International Journal of Multidisciplinary Education and Research
www.multidisciplinaryjournals.in
ISSN: 2455-4588
Received: 29-04-2023, Accepted: 15-05-2023, Published: 30-05-2023
Volume 8, Issue 2, 2023, Page No. 53-60

Socio-economic effect and productivity loss due to cancer in Malwa region of Punjab

Dharminder Singh[1], Rajinder Kumar Uppal[2]
[1] Research Scholar (Ph.D.), Department of Evening Studies, Panjab University, Chandigarh, Punjab, India
[2] Professor in Economics, Baba Farid College of Management and Technology, Bathinda, Punjab, India

Abstract
Nearly half of all new cancer cases and more than half of all cancer deaths occur in Asia; however, productivity losses due to cancer have rarely been assessed in Asian countries. The purpose of this study is to examine the socio-economic effects of cancer and to calculate productivity losses of cancer patients in the Malwa region of Punjab, India. The paper is based on primary data collected from Bathinda, Faridkot, Ferozepur, Mansa, and Sri Muktsar Sahib districts of Punjab, India. 100 clinically diagnosed cancer patients were interviewed in the month of October 2021 to collect information about their socio-economic profile, the cost of illness, productivity costs, and the financing pattern of cancer. All the respondents were from rural areas of these districts. Out of total 100 cancer patients, 58 were female, and more than half of the cancer patients were in the age group of 41–60 years. The average productivity cost for male and female cancer patients was found to be Rs. 69,956 and Rs. 44,822, respectively. There was a high degree of positive correlation (0.95) between the number of days lost due to illness and the productivity cost of cancer. The average value of the out-of-pocket expenditures by cancer patients was Rs. 2,78,000. The present study attempts to establish urgency in strategies for public health care vis-à-vis effective cancer treatment in the state of Punjab.

Keywords: cancer, treatment cost, economic burden, social effect, productivity cost

Introduction

Cancer is predicted to be the primary cause of death and the major obstruction to rising life expectancy in the twenty-first century, as noncommunicable diseases already account for the majority of global deaths (WHO, 2014) [1]. Cancer is the second leading cause of death in India, trailing only cardiovascular disease. Cancer cases in India have increased in recent years, putting a strain on many families (Thakur *et al.*, 2008) [22]. Despite the fact that more individuals die from cardiovascular disease than from cancer, cancer-related expenditures tend to be much higher (Hanly *et al.*, 2015) [9]. Furthermore, the rapid rise in cancer cases poses a serious threat to public health, having a direct and significant negative impact on the four Sustainable Development Goals (SDGs), namely poverty, good health and well-being, quality of education, and gender equality, particularly in developing countries like India (Morgan *et al.*, 2018) [15]. The burden of cancer in developing countries has typically been measured using the key variables of incidence, death, and survival (Jemal *et al.* and WHO, 2015). In addition to the obvious public health impact, cancer also imposes economic cost on individuals and society (Gelband & Sloan, 2007) [7]. These costs include lost productivity, which occurs when society loses an individual's contribution to the market economy due to cancer death. When determining cancer prevention and control priorities, policymakers and decision-makers gain a new perspective by valuing this lost output. This is especially crucial in emerging economies where human capital and productivity are critical resources for sustaining economic growth (Pearce *et al.*, 2018) [18].

In India, the estimated number of people living with the disease was 27,20,251 and approximately 13,24,413 new cancer patients were registered in 2020 (Table I). The number of cancer related deaths was 8,51,678 in 2020 that signify the severity of this disease (IARC, 2020). The data clearly shows that cancer incidence and mortality is on the rise in India. Cancer is one of those diseases where the expenditure on treatment is quite high, and the most commonly suggested treatment regimens, such as radiation therapy, surgery, and chemotherapy, are out of reach for the majority of patients and their families (Singh & Kumar, 2013) [21]. The few who can afford the high treatment cost is likely to change lifestyle as the treatment and handling of the ailment eats the financial resources. The incidence of cancer is higher in Punjab than national average. In comparison to World Health Organizations (WHO) point of reference- 80 cancer patients among one lakh population- in Punjab 90 persons were suffering from cancer among population of one lakh (WHO, 2014) [1]. Due to the high incidence of cancer in the state, Punjab is also known as a 'Cancer Capital' of India.

The diagnosis of cancer has far reached social and economic consequences not only for the cancer patient but also for his family and society. The social impact of cancer involves immense suffering and pain for the patient as well as for the family members and often immeasurable. The economic consequences are the mainly direct and indirect costs associated with the treatment of cancer incurred by the patient over the course of the disease (Mutuma *et al.*, 2017) [16]. The cost of screening and investigation, the consultation fee, the cost of drugs, the cost of hospitalization, and the cost of medical durables are all included in the direct cost. The indirect cost includes loss of productivity of cancer patient and the care taker who has to look after the patient. A single cancer case in the family can derail the economy of that family for several generations. It also compels the family to reduce expenditure on necessities of life, distress sale of assets and ultimately leads to indebtedness. The economic burden of this disease can be even more in the

absence of insurance coverage and state support. The aim of this paper is to examine the socio-effect of cancer on the livelihood of cancer patients.

Cancer cases are increasing all over the world. Cancer patterns differ not only around the world, but also within the same country among different population groups (Thakur *et al.*, 2008) [22]. Though infectious diseases remain a public health concern in India, there has been an increase in the occurrence of noncommunicable diseases, particularly in urban areas and economically advanced states. Table I shows the data related to incidence, mortality and 5-year prevalent cases of cancer in India in the year 2020.

Table 1: Incidence, mortality and 5-year prevalent cases of cancer in India, 2020

Population	Males	Females	Both sexes
	71,71,00,976	66,29,03,415	138,00,04,378
Number of new cancer cases	6,46,030	6,78,383	13,24,413
Risk of developing cancer before the age of 75 years (%)	10.4	10.5	10.4
Number of cancer deaths	4,38,297	4,13,381	8,51,678
Risk of dying from cancer before the age of 75 years (%)	7.4	6.7	7.1
5-year prevalent cases	12,08,835	15,11,416	27,20,251

Source- GLOBOCAN, 2020

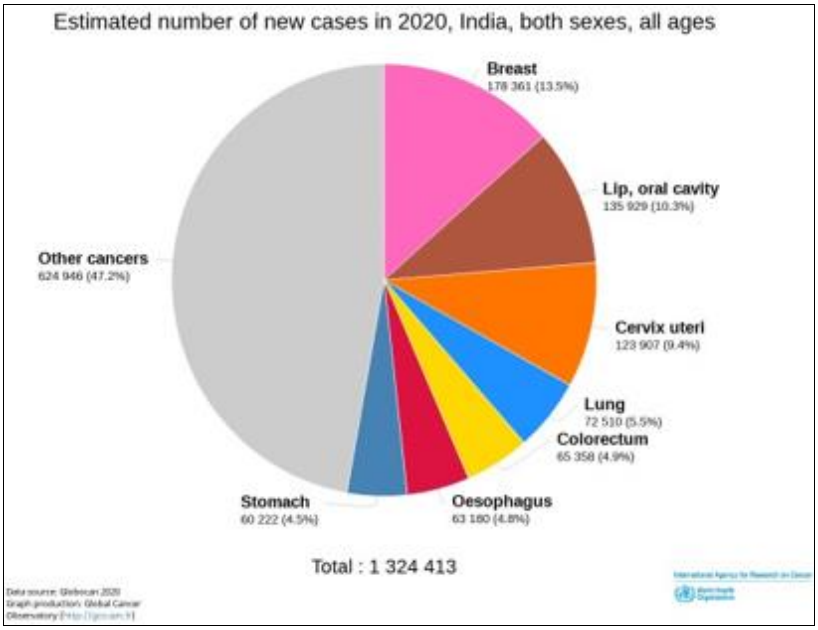

Fig 1: Estimated number of new cancer cases in India in 2020

Review of literature

Bradley *et al.* (2008) [2] calculated the productivity costs of cancer mortality in the United States (US) from 2000 to 2020. Human capital approach was used to measure the lost productivity due to cancer mortality. The total present value of lifetime earnings (PVLE) lost due to cancer deaths was around $115.8 billion in 2000, and it is expected to rise to nearly $147.6 billion in 2020. When we added the value of caregiving and household activities, the productivity costs increased to $232.4 billion in 2000 and $308 billion in 2020. Men's productivity costs were greater ($75.9 billion) than women's ($39.9 billion) in 2000, that was associated with higher mortality rates in men (17,647 more men died than women in 2000), higher labour force participation, and higher salaries of men. More than a quarter of the total productivity costs ($39.0 billion) were attributed to lung cancer deaths in 2010. Colon and rectal cancers ($12.8 billion) and female breast cancer ($10.9 billion) were the next most expensive malignancies in terms of productivity costs, accounting for nearly 9% and 8% of total PVLE lost, respectively. Testicular cancer was the most expensive cancer per death in 2010 which account for $1.3 million. Investments should be directed toward initiatives that target high-incidence cancers and/or cancers that occur in the younger, working-age population and are expected to increase the productivity losses in society.

Darbà & Marsà (2020) [5] evaluated the productivity losses due to premature mortality from colorectal cancer in Spain. To calculate the productivity losses from premature death caused by colorectal cancer the data was collected from Spanish National Statistics Institute for the year 2008 to 2017. Cancer accounts for around 27% of all fatalities in Spain each year, with colorectal cancer accounting for 15% of all deaths. Colorectal cancer caused the deaths of 15,103 people every year between 2008 and 2017. An estimated 25,333 years of potential productive life were lost each year, 14,992 in men and 10,341 in women. Productivity losses totalled €510.8 million in 2017, with colon and rectum cancers accounting for 9.6 percent of cancer-related productivity losses in Spain. Age group between 50 and 59 years were most vulnerable for premature mortality associated with colorectal cancer and accounted for highest number of years of potential productive life lost (YPPLL), which directly leads to productivity losses.

Kristina *et al.* (2022) [12] predicted the productivity losses caused by cervical cancer mortality in Indonesia in 2018. Cervical cancer is the second most common malignancy in Indonesia, impacting the country's 93.15 million female

population; around 18,279 fatalities occur each year as a result of cervical cancer in Indonesia. In 2018, 17,253 deaths occurred due to cervical cancer in Indonesia, which resulted in total of 246,350 Years of Life Lost (YLL). The highest number of YLL were seen in the 50–64 years age group (112,952 Years), followed by 35-49 years old (112,520 Years) and 20–34 years old (13,376 Years). In 2018, the overall loss of productivity due to cervical cancer fatalities was a huge IDR23,174 trillion. The highest loss of productivity was calculated in the age group of 50–64 years old (IDR12,149 trillion), followed by the 35–49 years old (IDR8,944 trillion) and 20–34 years old (IDR12,149 trillion). The scale of the loss indicates the enormity of cancer's social cost and the potential economic advantages that may be realised by investing in effective healthcare.

Lee *et al.* (2014) estimated the economic burden of cancer in Korea from 2000 to 2010 by cancer type, gender, age group, and cost component. Between 2000 and 2010, the economic burden of cancer in Korea increased at an annual rate of 8.9%, rising from 11,424 to 20,858 million US dollars. Between 2000 and 2010, the total number of cancer patients rose by 66.67 percent, from 5,44,402 to 9,07,347. Women experienced a greater increase in cancer prevalence throughout this time than men, with a growth rate of 79.1 percent versus 54.5 percent. The top three malignancies in terms of total burden were liver, stomach, and lung cancers in both 2000 (1744, 1332, and 881) and 2010 (2638, 2090, and 1476). During the period 2000-2010, the share of mortality costs in the total burden in Korea fell from 71 percent to 51 percent, while colorectal, thyroid, breast, and prostate cancers led the relative growths in direct and morbidity costs. These findings demonstrate that chronic components are becoming more important in the economic burden of cancer in Korea.

Meneses *et al.* (2012) [14] examined the economic effect of cancer on the quality of life of breast cancer survivors. The data was collected from 132 stage one and two breast cancer survivors. The socio-demographic characteristics shows that 57 percent of patients belong to 46-65 age group and family income of 50 percent was more than $50000. More than a quarter surveyed patients experienced change in income or sacrificing things like family plans over a six-month period, and among those who worked, more than 15 percent reported changes in inspiration, quantity or productivity of work. These occurrences, in turn, were linked to a decrease in quality of life. In general, evidence shows that a cancer diagnosis is associated with a larger financial burden. Cancer survivors, for example, incur greater out-of-pocket medical expenses than those who have never had cancer.

Pearce *et al.* (2018) [18] estimated the productivity losses due to cancer related premature mortality in Brazil, Russia, India, China and South Africa (BRICS). The data was obtained from Global Cancer Observatory (GLOBOCAN) for BRICS countries to estimate the mortality rate of 28 types of cancer by country, sex and age group. The data related to workforce participation and unemployment rate in each country were obtained from the Organisation for Economic Co-operation and Development (OECD) for the year 2012. In 2012, the total cost of lost productivity owing to cancer related mortality was $46.3 billion in the five BRICS countries. This amounts to 0.33 percent of their total GDP, with country-specific GDP shares ranging from 0·21 percent in Brazil to 0·49 percent in South Africa. China had the largest 5.9 million years of productive life lost (YPLL) and absolute productivity loss ($28 billion) in proportion to population size, while South Africa had the least (2,57,621 years, $19 billion). Productivity losses per cancer death were more than five times higher in South Africa ($101,105) as compared to India ($19,691). Cancer deaths in working age population in China were over four times more in men (3,96,781) than women (90,299), accounting for more than 80 percent of China's YPLL and total productivity losses coming from males. In India, male and female cancer mortality and YPLL were similar, but total productivity losses and cost per death for females (total $1.93 billion, $10,740 per death) were less than half of those for males (total $4.81 billion; $29,574 per death). Country specific cancer strategies and awareness programmes are needed to reduce the economic burden in developing countries.

Rapiti *et al.* (2009) analysed the impact of socioeconomic status of cancer patients on diagnosis, treatment and prognosis of prostate cancer. Total 2738 prostate cancer patients diagnosed between 1995 to 2005 in Geneva, Switzerland was selected for this cohort study. There were 839 men with a low socioeconomic status (SES) (30.6%), 1173 men with a middle SES (42.8%), and 726 men with a high SES (26.5%). Low-SES males were older at the time of diagnosis, more likely to be immigrants, had fewer screening diagnoses, and were treated more frequently in the public sector. Moreover, they diagnosed at advanced stage of cancer with large tumour size as compared to cancer patients belong to middle and high SES. The 5-year cumulative survival rate for prostate cancer patients was 88 percent. Mortality rate was higher among those patients who were diagnosed at stage III to stage IV. Despite the high quality and extensive access of healthcare in Geneva, Switzerland, the study revealed that the mortality rate associated with prostate cancer is twice as high in low SES cancer patients as in high SES cancer patients. This higher mortality is mostly due to delayed diagnosis, inadequate diagnostic workup, and less invasive therapies in these people.

Zaidi *et al.* (2012) [24] estimated the cost of cancer treatment in a tertiary care hospital for breast and head & neck cancer patients. For this study, 67 cancer patients were chosen who had been diagnosed with cancer for at least three months. Males were 42.6 years old on average, while females were 46.8 years old. The mean and median monthly household income of the respondents were 996.4 USD and 562.5 USD, respectively. The mean and median monthly costs of cancer care, respectively, were 1093.13 USD and 946.42 USD. In 38.8% of the instances, the patient was the major breadwinner. The average length of cancer treatment was 6.7 months, 7.8 months for breast cancer, and 5.04 months for head and neck cancer. In 94 percent of cases, the patient or their family covered the full or partial cost of the treatment. The financial burden of cancer was perceived as significant by 42 percent patients and overwhelming by 27 percent patients. According to the study, 73 percent patients reported that cost of treatment was either more than or much more than anticipated and 55.2 percent of them responded that they were unaware about the cost of treatment at the inception of treatment. The study suggested for the immediate need of the government programmes to financially help the patients who are in difficult and challenging situation.

Material and methods

1. Approach

This paper is based on the primary study that was conducted in the five districts of Punjab, namely Bathinda, Faridkot, Ferozepur, Mansa, and Sri Muktsar Sahib in the month of October, 2021. Total 100 cancer patients were included in this study and data was collected with the help of well-structured questionnaire. The researcher conducted a household level study to collect appropriate information, and only those cancer patients were included in the sample who were getting treatment of cancer.

Socio-culturally, the state is divided into three regions: Majha, Malwa, and Doaba. The incidence of cancer is higher in the Malwa region as compared to the Majha and Doaba region. Our research area is in the Malwa region of the state of Punjab, south of the river Satluj.

2. Data sources

This paper is based on primary as well as on secondary data. Primary data was collected by a field survey with the help of well-structured questionnaire. Researcher has conducted interviews with cancer patients to obtain the relevant data for the study. In case the patient was not able to give information the same was obtained from the caretakers (the family members or relatives who were taking care of the cancer patient).

Secondary data was also used for this study and that was obtained from Global Cancer Observatory (GLOBOCAN). The Global Cancer Observatory is an interactive web-based platform that uses country specific data to estimate cancer incidence, mortality and prevalence of cancer worldwide.

3. Data analysis

The statistical package for social sciences (SPSS- version 25) software was used to analyze the data. Descriptive statistical tools were used along with non-parametric tests to analyze the data. To calculate the productivity losses of the cancer patients, the number of days lost due to illness were calculated first. Furthermore, by dividing monthly income by the number of days in the month, per day income of the cancer patients working in various occupations was estimated. As a result, each cancer patient's productivity cost was determined by multiplying the total number of days lost with per day income of the respondent.

4. Sensitivity analyses

As this study covered cancer patients from different occupations. To assess the impact of different methodological assumptions on the results, the following sensitivity analyses were conducted: (1) the difference in working conditions among various occupations has been analyzed; (2) number of working days in the agricultural sector has been calculated according to the Punjab Agriculture University study on cost of cultivation (Kaur *et al.*, 2018) [11]; (3) productivity cost of household work has been calculated according to the market wage of domestic workers; (4) market wage rate of domestic workers was obtained from the EPW Research Foundation (EPW, 2021) [20].

Results and discussion

Incidence of cancer is high in the Malwa region of Punjab as compared to the Majha and Doaba region (Govt. of Punjab, 2013) [21]. Age, gender, and socioeconomic status are all well-known risk factors of cancer. Table III shows the frequency of cancer patients according to age-group and the maximum number of cancer patients are of working age people. 71 percent of respondents are below the age of 60 years. The high incidence rate of cancer in working age population causes loss of human capital, which negatively affects the economic growth of the country.

Table 2: Demographic profile of the cancer patients

District	Frequency	Percentage
Bathinda	20	20.0
Faridkot	20	20.0
Ferozepur	20	20.0
Mansa	20	20.0
Sri Muktsar Sahib	20	20.0
Total	100	100.0
Gender		
Male	42	42.0
Female	58	58.0
Total	100	100.0
AGE		
Less than 20	5	5.0
21-40	15	15.0
41-60	51	51.0
60 & above	29	29.0
Total	100	100.0
Educational qualification		
Illiterate	47	47.0
Primary	25	25.0
Secondary	14	14.0
Higher secondary	10	10.0
Graduate	3	3.0
Total	100	100.0
Occupation		
Agriculture	22	22.0
Agricultural labour	5	5.0
Non-agricultural labour	9	9.0
Self employed	4	4.0
Service sector	5	5.0
Homemaker	50	50.0
Others	5	5.0
Total	100	100.0
Monthly income		
0-5000	74	74.0
5000-10000	17	17.0
10000-15000	5	5.0
15000-20000	2	2.0
Above 20000	2	2.0
Total	100	100.0

Source: Primary survey

Table II indicates the demographic profile of cancer patients, with data on their district of residence, gender, age, educational qualification, occupation, and monthly income. Data shows that the sample of cancer patients was evenly distributed across the five districts, with each district accounting for 20% of the total sample population. In terms of gender, the majority of the cancer patients (58%) were female.

In terms of age, the largest group of patients (51%) were in the age group of 41-60, while almost one-third (29%) were aged 60 and above. Only a small proportion of patients (5%) were under the age of 20 years. Regarding educational qualifications, almost half (47%) of the patients were illiterate, while a quarter (25%) have completed primary education. The proportion of patients with higher education

qualifications (graduate level or above) was very small (3%).

In terms of occupation, the largest group of patients (50%) were homemakers, while the remaining patients were employed in various sectors, such as agriculture (22%), agricultural labour (5%) non-agricultural labour (9%), self-employed (4%), service sector (5%), and others (5%). Income is an important factor to decide about health expenditure. Majority of the cancer patients (74%) have a monthly income of less than 5,000 rupees, with only a small proportion having a monthly income above15,000 rupees. Most of the survey patients belong to the lower and middle-income group and they find it difficult to finance health expenditure from their own sources. Moreover, the high treatment cost of disease compelled the patients to cut household expenditure of essential items in order to receive treatment of cancer.

Overall, this table provides a snapshot of the demographic characteristics of the cancer patients, with majority of the cancer patients were female (58%) and 51% were in the age group of 41-60 years.

1. Major cancers

Major cancers in Punjab are of Breast, Cervix Uteri, Lung, Prostate and Oesophagus (Thakur *et al.*, 2008) [22]. Table VII shows the data of the study area based on the type and stage of cancer. This table presents the distribution of the population based on the type and stage of cancer. The table provides a summary of the number of individuals diagnosed with different types of cancer at various stages. The types of cancer included in this table are blood, brain, breast, food pipe, liver, head and neck, uterus, prostate, stomach, nasal, eye, lung, Hodgkin's disease, oral, throat, and any other.

Stage zero represents cancer in situ or cancer that has not spread to nearby tissues, while stages one to four indicate cancer that has spread to other parts of the body. Breast cancer has the highest number of cases, with a total of 17 individuals diagnosed. Among them, 6 individuals were diagnosed at stage one, 4 individuals at stage two, 5 individuals at stage three, and 2 individuals at stage four. Uterine cancer is the second most common type of cancer, with a total of 15 individuals diagnosed, including 6 individuals at stage two. There was total 11 cases of blood cancer in sample population and 6 of them were diagnosed at stage first, 3 at stage third and 2 among them were diagnosed at stage third of the disease. Other types of cancer, such as oral, liver, and stomach, had relatively lower numbers of cases. Additionally, some types of cancer, such as brain, nasal, eye, and Hodgkin's disease, had very few cases, with only 1 or 2 individuals diagnosed.

It's also worth noting that stage second is the most commonly diagnosed stage for most types of cancer. On the other hand, stage zero is the least common stage for all types of cancer except for uterus and stomach cancer, which has one person each diagnosed in this stage. The majority of cancer cases in rural and urban settings are discovered when the disease has progressed to an advanced stage (Thakur *et al.*, 2008) [22]. Overall, the table provides a quick overview of the distribution of cancer cases by type and stage, which can be useful for understanding cancer incidence rates and for designing targeted interventions.

Table 3: Distribution of population according to type and stage of cancer

Type of cancer	Stage of cancer					
	Stage zero count	Stage first count	Stage second count	Stage third count	Stage fourth count	Total
Blood	0	6	3	2	0	11
Brain	0	0	1	1	0	2
Breast	0	6	4	5	2	17
Food pipe	0	2	4	2	0	8
Liver	0	1	3	2	1	7
Head and neck	0	3	2	1	0	6
Uterus	1	3	6	4	1	15
Prostate	0	0	2	1	1	4
Stomach	1	1	2	2	0	6
Nasal	0	1	0	0	0	1
Eye	0	0	1	0	0	1
Lung	0	1	1	2	0	4
Hodgkin’s disease	0	1	2	1	0	4
Oral	0	1	3	2	1	7
Throat	0	1	1	1	1	4
Any other	0	2	1	0	0	3

Source: Primary survey

2. Socio-economic effect of cancer

Cancer certainly has a significant socio-economic effect on the individuals suffering with cancer as well as on the community, state, and nation as a whole. It is increasingly depleting the resources available to patients. The effect of cancer on patients' quality of life was assessed using a five-point likert scale. The table includes the responses of participants on a scale ranging from "Strongly Disagree" to "Strongly Agree." It also provides the total count, mean rank, and Friedman test statistics for each factor.

Table 4: Effect of cancer on the quality of life of cancer patients

Effect of Cancer	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total	Mean Rank	Friedman Test ($\chi 2$)	P-value
Financial Stress	0	2	3	35	60	100	7.41	440.90	**.0001***
Depression/Anxiety	0	15	10	70	5	100	5.22		
Decrease in Health Care of other family members	15	30	20	30	5	100	2.48		

Psychological Passiveness	10	34	18	34	4	100	2.70		
Social Alienation	4	14	21	51	10	100	4.54		
Hampering of Long-term Goals	0	6	15	60	19	100	5.96		
Decrease in Qualitative Engagement with Work	0	4	14	27	55	100	7.48		
Perturbation of Family Aspirations	4	14	20	55	10	100	4.57		
Sense of Burden	6	10	17	59	8	100	4.65		

Source: Author's own calculation

The majority of respondents (95%) agreed or strongly agreed that cancer causes financial stress, while only a small proportion disagreed (2%). The mean rank (7.41) indicates a relatively high agreement among participants. There was a mixed response for this factor, with a significant proportion of respondents (75%) agreeing or strongly agreeing that cancer leads to depression/anxiety. However, a considerable number of participants (15%) disagreed. Cancer also has a significant impact on the health care of other family members, with 35% of respondents agreeing that there was a decrease in expenditure on the health care of other family members due to the high treatment cost of cancer. However, a sizable portion of respondents (45%) disagreed or strongly disagreed that cancer leads to a decrease in health care for other family members. Respondents had mixed responses on whether cancer leads to psychological passiveness among cancer patients. While a significant proportion (44%) disagreed or strongly disagreed, an almost equal number (38%) agreed or strongly agreed. A majority of respondents (61%) agreed or strongly agreed that cancer causes social alienation. A significant proportion (21%) remained neutral, while smaller percentages disagreed or strongly disagreed. As much as 79% of them agree that it has hampered their long-term goals, and 82% have noticed a decrease in their qualitative engagement with their occupation. As a result, it limits their ability to work and live a decent life. Being unable to perform routine work, cancer patients consider themselves to be burden on their families. Furthermore, as their physical and mental well-being deteriorates, they become the subject of empathy for others. Majority of respondents expressed their inability to fulfil family aspirations, due to disease-related setbacks.

The Friedman test ($\chi 2$) result shows a significant effect of cancer on the quality of life of cancer patients based on the alpha value of. 05, $\chi 2=440.90$, $p<.0001$. Overall, the table shows that cancer has a substantial impact on various aspects of the quality of life of cancer patients, including financial stress, psychological well-being, social interactions, work engagement, and family aspirations. The responses highlight the significant challenges faced by cancer patients and their families.

3. Gender specific lost productivity

Most previous cancer studies failed to account for cancer patients' productivity losses, which constitute a significant portion of the indirect cost of cancer. Productivity losses are a major economic setback and, in some cases, it also leads to indebtedness of cancer patients. Cancer results in economic burden for patients, healthcare systems, and countries due to healthcare spending, and productivity losses from morbidity and premature mortality. Economic analysis of cancer can inform resource allocation decisions and investments in cancer control programs, including prevention, early detection, treatment of cancer, and survivorship. When a person is diagnosed with cancer during his or her productive years, they will not be able to work due to treatment of cancer and recovery, and the productive time period that they will miss from their workplace will be considered as productivity loss. Productivity losses varies with age of the cancer patient, type of cancer, stage of cancer, occupation, nature of employment, and wage rate of the cancer patient. Table V and figure II indicates the data related to productivity losses of cancer patients. There were 42 male cancer patients in the sample, with an average loss of productivity of Rs. 69,956. The standard deviation (SD) of this sample was 27,766, which indicates that the data points are spread out around the mean. The coefficient of variation (C.V) was 39.69%, which is the ratio of the standard deviation to the mean. For females, the table indicates that there were 58 females' cancer patients in the sample, with an average loss of productivity of Rs. 44,822. The standard deviation (SD) of this sample was 15,014, which indicates that the data points are spread out around the mean. The coefficient of variation (C.V) was 33.49%, which is less than that of male cancer patients. This suggests that female cancer patients in the sample experienced less variability in their productivity losses compared to male cancer patients.

The Mann-Whitney U test was used to compare the average loss of productivity between male and female populations. The test statistic (z-score) was 5.24, and the p-value was less than 0.001. This indicates that there is a statistically significant difference in the average loss of productivity between male and female cancer patients. Overall, productivity losses to male cancer patients were higher than the female cancer patients as they were getting higher wages/salaries when they diagnosed with cancer. Moreover, majority of the females in sample were doing domestic work so there was an indirect productivity loss in case of female cancer patients. The value of standard deviation is also higher in case of male cancer patients as compared to female patients that highlights the high deviation from average value of productivity loss in case of male patients. These findings highlight the significant impact that cancer can have on individuals' productivity and the importance of addressing this issue in healthcare policies and interventions. It is crucial for healthcare providers to consider not only the physical and emotional effects of cancer but also its economic consequences on patients and their families.

Table 5: Distribution of population by average loss of human productivity

Gender	**Average loss of Productivity (In rupees)**				**Mann-Whitney U (z)**	**p-value**
	N	Mean	SD	C.V		
Male	42	69956	27766	39.69	5.24	**.001***
Female	58	44822	15014	33.49		

Source: Author's own calculation

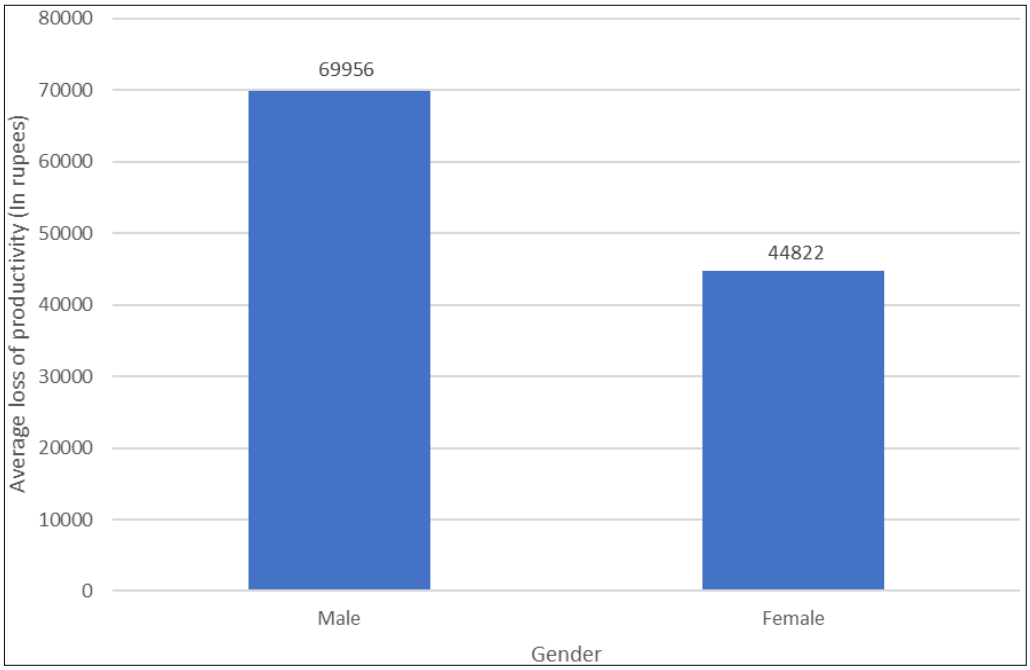

Fig 2: Gender wise average loss of productivity

The treatment expenses for cancer are prohibitively expensive, rendering it unaffordable for a significant proportion of the population. The financial burden becomes insurmountable in the event of lacking health insurance and governmental assistance. The current study also obtained data regarding the insurance coverage of individuals with cancer and determined that merely four patients possess an active insurance policy, which is limited to life insurance. The study also examined the primary initiatives undertaken by the government to furnish financial aid to individuals afflicted with cancer. According to the survey results, a significant majority of 75% of participants reported inadequate financial support from the aforementioned schemes. Consequently, they rely heavily on both institutional and non-institutional sources to cover the expenses associated with cancer treatment. The correlation between the number of sick days and the cost of lost productivity is also examined. Analysis of correlation reveals a significant positive relationship between sick days and productivity costs. It implies that as more days of labour are lost due to illness, human productivity will decline.

These findings highlight the relative impact of cancer on households and the economy, allowing public policy to take a broader view of healthcare planning and prioritization. When combined with incidence and mortality data, lost productivity estimates highlight the need for investment in a variety of interventions, including some aimed at the working-age population.

Conclusion

This study was the first of its kind to estimate the productivity cost of cancer patients in Punjab, which is a significant part of the indirect cost of cancer. Besides bearing pain and social costs, the financial burden of cancer is too large, at least for individuals and their families. The average out-of-pocket expenditures for the treatment of cancer by the sampled population were Rs. 2,78,000, and they also vary with the type and stage of cancer. In the absence of state support, this financial burden sometimes leads to bankruptcy for them. In order to receive cancer treatment, 85 percent of cancer patients said they had to reduce their household consumption expenditure. Moreover, in some cases, cancer patients had to abandon the cancer treatment in between or shift to a cheaper treatment regimen as they were not able to finance the prohibitively expensive treatment cost of cancer. Although there are government schemes in Punjab that provide financial assistance to cancer patients, that is insufficient for treatment. In the state, there is an urgent need for primary and secondary cancer prevention strategies, as well as universal access to health care facilities. Such initiatives would not only improve population health but also increase the quantity and quality of human capital, resulting in higher productivity and long-term economic growth.

In addition to cancer prevention and access to healthcare, there are other key areas that require attention in order to promote overall health and well-being. Mental health services must be made more widely available, particularly in underserved communities where access to care is limited. Additionally, efforts should be made to address social determinants of health such as poverty, housing insecurity, and food insecurity. These factors can have a significant impact on health outcomes and must be addressed in order to create a more equitable society. Finally, education and awareness campaigns should be implemented to promote healthy lifestyle choices such as regular exercise, healthy eating habits, and smoking cessation. By addressing these various factors, we can work towards a healthier population that is better equipped to contribute to long-term economic growth and prosperity.

References

1. World Health Organization. Global status report on noncommunicable diseases 2014. No. WHO/NMH/NVI/15.1. World Health Organization, 2014.
2. Bradley, Cathy J, *et al.* "Productivity costs of cancer mortality in the United States: 2000–2020." JNCI:

Journal of the National Cancer Institute 100.24, (2008), 1763-1770.
3. Bonet, Marta, *et al.* "Characteristics and outcome of prostate cancer with PSA< 4 ng/ml at diagnosis: a population-based study." Clinical and Translational Oncology,2009:11:312-317.
4. Cancer control in developing countries – challenges and opportunities, The International Network for Cancer Treatment and Research.
5. Darbà Josep, Alicia Marsà. "Evaluation of productivity losses due to premature mortality from colorectal cancer." *Plos one* 15.12, 2020, e0244375.
6. DHFW (Department of Health and Family Welfare). "State wide door to door campaign, cancer awareness and symptom based early detection, 2013.
7. Gelband Hellen, Frank A Sloan eds. "Cancer control opportunities in low-and middle-income countries, 2007.
8. Global Cancer Observatory (GCO), International Agency for Research on Cancer, 2020.
9. Hanly P, Soerjomataram I, Sharp L. "Measuring the societal burden of cancer: The cost of lost productivity due to premature cancer-related mortality in E urope". International journal of cancer,2015:136(4):E136-E145.
10. Jemal Ahmedin, *et al.* "Global cancer statistics." CA: a cancer journal for clinicians 61.2, 2011, 69-90.
11. Kaur M, *et al.* "District-wise cost of cultivation of important crops in Punjab." Department of Economics and Sociology. Ludhiana: Punjab Agricultural University. Retrieved, 2018-2020.
12. Kristina Susi Ari, Dwi Endarti, Hardika Aditama. "Prediction of Productivity Costs Related to Cervical Cancer Mortality in Indonesia 2018." The Malaysian Journal of Medical Sciences: MJMS 29.1, 2022, 138.
13. Lee Kwang Sig, *et al.* "Economic burden of cancer in Korea during 2000-2010." Cancer research and treatment: official journal of Korean Cancer Association 47.3, 2015, 387-398.
14. Meneses Karen, *et al.* "Does economic burden influence quality of life in breast cancer survivors?." Gynecologic oncology 124.3, 2012, 437-443.
15. Morgan Graeme W, *et al.* "Improving health and cancer services in low-resource countries to attain the sustainable development goals target 3.4 for noncommunicable diseases." Journal of global oncology,2018:4:1-11.
16. Mutuma J, J Wakhungu, C Mutai. "The socioeconomic effect of cancer on patients' livelihoods in Kenyan households." Bibechana,2017:14:37-47.
17. Pearce Alison, *et al.* "Projecting productivity losses for cancer-related mortality 2011–2030." Bmc Cancer,2016:16:1-10.
18. Pearce Alison, *et al.* "Productivity losses due to premature mortality from cancer in Brazil, Russia, India, China, and South Africa (BRICS): A population-based comparison." Cancer epidemiology,2018:53:27-34.
19. Population-Based Cancer Registries at Chandigarh and SAS Nagar, Sangrur, Mansa Districts Punjab State, India, 2017.
20. Series EIT. EPW Research Foundation, 2021.
21. Singh Inderjeet, Parmod Kumar. "Economic and Financial Consequences of Cancer from Patient's Family Perspective: A Case Study of Punjab." Parmod, Economic and Financial Consequences of Cancer from Patient's Family Perspective: A Case Study of Punjab, 2013.
22. Thakur JS, *et al.* "Epidemiological study of high cancer among rural agricultural community of Punjab in Northern India." International journal of environmental research and public health 5.5, 2008, 399-407.
23. World Health Organization. International agency for research on cancer, 2015.
24. Zaidi Adnan A, Tayyaba Z Ansari, Aziz Khan. "The financial burden of cancer: estimates from patients undergoing cancer care in a tertiary care hospital." International journal for equity in health 11.1, 2012, 1-6.