endoscopy is a procedure that allows you to see within your body.
Surgical Procedures\(^{(47)}\)

**CANCER TREATMENT**

**NANOMEDICINE**

Nanoparticles are small systems (1–1,000 nm in size) with peculiar physicochemical properties due to their size and high surface-to-volume ratio.\(^{(48)}\)

Nanoparticles can be targeted in one of these ways passive or active.\(^{(50)}\)

Gold nanoparticles have been studied as a therapeutic drug delivery method, in photodynamic therapy for cancer treatment, and in diagnostics to identify biomarkers for various disorders.\(^{(48)}\)

**EXTRACELLULAR VESICLES FOR CANCER TREATMENT**

Exosomes (50-100 nm in diameter) and ectosomes are two forms of extracellular vesicles (also called microvesicles, 100-1000 nm in diameter) \(^{(51)}\)

Exosomes, which are potent extracellular nanovesicles secreted by nearly all types of live cells, are thought to be the communication engines (messengers) that govern and modify physiological pathways within target cells\(^{(52)}\)

**NATURAL ANTIOXIDANTS IN CANCER THERAPY**

Quercetin is a flavonoid with antioxidant, anti-inflammatory, anti-allergic, antiviral, and anti-cancer properties\(^{(53)}\). Breast, lung, nasopharyngeal, kidney, colorectal, prostate, pancreatic, and ovarian cancers are
among the tumours that quercetin has been shown to suppress. Because quercetin is cytotoxic to cancer cells through a variety of methods while causing no damage to healthy cells, it has been proposed as a potential therapy for ovarian cancer\(^{(54)}\). Berberine is an isoquinoline alkaloid discovered in Berberis species. It reduces drug resistance in cancer therapy and improves tumour suppression in part by triggering autophagy and cell cycle arrest\(^{(55)}\).

**GENE THERAPY FOR CANCER TREATMENT**

One possible use is treating genetic illness by introducing a healthy gene into cells of people who have a "malfunctioning" gene. The additional genetic information might allow these cells to operate properly, thereby reducing or eliminating the disease's consequences.\(^{(56)}\) Immunotherapy stimulates the immune system to kill cancer cells using genetically engineered cells and viral particles\(^{(57)}\). Oncolytic virotherapy, which employs viral particles that proliferate within cancer cells to kill them, is a new therapeutic option that has a lot of potential, especially for metastatic malignancies. Gene transfer is a novel therapy method that involves introducing new genes into a malignant cell or surrounding tissue in order to trigger cell death or delay cancer progression.\(^{(58)}\)

**STEM CELL THERAPY**

Proliferation, migration, and differentiation capacities of stem cells from various sources vary, determining their anti-tumor therapeutic applications.\(^{(59)}\) In multilineage differentiation, stem cells have the ability to self-renew and have a high replicative potential\(^{(60)}\).

**Type of Stem Cells for Cancer Treatment**

- Pluripotent Stem Cells (PSCs)
- Adult Stem Cells (ASCs)
- Cancer Stem Cells (CSCs)
Drug-Free Treatments

Yoga, massage, meditation, and hypnosis are examples of non-drug therapies that might help you live a better life while undergoing cancer treatment. Some can help you feel better by relieving tension.\(61\)

Night sweats, nausea, fatigue, hot flashes, depression, and pain can all be relieved by acupuncture, an ancient Chinese treatment that uses small needles inserted beneath the skin.\(62\)

Lifestyle Changes

Working exercise can lower your chances of developing 13 different malignancies. It will assist if you walk for 30 minutes during your lunch break every day.\(63\)

Chemotherapy Drugs and treatment

Chemotherapy is the use of chemicals or medications to kill cancer cells, with systemic effects.\(64\) Based on their modes of action, anticancer medications can be divided into numerous categories, which include the following: a) alkylating agents, which damage DNA; b) anti-metabolites, which replace the normal building blocks of RNA and DNA; c) antibiotics, which interfere with DNA replication enzymes; d) topoisomerase inhibitors, which inhibit either topoisomerase I or II, which are enzymes involved in unwinding DNA during replication and transcription; e) mitotic inhibitors, which inhibit mitosis and cell division; and f) corticosteroids.\(Table 2\).

Table 2: Current regimen of treatment for lung cancer.

<table>
<thead>
<tr>
<th>Drug name</th>
<th>Generic name</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xeloda</td>
<td>Capecitabine</td>
<td>anti-metabolites</td>
</tr>
<tr>
<td>Avastin</td>
<td>Bevacizumab</td>
<td>VEGF/VEGFR inhibitors</td>
</tr>
<tr>
<td>Tarceva</td>
<td>Erlotinib</td>
<td>EGFR inhibitors</td>
</tr>
<tr>
<td>Cytoxan</td>
<td>Cyclophosphamide</td>
<td>alkylating agents</td>
</tr>
<tr>
<td>Taxol</td>
<td>Paclitaxel</td>
<td>mitotic inhibitors</td>
</tr>
<tr>
<td><strong>Drug</strong></td>
<td><strong>Chemical Name</strong></td>
<td><strong>Class</strong></td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>Taxotere</td>
<td>Docetaxel</td>
<td>mitotic inhibitors</td>
</tr>
<tr>
<td>Gemzar</td>
<td>Gemcitabine</td>
<td>antimetabolites</td>
</tr>
<tr>
<td>Erbitux</td>
<td>Cetuximab</td>
<td>EGFR inhibitors</td>
</tr>
<tr>
<td>Alimta</td>
<td>Pemetrexed</td>
<td>antimetabolites</td>
</tr>
<tr>
<td>Navelbine</td>
<td>Vinorelbine</td>
<td>mitotic inhibitors</td>
</tr>
<tr>
<td>Platinol</td>
<td>Cisplatin</td>
<td>alkylation agents</td>
</tr>
<tr>
<td>Trexall</td>
<td>Methotrexate</td>
<td>antimitobolites, antipsoriatics, antirheumatics</td>
</tr>
<tr>
<td>Ethyol</td>
<td>Amifostine</td>
<td>antineoplastic detoxifying agents</td>
</tr>
<tr>
<td>Iressa</td>
<td>Gefitinib</td>
<td>EGFR inhibitor</td>
</tr>
<tr>
<td>Neosar</td>
<td>Cyclophosphamide</td>
<td>alkylation agents</td>
</tr>
<tr>
<td>Platinol-AQ</td>
<td>Cisplatin</td>
<td>alkylation agents</td>
</tr>
<tr>
<td>Photofrin</td>
<td>Porfimer</td>
<td>miscellaneous antineoplastics</td>
</tr>
<tr>
<td>Onxol</td>
<td>Paclitaxel</td>
<td>mitotic inhibitors</td>
</tr>
</tbody>
</table>
PREVENTION OF CANCER

For more than a quarter-century, prevention has been the primary cancer control goal, yet the promise of prevention has mostly gone unmet\(^{(65)}\)

The interaction of Genes and Environment

The potential for understanding cancer aetiology through genetic association and gene–environment research is enormous.\(^{(66)}\) Good research design and methodological rigour, on the other hand, are critical. Studies must be big, reproducible, and well-powered, with proper case and control selection procedures, in order to analyse these relationships and interactions effectively and accurately.\(^{(67)}\) The objective of identifying high-risk people for preventive measures has some similarities to genomics research and its promises of tailored prevention—the goal being to identify individuals with susceptibility-predictive genetic markers.\(^{(68)}\) Although over 100 genes have been identified as causing Mendelian hereditary cancer syndromes, they only account for a small portion of the family clustering of prevalent malignancies. In the overall population, the higher family relative risk of cancer must mostly be due to low-risk genes\(^{(69)}\)

Attributable Risk Estimates

More than three decades ago, the Office of Technology Assessment of the United States Congress commissioned two eminent British epidemiologists, Sir Richard Doll and Sir Richard Peto, to review the evidence on ways to avoid cancer and quantify the reductions in death rates that could be achieved by preventive measures taken over the next one to two decades.\(^{(70)}\) Cancer has multiple causes that interact with each other at different points in life; the sum of attributable fractions of causes for cancer is not 100%; rather, the sum is infinite\(^{(71)}\) Cancers are multifactorial with multiple etiologic pathways; prevention may be possible by focusing on several different factors at multiple times throughout one's lifetime.\(^{(72)}\)

Clinical Dimensions of Cancer Prevention

Because cancer prevention is linked to other components of the medical care system through this cancer control continuum, preventive health services such as breast or colon cancer screening, tobacco cessation counselling, and vaccination against infectious diseases have gained prominence since the mid-1970s (e.g., Tamoxifen, Raloxifene).\(^{(73)}\) The health-care system, on the other hand, is more likely to affect cancer incidence than morbidity and survival.\(^{(74)}\) Furthermore, considering disease prevention as part of a continuum with illness diagnosis and treatment presents a paradox: if effective, cancer prevention would stop the later phases of the disease.\(^{(75)}\)

Definition of Modifiable Risk Factor

Many individual risk variables (e.g., sex, age, genetic inheritance, and occasionally education and money) are seen as fixed and not adjustable.\(^{(76)}\) Typically, modifiable or preventable cancer risk factors are divided into two categories: lifestyle and environment. Individual behaviours such as tobacco smoking, poor diet, and physical inactivity are often described as lifestyles.\(^{(77)}\) At the societal level, factors such as environmental contamination, unsafe conditions for physical activity, and food deserts, where people have limited access to fruits and vegetables, are all factors to consider (a factor that disproportionately affects low socioeconomic [SES] populations).\(^{(78)}\) Tobacco use is an example of a risk factor that is both behavioural and societal, necessitating separate prevention strategies. Community-based interventions (e.g., raising
tobacco prices, utilising mass media to counter tobacco industry promotion in conjunction with other interventions, restricting minors' access to tobacco products) are successful techniques for lowering the proportion of adolescents who start smoking.  

**Social Determinants of Cancer**  
Because health is significantly connected with educational level and SES, several important organisations have called for a focus on social determinants of health. The "upstream" social determinants of illness and health include the neighbourhood circumstances, environmental exposures, social and occupational possibilities, and personal resources that establish the context in which health decisions and behaviours are made. Damage to organ systems or genes is a "downstream" result of such socioeconomic determinants. Breast and skin cancer are significant exceptions, although when those cancer forms are identified in low-SES individuals, they have dismal survival rates.

**When to Take Action**  
Harm reduction (reducing exposure to known cancer causes), therapeutic treatments (vaccines, chemoprevention), and health promotion (promoting habits linked to lower cancer risk) have all been used in the fight against cancer. Although much more research on chemical exposures and other aspects of cancer prevention is needed before scientists, policymakers, and public health organisations can intervene on potentially harmful or protective factors, scientists, policymakers, and public health organisations must consider the thresholds of evidence that they deem necessary. Many areas of preventative research have grappled with issues regarding the degree of proof required for action. Individual behaviours and activities may influence personal exposures, environmental degradation, and society changes, which could improve prevention approaches. Similarly, a deeper knowledge of how social, economic, and environmental factors impact, encourage, or constrain "lifestyle" and other behaviours at various periods of life is required. The National Prevention Strategy, which was just issued, intends to raise the percentage of Americans who are healthy at every stage of life by integrating actions across many settings, and it presents a particularly applicable approach for cancer prevention.

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