

## Review Article

# A Challenging Task: Prevention and Control of Cancer in India

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## Introduction

Cancer is one of the major causes of a few million mortalities in the world. Mortalities occur due to two reasons. They are morbidities and accidents. Accidents are almost unavoidable. Major morbidities or diseases may be of two types. They are Communicable Diseases (CDs) and Non-Communicable Diseases (NCDs) apart from disability and injury and other diseases including maternal, neonatal, and nutritional diseases [17,18]. Communicable diseases are those diseases that spread through the causative/infective organisms or pathogens, which are carried from one person to another directly or indirectly. Hence, they are also called infectious diseases. Due to various efforts taken by world countries and medical advancements, the seriousness of many CDs is slowly disappearing and less concentration is given on these CDs. Even COVID-19 itself is under control, and so no government has taken even the counting of patients infected by the Corona virus for the lost three or four years. Diseases like malaria and tuberculosis are almost on the verge of disappearance. Diseases like polio are completely eradicated. Poliovirus type 2 was certified eradicated even in 2015, and there has been no detection of poliovirus type 3 since 2012 and it was certified eradicated in 2019 [29]. But at the same time, some diseases like monkey pox, amoeba, dengue, nipa, and zika affect people here and there frequently.

## Abstract

Apart from disability and injury and other diseases, including maternal, neonatal, and nutritional diseases, there are Communicable Diseases (CDs) and Non-Communicable Diseases (NCDs) that cause mortalities. Globally, one of the major health threats under NCDs is cancer, which causes millions of deaths every year. While the occurrence of CDs is slowly increasing, the occurrence of NCDs is increasing very fast. There are many risk factors for cancer. Broadly, they are classified into three groups: behavioral risks, environmental risks, and metabolic risks. Behavioral risks include dietary risk, tobacco consumption, high drug and alcohol use, genital hygiene, etc. Environmental risks refer to risks related to air pollution, unsafe water and sanitation, occupational risks, etc., while metabolic risks are those risks caused by high blood pressure, high plasma glucose, high LDL cholesterol, high body mass index, etc. In India, both cancer cases and cancer-related deaths are increasing fast. But public facilities available for cancer screening and treatment are few and far between. Hence people opt for private hospitals, where service is good but cost is very high, and so Out-Of-Pocket Expenditure (OOPE) is very high. Most of the patients affected by cancer are men, aged between 50 and 70 and belonging to a middle- or low-income group. These views are supported by the primary data collected from Kanniyakumari district, Tamil Nadu, India. Of the surveyed patients, 56.67% are men and in the age group of 50–70 years, and 76.67% of cancer patients belong to either a low- or middle-income group. The OOPE is as much as 65.16%. A few suggestions are given to make people feel relieved from the hazards of cancer. However, under the prevailing situations, the prevention and control of cancer is a challenging task for the government of India.

**Keywords:** Non-Communicable Diseases; Communicable Diseases; Cancer incidence rates; Environmental risks; Out-of-pocket-expenditure; Public healthcare facilities.

The above-mentioned fact is true to India also. Because of various measures taken by healthcare departments and central and state governments, the occurrence of CDs in India is controlled significantly. However, the occurrence of NCDs is increasing without much control. The prevalence of CDs increased only by 1.88 times between 1995 and 2018, while the prevalence of NCDs has increased by 3.50 times in the same period-more than tripled [18]. Due to the increase in the prevalence of morbidities, mortalities related to them also increased between periods. In India, the total number of estimated deaths from all causes, including injuries, is 11.74 million in 2021. Of these, the total number of deaths due to communicable diseases, maternal, neonatal, and nutrition-related diseases is 3.69 million, and deaths due to the COVID-19 pandemic are 0.65 million. It is very sad to note that the deaths due to NCDs are 6.47 million. Of the total deaths related to NCDs, the maximum is contributed by cardiovascular diseases (2.87 million), and the second is by chronic respiratory diseases, numbering 1.33 million. The third most contributing factor to NCD-related deaths is cancer, consisting of 0.85 million deaths (13.21%) [17]. These figures speak volumes about the adverse impact of NCDs, particularly cancer, on people's health. To emphasize the importance of prevention and control of cancer, every

year the 4<sup>th</sup> of February is observed as ‘the World Cancer Day’ and the 1<sup>st</sup> of August as ‘the World Lung Cancer Day’.

Cancer is not a single disease. It is a group of diseases having almost similar characteristics, diagnosed on the basis of changes in cells, divided and subdivided, and multiplied in an inappropriate number. In other words, it refers to a changed status of a tissue or cell of any part of the body of a living being by forming a tumor, which has a different behavior from the ordinary cells. These cellular changes are called neoplasm, malignancy, oncogenes, neoplastics, etc. [14]. It means that cancer can affect not only human beings but also other living beings that have cells. Globally, cancer is a major health threat to human life after cardiovascular diseases [2], and the total number of cancer cases and cancer-related deaths are increasing continuously; cancer cases increased from 18.1 million in 2018 to 19.3 million in 2020. Cancer-related deaths mounted to 10 million in 2020 from 9.6 million in 2018 [24]. It is estimated that cancer cases increased to 20 million and deaths to 9.7 million in 2022, and the number of persons who are alive within five years after the positive diagnosis is 53.5 million [26]. Globally, among cancers, lung cancer tops the list with 2.5 million (12.4%), and breast cancer follows it with 2.3 million, i.e., 11.6%. The third common cancer is colorectal cancer, numbering 1.9 million cases (9.6%). In the same way, lung cancer is the top most contributor to total cancer-related deaths, with 1.8 million deaths (18.7%), and colorectal cancer occupies the second place with 0.90 million deaths, or 9.3%. The third place is occupied by deaths caused by liver cancer, 0.76 million, or 7.8%, and deaths due to breast cancer occupied the fourth place, 0.67 million deaths, or 6.9% of total cancer deaths [33]. The report also indicates that the total number of cancer cases in 2050 will be 35 million, an increase of 77%. In 91 countries out of 172 countries taken for discussion, cancer is the first or second leading cause of adult deaths, and in another 22 countries, it is the third or fourth cause of adult deaths [27].

In India also, the total number of cancer cases is continuously increasing; it is the second leading cause for adult deaths in urban areas and fourth in rural areas. In reality, the diagnosis of cancer started in India only in the 19<sup>th</sup> century, but it became a health burden in the 20<sup>th</sup> century [27]. The average number of cancer cases in India per year is 0.8 million, and at any given point in time there are at least 2.4 million cancer cases [30]. At present, India is considered ‘the Cancer Capital of the World’ [21,31]. In India, between 1990 and 2016, both cancer cases and cancer deaths had doubled (Dhilon et al., 2018) [24,27]. The total number of persons affected by cancer increases from 0.98 million in 2010 to 1.39 million in 2020 [14] and to an estimated number of 1.46 million in 2022. Deaths related to cancer were only 0.2 million persons in the 1950s, according to Pai and Khanolkar [27]. They show a sharp increase in the 21<sup>st</sup> century: 0.77 million in 2020 and 0.81 million in 2022 [3]. Like the global trend, lung cancer in India

is rising very fast, and deaths related to lung cancer contribute about 10% of the total cancer-related deaths. In terms of total number of lung cancers, India occupies the fourth place among world countries with 81,000 cases and 75,000 (92.59%) deaths in 2022 [25]. The overall burden of cancers in India is expected to increase by 31.4% between 2005 and 2025 [18,24]. It is also noteworthy to indicate that the most affected persons are in the age group of 50-69 years [2]. But the great concern for medical fraternity is that there is a sharp increase in the occurrence of cancer cases among persons belonging to the age group of 15-39 [18]. All these mean that in India, cancer cases and cancer-related deaths are increasing fast. However, in India, the contribution of each state to total cancer cases differs a lot. Uttar Pradesh has an estimated heavy load of 0.21 million cancer cases while the minimum load of just 496 cases is reported from Sikkim in 2020 [3]. As it is better to highlight states that are contributing the most to the total cancer cases and cancer-related deaths, data related to the top seven states are presented in the following table.

Data given in the above table are the absolute number of cancer cases and cancer-related deaths in the top seven states in India. The data given by the WHO are slightly different from these figures. The news released on 1<sup>st</sup> February 2024 by WHO (2024b) points out that there were 1.41 million cancer cases and 0.91 million cancer deaths in India in 2022. It means that one in five persons might be affected by cancer, and one in nine men and one in twelve women met death. The above-given figures do not indicate the seriousness of cancer in different states unless its intensity (cancer cases in comparison with the state’s population) or Cancer Incidence Rate (CIR), which refers to the number of cancer cases per 100,000 people, is known. Though CIR in India is nearly 100, it is lower than that which is prevailing in many developed countries like Denmark, Ireland, and Belgium, and in the US CIR is about 300 (Rajavanshi 2024). Among the different Indian states, Kerala is at the top with a CIR of 135.3. It is followed by Mizoram with 121.7 [4]. Though Tamil Nadu is ranked 5<sup>th</sup> on the basis of the absolute number of cancer cases, it is not among the 10 top cancer states on the basis of CIR. The rate of cancer incidence in India is expected to increase by 12% in the next five years [10,24]. The expected increase in cancer cases is estimated at 57.5% between 2020 and 2040 [7].

The burden of cancer in India is also differing from region to region. The rate of cancer incidence is the highest in the northern region. It is followed by northeast. The CIR in some areas in Mizoram is seven times higher in men and four times higher in women than in some areas in Maharashtra (Mathur et al. 2020) [24]. Shafi et al. (2023) also report that by taking cancer data from six zones covering the entire nation, in the southern region, Tamil Nadu is at the top, followed by Karnataka. In the northern region, Uttar Pradesh is at the top, and Punjab follows it. In the east zone, Bihar is at the top and

**Table 1:** Estimated Cancer Cases and Cancer-related Deaths in the Top Seven States in India from 2020 to 2022.

State	2020		2021		2022	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Uttar Pradesh	201,319	111,491	206,088	114,128	210,958	116,818
Maharashtra	116,121	63,797	118,906	65,326	121,717	66,879
West Bengal	108,394	59,786	110,972	61,213	113,581	62,652
Bihar	103,711	57,531	106,435	59,043	109,274	60,629
Tamil Nadu	88,866	48,314	91,184	49,571	93,536	50,841
Karnataka	85,968	47,113	88,126	48,290	90,349	49,516
Madhya Pradesh	77,888	42,966	79,871	44,056	89,901	45,176
All India	1,392,179	770,230	1,426,447	789,202	1,461,427	808,558

Source: BioVoiceneews.com Health

**Table 2:** Age wise and Samwise Distribution of Cancer Patients.

Age/Sex	Male	Female	Total
≤25	0	1	1
25 – 50	3	3	6
50 – 70	8	6	12
≥70	6	3	11
<b>Total</b>	<b>17</b>	<b>13</b>	<b>30</b>

Source: Primary data

it is followed by West Bengal. The two top states in the west zone are Maharashtra and Rajasthan. In the same way, the two top states in the north-east zone are Assam and Meghalaya, and in the central zone are Madhya Pradesh and Chhattisgarh. In all these 12 top states, the incidence rates of cancer are significantly higher than other states and Union Territories in all the six zones taken for analysis. It means that region-/zone-wise, Uttar Pradesh, Tamil Nadu, Bihar, Maharashtra, Assam, and Madhya Pradesh are six states where cancer incidence is the maximum.

## Risk Factors of NCDs and Cancer

The various risk factors, in general, contributing to mortality are: air pollution, high blood pressure, and poor diet, including inadequate intake of fruits and vegetables. Risk factors that cause mortality are classified into three by healthcare experts. They are: 1) behavioral risks; 2) environmental risks/occupational risks; and 3) metabolic risks. All these risks contribute to morbidities, which become the cause for mortalities. In India, of all the deaths, 74.26% are due to NCDs. Among the factors that contribute NCDs, the top most risk factor is air pollution, contributing 1,797,387 deaths in 2021. The second and third factors are dietary risk, causing 1,220,489 deaths, and high blood pressure, causing 1,439,478 deaths. The fourth factor is tobacco consumption, contributing 919,892 deaths. The first three factors alone contribute 61.65% of deaths out of the total deaths due to non-communicable diseases and 45.79% of total deaths. Among the behavioral risks, dietary risks and risks due to tobacco consumption are the two major reasons for deaths related to NCDs: dietary risks for 1,220,489 deaths and tobacco usage for 919,892 deaths. Dietary risks refer to the intake of a low quantity of fruits, vegetables, whole grains, nuts and seeds, milk, fiber, calcium omega-3, etc. Among the metabolic risks, high blood pressure causes 1,439,478 deaths (39.65% of total deaths due to metabolic risk factors), and the next is high plasma glucose with 796,034 (21.93%). The top reasons for mortalities related to CDs are unsafe water and poor sanitation, amounting to a death of 0.47 million in 2021 [17].

As it was discussed earlier, in India cancer is widespread in some regions and few and far between in some other regions. The risk factors contributing to this state of affairs also differ from place to place. It is reported by Varghese (2023) that 70–90% of cancers occur due to environmental factors. Among the environmental factors, air pollution is the major reason for cancer. Out of 2,543,272 NCD-related deaths, air pollution alone becomes the cause for 1,797,387 deaths or 70.67%, and it is also the most serious risk factor for lung cancer [17,30]. Deaths related to lung cancer increased by 30% since 2007; these deaths are only because of air pollution-related causes, accumulation of harmful substances like PM2.5 (particulate matters of diameter less than 2.5 micrometers) and PM10, and gases like sulfur and nitrogen in the air [25]. PM2.5 are tiny, so they can enter the blood stream and become the cause for heart diseases and lung problems. PM10 becomes the cause of health problems only when

they are coated with toxins [16]. Another major reason for cancer is tobacco consumption; it is consumed either by chewing or by smoking. It is reported that 40% of cancer cases in India are due to tobacco usage. Tobacco usage is the major cause for lung, oral, and throat cancers [21,30]. But according to Pandey and Rajit (2024), of a total of 2,548,398 deaths due to behavioral/lifestyle-related causes, 919,892 deaths are due to tobacco consumption alone, i.e., 36.10% in 2021. Varghese (2023) points out that tobacco consumption is more among men, and so cancer is high among them (35–50%) and less among women (17%).

The other risk factors for cancer are dietary risks and reproductive and sexual risks. Of the behavioral risks causing deaths, nearly 2.54 million deaths are due to NCDs; the dietary risk alone causes 1.22 million deaths, 48% of behavioral-related deaths, and 10.8% of overall deaths in 2021 [17]. Dominant dietary-related cancers are cancers of the upper aero digestive tract, stomach, and large intestine. The major risk factors for head and neck cancers are tobacco and alcohol. Alcohol use and drug use alone constitute almost 10% of behavioral risks and 2.87% of the total NCDs. Stomach cancers are mainly due to the usage of red chillies in large quantities, consumption of food at high temperatures, and drinking of alcohol, and the consumption of red meat is the main reason for large intestine cancer. Late age at first pregnancy, single child, and late-age menopause are a few major reasons for breast cancer. The most common cancer among women is uterine cervix cancer. Poor sexual hygiene, multiple sex partners, and early-age sexual intercourse are some of the reasons for it [30]. Unsafe sex is the reason for 60,026 NCD-related deaths and childhood sexual abuse and bullying for 2,693 deaths [17]. To put it in simple words, gynecological cancers, including breast cancer, constitute almost 50% [26]. In total, cancer deaths constitute 13.13% of NCDS and 7.5% of all deaths (11.74 million) in the year 2021 [17].

Obesity is also another risk factor for cancer, and there is an absolute increase in cancer cases in countries where the Human Development Index is very high. Genetic materials also become the cause for cancer to the extent of 4% of all cancer cases at the global level [33]. A few cancers are specific to men, and some others are specific to women. For example, among women, breast cancer, cervix cancer, and ovarian cancer are the most prevalent, and among men, lung cancer, mouth cancer, and prostate cancer are the most common. As men spend many hours every day outside, the adverse impact of the environment is more on men than on women. Further, the usage of tobacco, drugs, and alcohol among men is also higher than that of women. Hence the prevalence rate of cancers like lung and oral cancers is higher among men than among women; the world trend indicates that cancer cases are 25% higher among men than women. Antony et al. (2020) highlights that cancer cases among men are 50.9% and the remaining 49.1% cases are among women.

## Facilities Available in India for Screening and Treatment

Like all other emerging economies, the healthcare facilities available in India are limited, particularly in rural areas. There are huge shortfalls in healthcare facilities (less in position than the minimum required), a lack of other facilities such as medicines, and lethargic attitudes of healthcare professionals in caring for patients. In many states, specialists are completely absent in Community

Health Centers (CHCs) and in district hospitals. For example, in Tamil Nadu, all specialist posts (1,540) are vacant between 2014 and 2019. Even in 2020, the persons in position were only 179 for the minimum requirement of 1,540 [5,13]. The facilities available for cancer screening and treatment are few and far between. Though some ideas on neoplasms were given in Ayurveda, in India there was almost no facility for screening and treating cancer before the arrival of British people. Some positive changes have taken place during and after the British rule. Even now, public facilities for screening and treating cancer are far behind the minimum required [27]. There are very limited facilities, even for registering cancer cases that result in lack of data. As per the data available as of March 2023, there are only 38 population-based registries in India, 35 in 20 states [7]. It is reported that all these registries covered only less than 10% of the population of India [2]. Further in India, due to social stigma and lack of awareness regarding causes and treatment of cancer, people hesitate to do screening. For cancer treatment, the first foremost step is the identification of cancer patients, screening. For screening cancer, there are only 19 State Cancer Institutes (SCIs) and 20 tertiary care cancer centers (TCCs) as of 2022 [8]. But it is reported that screening is very limited and screening rates for oral, breast, and cervical cancers are only less than 1% [21]. In India, many programs have been developed for screening different cancers. However, lung cancer, though the occurrence of it is increasing very fast, has not yet been included in this framework [25]. To boost the number of screenings, occasionally special medical camps have also been organized for doing cancer screening. Because of all these efforts, 184.6 million people for oral cancer, 88.8 million for breast cancer, and 49.6 million for cervical cancer have been screened up to 2022 [8]. These numbers are, however, insufficient in comparison with India's population and its natural increase. These cancer centers (SCIs & TCCs) also undertake cancer treatments. Recently, all new AIIMS (All India Institute of Medical Sciences) are permitted to do cancer treatments, and 13 government medical colleges and institutes have been upgraded for making cancer treatments [8]. Another hindrance is the wrong diagnosis. According to Sarode (1993) [27], there are high percentages of wrong or incorrect diagnoses, 25.8%. It is highly dangerous than non-diagnoses, as treatment for cancer without it will result in many side effects.

Treating cancer is a tough task; spending on its treatment is heavy, and its pain is high. Medicines for cancer treatment are also costly. As mentioned earlier in public hospitals, people are hesitant to take treatment. On the other hand, in private hospitals, treatment is good, but the cost is very high, leading to high exploitation of patients. Due to all these reasons, Out-of-Pocket Expenditure (OOPE) in India is a very high, unbearable burden to inpatients who undertake treatment in private hospitals, three times higher, and in 60% of households having cancer patients, cancer treatment cost is more than 20% of the average annual household income [27]. The main reason for high OOPE is low public spending, which is around 1% of GDP (gross domestic product). The current public spending is just 1.35% and the private spending is 2% [22]. He further reports that because of high OOPE, 60-80 million households are forced to fall Below the Poverty Line (BPL) due to the cost involved in treatment. Though in India the OOPE has decreased from 64.2% in 2013-14 to 47.1% in 2019-20 [9], it is still very high.

In many developed countries, there are special cancer control programs. In India also, there is one National Cancer Control Programme. It takes all steps to control tobacco-related cancers, uterine cervical cancer, and takes measures to enhance available healthcare facilities for palliative care and pain relief [30]. To reduce the financial burden on individual households, there are insurance schemes. In some countries, the insurance coverage is universal. But in India, it is not so. At the national level, there is an insurance scheme called Pradhan Mantri Jan Arogya Yojana (PMJAY), apart from a few private schemes. Under RAN (Rastriya Arogya Nidhi), a maximum of \$17,647 is given for cancer treatment [8]. At the state level, there are separate health insurance schemes in each state. On this line in Tamil Nadu also there is one government scheme called Chief Minister's Comprehensive Health Insurance Scheme. Under this scheme, maximum financial assistance of \$1,471 is given as insurance money [8]. These schemes reduce the OOPE of households where cancer patients are getting treatment to a certain extent, but not to the expected level. Hence many households where there is/are a cancer patient are not able to come out of poverty.

### Impact of Cancer on Patients and on Households

In India, death rates are very high, as most cancer patients are admitted and diagnosed only at the last stage of it. India has a death toll of 0.92 million in 2022 [26]. There is also a continuous increase in cancer cases. In India, during the pre-independence period, there were only limited numbers of cancer cases as the Life Expectancy at Birth (LEB) was short. At present, the LEB is very high, and a significant proportion of the total population is aged, around 10% in India, and these push up the occurrence of NCD-related deaths [18]. Further, establishment of some facilities for screening of cancer and registration of it increases this number. For example, after the establishment of the Tata Memorial Hospital in Mumbai in 1948, later its pathology department was upgraded into a cancer research center and named the Indian Cancer Research Centre in 1952. The records of the Mumbai population-based cancer registry showed that there was a four-fold increase in cancer cases between 1964 and 2012. These are the results of epidemiological transition, improvement in screening facilities, and data recording [27].

A cancer patient may live for a number of years or die within a short period after the detection of cancer. It depends on the diagnosis period, the type of cancer, the part of the human body that is affected by cancer, etc. Generally, early detection of cancer may lead to the right treatment and so on, and the patient lives for a long period even after the cancer diagnosis. But last-stage detection results in quick deaths. In India, the majority of cancer patients, more than 75%, reported hospitals only in advanced stages that require mainly palliative care and pain relief [30]. Even then, there are 3.26 million people alive within five years after a cancer diagnosis. Globally, this number is nearly 53 million [32]. Further lung cancer and throat cancer are quicker at killing humans than breast cancer. A five-year survival rate of 51.7% is reported for cervical cancers and 66.4% for breast cancer (ICMR-NCDIR 2024). As lung cancer, which contributes about 10% of all cancer-related deaths in India, is detected at the 3<sup>rd</sup> or 4<sup>th</sup> stage, at a stage at which it is no longer curable, the survival rate is very low [25]. Further, if a cancer patient dies, after that there will be no

medical treatment or other treatment-related expenditure. But if he/she survives, it requires a lot of money and services. It is a burden on the family of the cancer patient.

The burden of cancer in India is very heavy. It is estimated at 26.7 million DALYs (adjusted mortality to incidence/disability-adjusted life years) for the year 2021. It would be 29.8 million for 2025 (WHO). Though DALYs are more common among cardiovascular patients (63.3%), DALYs due to cancer are very significant (18.1%) [10]. However, the expenditure related to cancer is very high. Cancer is not an ordinary disease; it is the most dangerous and highly expensive disease for treatments such as chemotherapy. It has greater psychological impact on patients and others than other diseases. Every cancer patient feels like dying every minute from immediately after the diagnosis till the actual death. And so it is considered the most dreaded disease among the NCDs [2]. The patients are unable to bear the cruel pain of cancer unless applying heavy doses of painkillers. It also has an adverse psychological impact on other family members. Cancer burden is increasing day by day, but public facilities for treating it are very limited. OOPE is also increasing as many opt for private cancer centers for their treatments [27].

### A Brief Profile of the Study Area and Primary Data

Among the Indian states, on the basis of the absolute number of cancer cases, Tamil Nadu is in 5<sup>th</sup> place, and among the southern states, it is at the top with a total cancer case of 53,022 in 2012 and 77,138 in 2018 [2] and an estimated number of 93,536 cases in 2022 [3]. In the state, the common cancers among men are stomach cancers (2,563 cases, CIR is 6.6) and mouth cancer (2,410, CIR is 6.2), and among women, breast cancer occupies the first place with 9,575 cases and a CIR of 24.6 and cervix cancer with a total of 7,548 and an incidence rate of 19.4 in 2016 [20]. There is also a rise in cancer cases in every part of the state. For example, in Chennai city, the number of cancer cases increased from 1,424 in 1994–1998 to 1,713 in 2014–2018. Of these cases, breast cancer increased from 346 to 584 for the same period. It is the details about only one city. It is the trend in almost all cities/urban centers; out of the total cancer cases reported from the country in the age group of 15–29, 5.8% are reported from five urban cancer registries (The Hindu Bureau 2024). It is the trend of cancer cases not only in cities but also in every village. In Kanniyakumari district, the southernmost district in the Indian subcontinent, it is also widespread. There were 2,326 cancer cases in the district out of the state total of 77,138 in 2018, 14<sup>th</sup> rank among the districts in 2018. It increased to 2,743 in 2022 (Sampath and Swaminathan 2018). But, on the basis of CIR data, the district occupies the third place with 93.1 for men after Chennai (129.3) and Thanjavur (100.9), and for women, the district is at the 7<sup>th</sup> place with a CIR of 105.2 in 2016 (Rajesh 2020). Data available for the year 2018 indicate that Kanniyakumari is in 4<sup>th</sup> place (CIR of 114.7) after Chennai (145.3), Coimbatore (120.0), and Tiruvarur (116.3) if both the sexes are taken together (Sampath and Swaminathan, 2023). The reason is that, as it is reported in many seminars and conferences, there is radiation in the soil itself in the district; in the district, in the existing long coastal area, there are minerals like ilmenite, monazite, rutile, zircon, and garnet [19], and among these minerals there are also a few radiating minerals. It is also reported that many villages like Manavalakurichi, Chinnvilai,

and Kadiapattinam in the district are considered ‘High Background Natural Radiation Areas’ (HBNRA), high radioactivity due to the presence of monazite sand [1]. To put in simple words, the presence of monazite in the district may be one of the reasons for the high incidence of cancer, and so the CIR is very high in the district.

To estimate the adverse impact of cancer on household expenditure, a survey has been conducted in Kanniyakumari district. Thirty sampling units have been selected by adopting the snowball sampling procedure. Kanniyakumari district is chosen as it is convenient for the author, the native district of him. Further, as it was discussed earlier, Kanniyakumari is in the 4<sup>th</sup> place on the basis of CIR, though it is at the 14<sup>th</sup> place on the basis of the absolute number of cancer cases in 2018. The results of the survey are presented in the following tables. The table given below presents both age wise and sex wise information of selected cancer patients. Of the 30 patients, 17 are males (56.67%), and the remaining patients are females (43.33%). Age wise distribution shows that the 50–70 age group contributes the most to the total, 40% of the total (it supports the inference drawn by the study conducted by Antony et al., 2020), and 36.67% of the total patients are in the age group of 70 and more than 70. It means that only 23.33% (only seven patients) of patients are in the age group of less than 50 years. All these details are available in the following table.

Table 3 presents the type wise and sex wise distribution of the surveyed cancer patients. The overall total shows that lung cancer is the most prevalent cancer among the selected cancer patients, at exactly 20%. Both breast and stomach cancers, each five cases, occupy the next place. Sex wise data show that among men, both lung and stomach cancer cases are the maximum, with four patients each, and among women, the most common cause of cancer is breast cancer, with 5 cases.

It is very clear from the table given below that 40% (12 patients) of the informants are government employees, nine males and three females. It is followed by workers in private offices; seven and five

**Table 3:** Typewise and Sexwise Distribution of Cancer Patients.

Type/Sex	Male	Female	Total
Lung	4	2	6
Breast	0	5	5
Cervix	0	3	3
Mouth	2	0	2
Stomach	4	1	5
Large Bowel	2	0	2
Ovary	0	2	2
Bladder	2	0	2
Liver	2	0	2
Prostate	1	0	1
<b>Total</b>	<b>17</b>	<b>13</b>	<b>30</b>

Source: Primary data

**Table 4:** Nature of Employment of Cancer Patients.

Employment/Sex	Male	Female	Total
Government	9	3	12
Private	4	3	7
Coolie	4	1	5
No Work	0	6	6
<b>Total</b>	<b>17</b>	<b>13</b>	<b>30</b>

Source: Primary data

**Table 5:** Household Annual Income of Surveyed Cancer Patients (in\$).

Income/Sex	Male	Female	Total
≤2,000	3	2	5
2,000 – 5,000	10	8	18
≥5,000	4	3	7
<b>Total</b>	<b>17</b>	<b>13</b>	<b>30</b>

Source: Primary data

**Table 6:** Source of Treatment of Cancer Patients.

Hospital/Sex	Male	Female	Total
Government Hospital	4	3	7
Private Hospital	13	10	23
<b>Total</b>	<b>17</b>	<b>13</b>	<b>30</b>

Source: Primary data

**Table 8:** Total Economic Loss of Cancer Patients & OOPE.

Economic Loss/Sex	Male	Female	Total (\$)
Medical Expenses	38,118	28,941	67,059
Wage Loss of Patients	30,882	3,676	34,558
Wage Loss of Caring Persons	3706	21176	24,882
Other losses	6,118	1,294	7,412
<b>Total Economic Loss</b>	<b>55,353</b>	<b>52,294</b>	<b>107,647</b>
Insurance Received	20,093 (36.5%)	17,414 (33.3%)	37,507 (34.84%)
OOPE (in %)	63.5	66.7	65.16

Source: Primary data

**Table 9:** Sources of Insurance.

Years	Male	Female	Total
Government	11	7	18
Private	5	3	8
No Insurance	1	3	4
<b>Total</b>	<b>17</b>	<b>13</b>	<b>30</b>

Source: Primary data

patients are basically coolies. The remaining patients, six in number, have no remunerative work, either housewife or unemployed.

The average household incomes per annum of surveyed cancer patients are distributed in the following table. The table highlights that most of the patients surveyed belong either to a lower income group or to a middle-income group, together constituting 23 (76.67%) patients.

The surveyed patients may get treatments either in public hospitals or in private hospitals. The data collected show that only seven cancer patients get treatment from public hospitals, and the remaining patients, 23, are getting treatment from private hospitals. Details are given in table six.

The table given below shows the distribution of cancer patients on the basis of the number of years surviving after the diagnosis of the disease. It is inferred from the table that 50% of patients are living within five years after the detection. Thirteen patients (43.33%) are living for more than five years but less than eight years, and only two patients are living more than eight years.

It is pertinent to ask questions like the following: What is their medical expense? What is the cost incurred in giving services to them? and What are other costs involved in giving treatment to cancer patients? Other costs include the cost of transport, loss incurred in business, and so on. Data are collected mainly to understand the OOPE. Information regarding the economic loss is first collected in terms of the Indian rupee, then converted into USD (85 INR = \$1). The above table shows the item wise expenses related to the treatment of cancer patients. It is obviously clear from the table that insurance covered only 34.84% of the total economic loss. However, if only medical expenses are taken for the calculation, the insurance coverage is 55.93%. Whatever the insurance coverage, the expense related to cancer treatment is a great loss to households. Unless proper steps are being taken, the family may have to borrow, and the result is high indebtedness. It is a wonder to see that four patients have not availed of any insurance as they have no insurance policy. Out of a total of 30 patients, 17 patients, the majority (56.67%) are availing of insurance from government schemes. All these details are given in Table 9.

From all these discussions, it is very clear that cancer is a major health threat in India. In India, the total number of cancer cases increases continuously, but facility available for screening and treatment in public institutions is not sufficient to meet the requirement. Hence, people seek treatment in private hospitals where they are highly exploited. This situation is not good both for the people and authorities and governments.

### Policy Implications

As it was discussed earlier, facilities available for screening and treatment are far below the requirement. For getting treatment like radiotherapy, people have to wait for a long time apart from the travel of a long distance. There are only limited facilities for screening cancers not only in rural areas but also in towns. This is the main reason for late presentation, and late presentation results in huge cancer deaths. All these are not good for these pain-torturing patients. Therefore, it is of utmost importance to establish enough screening and treatment facilities for easy accessibility of healthcare services that are necessary for cancer patients.

In India, the availability of specialists in public hospitals for treating cancer is very limited. It is, therefore, necessary to appoint specialists in all centers of cancer treatment. For that, both the central and state governments have to take precautionary measures apart from allotting a high proportion of money in every budget and every plan. It is already discussed that the total public expenditure of both the center and state is just three to four percent; in the center it is just one percent. It has to be increased to at least 2–3%. There is a negative correlation between OOPE and government healthcare expenditure on public healthcare services. Hence, to reduce the healthcare expenditure of individual households, it is necessary to increase the public spending on health.

There are regional cancer centers for giving a multi-disciplinary approach to cancer treatment. For this purpose, these centers require the services of specially trained medical professionals. But in India, specialists are almost absent. There are shortfalls of radiographers and technicians in almost all CHCs. The shortfalls of specialists were 17,459, radiographers were 3,148, and lab technicians were 605 as of the 31<sup>st</sup> of March 2019 [5].

Another reason for cancer is the consumption of tobacco and alcohol and the addiction to drugs. Though many steps have been taken by authorities to reduce the consumption of these items, consumption is seeing only an up but not a down [11]. Even now it is the situation. Hence, every step should be taken to prevent the consumption of these cancer-causing goods. As the target group is teen-aged people/students, it is necessary to conduct awareness programs among them or have messages related to cancer and cancer-causing substances in their curricula itself. It may have good results in reducing the consumption of these cancer-causing substances. But today every government is trying to increase its revenue even by legitimizing the sale of alcohol.

In India, 70 to 90% of all cancer cases are related one way or another to the bad environment existing in India [30]. Pollutants in water, soil, and air are intolerable. Many cities like Delhi, Varanasi, Bangalore, and Chennai and towns in India are highly polluted; the air contains huge amounts of both PM2.5 and PM10 that are beyond

control. Among the environmental factors, lifestyle-related risk factors are not only important but also preventable. Hence, steps taken in that line will certainly give good results.

As diet is also an important reason for upper aero digestive tract cancer, concentration should be given to change the dietary style of people. They should be given awareness on good diets and cancer-causing diets. Then there may be a possibility for changing the diet style of Indians, who are moving towards a western lifestyle concentrating on animal proteins. As green and yellow vegetables give proper protection against oral cancer, taking such vegetables may have great benefit. Hence, steps should be taken to make aware of this fact. Consumption of spicy and hot items is also another reason for stomach cancer, and red meat for colon cancer. The occurrence of these cancers can be avoided if the consumption of these items is avoided.

To avoid breast cancer, it is necessary to avoid risk factors like first pregnancy at late age, giving birth of only one child, menopause at late age and consumption of fat diets and absence of physical activities. Hence, action taken on these lines will also result in positive results.

The main lacuna of every sector or department in India is a lack of reliable data. It is true in cancer cases also. Only if and then there are reliable data can one evaluate the policies introduced by either authorities or governments. In India, even death registration and certification are inadequate and incomplete. To get feedback about cancer-related programs, it is necessary to have reliable data about the number of persons screened, the number of cancer cases, the number of persons getting treatments, and the number of persons who expired due to cancer. Hence, the government should have a network of registries. Further, it is better to start hospital-based cancer registries in order to get local-level data on cancer-related matters.

The National Cancer Control Programme is in need of a large number of trained personnel in various services that are provided to cancer patients. The service personnel may be epidemiologists, statisticians, cytotechnicians, cytotechnologists, and nurses, both male and female, trained in palliative care and chemotherapy and radiotherapy. Hence, special care should be given in training people in these lines of healthcare services.

Another limitation existing in the Indian healthcare system is an unequal distribution of quality cancer care and treatment, specifically in rural India. As it is noted, there are only 38 cancer registries, of which seven are in Maharashtra, and in many states, cancer registries are absent. Even in having cancer registries, it is the situation; then think of situations in cancer care and treatment. Therefore, closing the cancer care gap is the need of the hour. It is also necessary to establish advanced cancer care centers in all areas, particularly in underserved areas.

It is reported by Nadh and Madhavi (2024) that cervical cancer is caused by a virus called Human Papilloma Virus (HPV) and so the occurrence of cervical cancer can be considerably reduced by vaccination and so its related deaths can be stopped. A few strains of HPV are associated with 'precancerous lesions' and most of the women who met deaths due to cervical cancer are HPV positive. As it was discussed earlier, cervical cancers are common because of poor genital hygiene. Hence, good genital hygiene practices and enhanced living

standards will certainly reduce cervical cancer. In many countries and in India, in states like Kerala, it is proven. Cervical cytology screening programs have also given positive results in reducing cervical cancer (Varghese 2023). Hence steps should be taken to improve not only the living standards but also the awareness related to genital hygiene.

## Conclusion

Cancer becomes the cause of a huge health burden not only on the family of the patient but also on the entire country as its treatment involves huge spending. There is an increase in cancer cases in India, though the cancer incidence rate is much below that which is prevalent in many developed countries like Denmark and the United States of America. Though CIR in India is less than that in developed countries, the adverse impact of cancer on Indians is heavy as less government support is available to them. In India, both cancer cases and cancer-related deaths show a sharp increase between years. Among the NCDs, cancer is the most contributing factor to the total number of deaths after cardiovascular diseases, a major health threat after cardiovascular diseases, and so India is considered 'the world capital of cancer'. While communicable diseases are slowly increasing, non-communicable diseases are increasing manifold. There are so many risk factors contributing to the increase in NCDs; the most important factors for cancer are environmental factors. Because of both environmental factors and the usage of tobacco, the total number of cancer cases is huge, and cancer incidence rates are very high. Cancer care facilities in public hospitals are very poor, and there are also shortages of cancer care professionals. So people seek treatment in private hospitals where people are exploited much, and so out-of-pocket expenditure is very high. From the primary data collected, it was inferred that the majority of surveyed cancer patients are men (56.67%), are in the age group of 50–70 years (40%), and belong to low- or middle-income groups (76.67%). Even though a few health insurance schemes are introduced to reduce the financial burden of individual families, the OOP is very high in India. Even then, the OOP is about 65.16% of the total economic loss related to cancer treatment. To relieve people from the burden of cancer, a few recommendations have been given. If they are followed strictly, there may be a good chance of relieving the people of India from the brunt of cancer and its related costs. However, under the prevailing socio-economic conditions, the prevention and control of cancer is a challenging task.

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