**Pharma Vision: Research and Reviews**

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# Recent Advancements in Cancer Therapies

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Article Information

**Article history**
**Received** February 08, 2023
**Accepted** February 22, 2023
**Published** March 4 2023

**Keywords**
Cancer, global statistics, recent developments, recent advancements

**Abstract**

Cancer is a disease where cells undergo abnormal division and can extend adjoining organs. In recent years cancer is regarded as the leading cause of death in many underdeveloped and developing countries. Hence, there is a constant need of developing newer approaches to cure cancer. Many industries and institutes are striving hard to overcome the resistance to many therapies and prevent the cancer relapse. This mini review consists of the global statistics and potential causes of cancer along with the recent developments in the field of cancer treatment.

## 1. Introduction:

Malignancy is a group of diseases which can initiate in any part within the body. It occurs when anomalous cells multiply uncontrollably, traverse their physical limits and extend to adjacent organs. Metastasis is a crucial contributor to mortalities due to cancer. The phrases "neoplasm" and "malignant tumors" are frequently employed to represent cancer.

Approximately 9.6 million casualties were due to malignancy in 2018, making it one of the most fatal diseases across the globe. The most prevalent tumors in males include pulmonary, prostate, colorectal, stomach, and hepatic cancer while those in females include breast, colorectal, pulmonary, cervical, and thyroid cancer [1].

The physical, psychological, and economic effect that cancer has on patients, family members, societies, and healthcare systems in the world keeps advancing. Numerous under-developed and developing country's healthcare systems are not well equipped to withstand this impact, and several patients have deficient access to instantaneous, efficacious prognosis and therapies. Due to readily accessible and timely diagnosis, sophisticated therapy, and survivorship caring, the mortality status of various types of cancer are decreasing in countries having robust medical services.

Whenever malignancy is detected in the initial phase, the patient is more responsive to appropriate therapies, increasing the likelihood of survival as well as reducing chances of mortality and treatment costs.

Early diagnosis is facilitated by two different techniques:

1. Rapid disease detection discovers symptoms of malignancy at the initial stage.
2. The goal of monitoring is to locate people who have deformity indicating a particular disease or pre-cancer but do not yet have any symptoms so that they can be quickly diagnosed and treated.

Surgical procedures, cancer medications, and/or radiation, either alone or in combination, are available as alternative treatments. Based on tumor kind, malignancy stage, clinical, and other characteristics, an interdisciplinary team of cancer experts suggests the ideal treatment strategy.

Patients' preferences should be taken into account, as well as the capabilities of the healthcare system. A crucial part of cancer treatment is palliative care, that aims to enhance the life experiences of patients and associated relatives. A comprehensive objective of keeping tabs on cancer relapse and identifying developing cancers, evaluating and treating the long-term adverse reactions of malignancy and/or accompanying therapy, and assistance to suffice the requirements of cancer survivors are all included in survivorship care.

## 2. GLOBAL STATISTICS OF CANCER [2,3]:

Cancer is the prevalent reason of casualties across the globe, comprising 10 million fatalities in 2020. Figure 1 and 2 gives the statistics of incidence and mortality rates of various cancers.

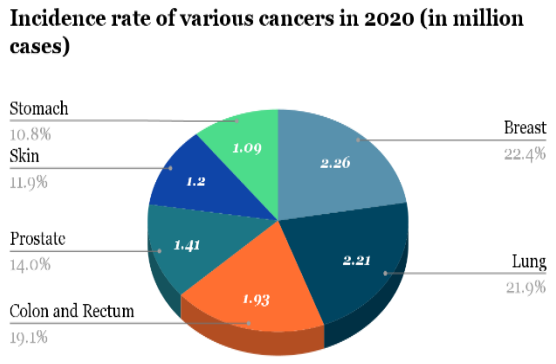


**Fig 1**: Incidence rate of cancers in 2020.

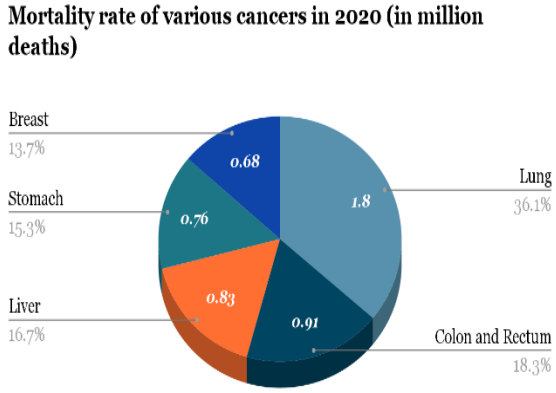


**Fig 2**: Mortality rate of cancers in 2020.

## 3. POTENTIAL CAUSES OF CANCER:

In a multilevel pathway that generally moves from a pre-malignant wound to a malignant tumor, the tumor progresses as the normal cells undergo a change to cancerous cells. The interaction of subject's genetics and predisposing factors of external agents which causes alterations include:

- Physical carcinogenic substances, like UV radiation and ionizing irradiation;
- Chemical carcinogenic substances, like alcohol, asbestos, smoke, and aflatoxin; and
- Biological carcinogenic substances, viral, bacterial, or parasitic infections.

The International Agency for Research on Cancer (IARC), a WHO division, monitors a taxonomy of cancer-causing substances.

Risk for many cancers increases with age due to inefficient cellular repair systems. This is the root-cause of the steep rise in incidence rates. Tobacco use, alcohol usage, poor diet, lifestyle factors, and pollution are the leading cause for malignancy and other related diseases.

Risk factors for cancer may comprise some chronic infectious diseases; underdeveloped and developing countries are majorly influenced by this. Internationally, malignant infections such as *H. pylori, human papillomavirus (HPV),* hepatitis B, hepatitis C, and *Epstein-Barr virus* were the cause of more than 13% of total cancer prognosis in 2018 [4].

Some types of HPV, hepatitis B and C viruses, increase the probability of hepatic and cervical cancer development, respectively. HIV infection remarkably elevates the chances of getting some cancers, including Kaposi sarcoma, and elevates the likelihood of developing cervical tumor.

Recently the medical industry has seen various developments in the field of cancer therapy. Here are some of the major developments in the past few years.

## 4. MAJOR DEVELOPMENTS IN THE FIELD OF CANCER THERAPY

### 4.1 Strategy to improve the success rate of immunotherapy [5]:

Researchers from University of Southampton discovered the justification of failure of immunotherapy treatment in some cancers. This breakthrough brings a ray of hope that many patients can survive cancer. Researchers along with Cancer Research UK, have identified a key cellular protein that prevents the treatment from working and crucially, have found a drug that can overcome it.

Immunotherapy acts by activating the immune system to identify and mitigate cancer cells and has great success in curing various cancers. Although, for many patients, the immunotherapy is unsuccessful due to a defensive barrier called cancer-associated fibroblasts (CAFs) present on the tumor into which the T-cells cannot penetrate.

### 4.2 Engineering immune cells to hunt down cancer [6]:

Adoptive cell treatment is a cancer treatment that uses immune system cells to get rid of tumor cells. This cutting-edge technique to treatment has shown to be, at least briefly, helpful for select cancers, such melanoma, however it is ineffective for the majority of tumors.

This research focuses on the immune cell subtype known as invariant natural killer T cells (iNKT cells). The cells are a regular component of the immunity system of the human body; they fight cancer cells by eliminating other immune cells which would promote the growth of the disease.

The application of nanotechnology to accurately transport the medicine to the tumor tissue increased the efficacy of this strategy by strengthening the anti-tumor effects of the therapy and enhancing the ability of iNKT cells to eradicate cancer cells.

### 4.3 Killing cells while they sleep to stop the spread of breast cancer [7]:

The researchers discovered that normal cells in the soft tissues produce more antioxidants, which are substances the body releases to shield the body from harm. Surprisingly, scientists discovered that the rise in antioxidants fosters the arrival of tumor cells and makes it challenging to eradicate them with chemotherapeutic agents.

In-depth study discovered that according to the flexibility of the tissue, molecules termed DRP1 and NRF2 were in charge of causing antioxidant production. According to the study's findings, inhibiting DRP1 and NRF2 may be a strategy for chemotherapeutically treating malignant cells that have migrated to unaffected areas of the body. Such Breast cancer discoveries are tremendously encouraging because they usher in a new era of therapies that may prevent the spread of metastatic or secondary breast cancer.

### 4.4 Promising results of Dostarlimab clinical trial [8]:

A small clinical trial conducted for Dostarlimab showed remarkable results in all the 18 patients suffering from rectal cancer. It was predicted that post- trial these patients will need to undergo surgery or radiation. But in physical examination through endoscopy, positron emission tomography scans, or MRI scans, the tumor growth was not detected. Also, all the did not show the common side effects like bowel, urinary, and sexual dysfunction which are more prevalent in conventional treatment such as chemotherapy, surgeries, and radiation. The researchers also stated that chemoradiotherapy or surgery was not applied to patients, and progression or recurrence had not been reported during follow-up post-trials.

### 4.5 Novel strategy for cancer patients offers a ray of hope [9]:

When other therapeutic options, like surgery, radiotherapy, or chemotherapy are unsuccessful, immunotherapy focuses on the immunity to locate and eradicate malignant cells and may save life. However, all patients are not benefited by it, and some tumors may become resistant to it. In the UK, oncologists have studied immunotherapy in conjunction with the ingenious investigational medicine guadecitabine that can prevent tolerance by malignant cells to immunotherapy. The patients who were not responding to any therapy sustained substantially better. More than 1/3rd of the enrolled patients in the preliminary phase I trial, the combined effect of the immunological drug pembrolizumab and the next-generation DNA

hypomethylating agent guadecitabine prevented the proliferation of the tumor. The two together might prove to be a potent new tool in the fight against various cancer types.

## 5. CONCLUSION:

This article provides a clear view of the global cancer statistics with respect to their incidence rates and mortality rates of various prominent cancers. This helps us to understand the severity of cancer progression across the globe. The article also put some light on the potential causes of cancer which can help us to take preventive measures at early stages. Further some of the research advancements in the field of cancer mitigation are also explored.

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