

Cost Analysis of Diagnosis and Treatment of Tobacco-Related Cancer

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ABSTRACT

Background: Tobacco use is the leading cause of cancer, accounting for approximately 20% of all cancer deaths and 70% of lung cancer deaths worldwide. The use of tobacco has multiple consequences; it damages health and pushes the household below the poverty line. The treatment of cancer is very costly. The study attempts to determine the cost associated with the diagnosis and treatment of tobacco-related cancer in Nepal.

Methods: A descriptive cross-sectional study was conducted among 103 patients from public and private hospitals in 2019. Patients with the second and third stages of cancer who had ever used tobacco were randomly selected for the study purpose. All patients who met the inclusion criteria were selected for interviews. The data were analyzed using SPSS version 22, and summarized in descriptive form only.

Results: The total cost of tobacco-related cancer was NPR 9,81,370 per patient in 2019. A patient's average direct medical cost was found to be NPR 5,88,740 (60%), whereas the average direct non-medical cost was NPR 1,23,147(13%). The wage loss as a result of illness accounted for over one-fourth (27%) of the total cost. Approximately one-sixth of the patients sold their property for the treatment of cancer. The majority of the cancer patients were found to be illiterate or with primary education only, and financially dependent on their families.

Conclusions: Treatment of cancer is costly and patients in Nepal can hardly afford the expenses. Enrolling clients in health insurance and increasing the government subsidy by raising the tax on tobacco products can be a long-term source of health financing to protect patients from sliding into poverty. The increased price of tobacco due to an increase in tax would reduce tobacco consumption, particularly among youth and the poor.

Keywords: Cancer; direct medical costs; non-medical costs; tobacco use; wage loss.

INTRODUCTION

Tobacco kills more than 8 million people each year worldwide. Tobacco use is one of the major risk factors in the development of cancer, lung disease, coronary heart disease, stroke, and birth defects.¹⁻⁴ Cancer is the second leading cause of death globally, and it is responsible for an estimated 9.6 million deaths in 2018. Globally, about 1 in 6 deaths is due to cancer.⁵

Over the last ten years, the number of cancer patients in Nepal has risen significantly. As cancer cases are rising, deaths from cancers are also increasing.⁶ Treatment of cancer is very costly, requiring expensive facilities, high technology, highly specialized health personnel, and expensive drugs. Cancer has a considerable

economic impact, including both healthcare costs and lost productivity owing to illness and cancer-related premature death⁷. The objective of this study was to determine the cost associated with the diagnosis and treatment of tobacco-related cancer in Nepal.

METHODS

It was a descriptive, cross-sectional, and a quantitative study conducted at hospitals, including public, for-profit, and not-for-profit hospitals in 2019. There are three major cancer-specialized hospitals in Nepal with two being in the private sector and one being in the public. Nearly, half of the patients (48%) were selected from the public and the other half (52%) from private

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hospitals based on the client load.

The purposive sampling technique was employed to collect the data. 49 samples were selected from BPKMCH, Bharatpur, Chitwan, 28 samples from Bhaktapur Cancer Hospital, Bhaktapur, and 26 samples from Nepal Cancer Hospital (NCH), Harisiddhi, Lalitpur. Hence, a total of 103 patients who had ever used tobacco, were selected for the study purpose. The sample size was calculated as below;

where, n = required sample size; Z = Confidential level 1.96; p = per cent of patients who come to the hospital for treatment 0.5; $1-p = (1-0.5) = 0.5$; $d=0.1$ and $n = 96$. Hence, the minimum sample size was 96.

A structured close-ended questionnaire was employed to collect the cost-related information from the patients. Inclusion criteria of the respondents included; cancer patients recorded in the registry, patients who have cancer on the lip, tongue, gum, the floor of mouth palate, unspecified of mouth, tonsil, oropharynx, nasopharynx, pyriform sinus, hypopharynx, oral cavity, esophagus, larynx, trachea, bronchus and lung, and urinary bladder as defined by national cancer registry report of 2003-2012, patients admitted and discharged from the selected hospital aged between 18 and 65 years, and patients with the history of smoking (ever smoker). Ever smoker was defined as a patient who had ever smoked or tried smoking tobacco in the past. This study excluded the patients with cancer who never used tobacco in any form, who were admitted to traditional medicine centers, and those aged below 18 and above 65 years. Patients who matched the inclusion criteria were chosen for an interview.

Only patient perspective costs were taken into account. The total cost included medical, nonmedical, and productivity loss due to illness. The medical costs included diagnosis cost (consultation fee, laboratory test cost, radiological cost, and other related costs), treatment cost (doctor fee, bed or room charge, surgery charge, chemotherapy charge, radiotherapy charge, supportive treatment charge), and follow-up costs (follow up consultation, follow up test, follow up others). Because it was a hospital-based study, wealth and income were not taken into account; instead, the clients were classified equally into low, medium, and high spending groups based on their spending capacity. The non-medical cost included transportation, lodging, and food, whereas productivity loss due to illness included wage loss of patients and wage loss of caregivers. However, the productivity loss due to premature deaths

was ignored in the study.

The study was conducted after getting the approval from Nepal Health Research Council (NHRC) with reference number 2713 and data were gathered only after receiving written consent from the hospitals and informed consent from the respondents (patients/clients) before collecting data for the study. The patients/clients were clearly communicated about the confidentiality of their responses and assured that the study would maintain high ethical considerations by not disclosing their identity in any way. The patients were, further, informed that the information obtained would be used only for this study and would publish in a general way so that their personal identity would not be noticed.

Data were analyzed using SPSS version 22 and summarized in percent, mean, median, and standard deviation. This was a descriptive study; therefore, no relationship was observed between the variables.

RESULTS

Nearly, one-fourth (27.2%) of the patients were between the 55-59 age group followed by the 60-64 age group (24.3%) and the 50-54 age group (20.4%). Three-fourth (74.8%) of the patients were above 50 years of age group. The mean year of patients who belong to tobacco-related cancer was 53.5 years (Std 8.712).

The education attainments showed that over one-fourth (27%) of the patients were illiterate and approximately one-fifth (19%) attended only informal education. Nearly half (i.e. 46%) of the patients were either illiterate or had non-formal education. Around one-fifth (17.5%) of patients obtained primary level education, whereas lower secondary (9.7%), secondary (16.5%), higher secondary (7.8%), and a university degree (1.9%). This suggested that illiterates were more likely to develop tobacco-related cancer.

The major source of income for the treatment of cancer was agriculture (42.7%) followed by business (22.3 %) and daily wage (11.7%), government services (8.7%), and foreign employment (8.7 %), whereas approximately six percent patients were involved in non-governmental service (3.9%), house rent (1%), and others (1%) respectively.

Similarly, over one-fourth (27.2%) of the household managed the expenses from household savings, and the other one-fourth (27.2%) borrowed from relatives.

Only one-seventh (13.6%) of the patients managed the expenses from their own income. Others arranged the expenses through mixed sources, such as support from relatives, borrowed, and family income. Moreover, over one-sixth (15.5%) of the households have sold their property for the treatment of cancer.

The study found that the total cost of tobacco-related cancer was NPR 9,81,370 in 2019. The medical cost accounted for NPR 5,88,740 (60%) in a year. Non-medical cost was equal to NPR 1,23,147.3 (13 %), whereas the absenteeism/wage loss due to sickness accounted for NPR 2, 69,482.3 (27%) in a year.

The direct medical cost constituted a significant proportion of total costs. Particularly, the cost of chemotherapy was the major component (28.15 %) of the medical cost followed by laboratory cost (12.70 %), radiological cost (11.66 %), surgery charge (5.91), and radiotherapy cost (5.48 %). The high standard deviation was observed due to high variability of the severity of illness, used technology, and type of the hospitals (public and private). Details are given in table 1 as below;

Table 1. Mean cost of diagnosis and treatment.

Costs	Mean	Percent (%)
Diagnosis consultation fee	3797.39	0.65
laboratory test cost	74763.07	12.70
Radiology cost	68662.67	11.66
Other related costs	18144.37	3.08
Doctor fee	11045.17	1.88
Bed or room charge	31552.84	5.36
Surgery charge	34818.11	5.91
Chemotherapy charge	165716.95	28.15
Radiotherapy charge	32280.49	5.48
Supportive treatment charge	33356.89	5.67
Other costs	73651.58	12.51
Follow up	4785.86	0.81
Follow up test	24900.30	4.23
Follow up others	11264.66	1.91
Total	588740	100
Std.	449568	

The low spending group spent approximately NPR 2,08,626.5, whereas medium spending and high spending groups spent NPR 4,66,680 and NPR 9,49,360. The medium spending group spent more than double

compared to the low spending group, whereas the high spending group spent over 4 times. The details are provided in table 2 below;

Table 2. Medical cost: Spending groups.

Spending Groups		Total Medical Cost
Low cost N=34	Median	208626.5
	Interquartile Range	82687.75
Medium cost N=35	Median	466680
	Interquartile Range	164571.5
High cost N=34	Median	949360
	Interquartile Range	563965
Total (N) = 103	Median	466680
	Interquartile Range	508530.5

The study found that both patients and caregivers spent on an average NPR 47,521, which accounted for 38.6 % of the total non-medical cost on food, whereas transport expense was equal to NPR 37,431(30.4%). The non-medical cost of patients accounted for nearly half (47.6%) and the other half accounted for caregivers (52.4%). The high standard deviation was due to high variation of hospital visits, length of hospital stays, and price of goods, and services. The details are presented in table 3 below;

Table 3. Non-medical cost of tobacco-related cancer.

Costs	Mean	Percent age	Std.
Patient			
Transport	19570.0	15.9	22198.2
Lodging	11022.3	9.0	31426.7
Food	21198.9	17.2	35598.0
Others	6850.2	5.6	19981.3
Subtotal	NPR 58641.4	47.6%	
Caregivers			
Transport	17861.4	14.5	19076.5
Lodging	12334.5	10.0	36479.8
Food	26322.3	21.4	24460.0
Others	7987.7	6.5	20076.8
Subtotal	NPR 64505.8	52.4%	
Total	NPR 123147.3	100	

The existing method used wages as a proxy value of productivity loss due to absenteeism of patients and his or her care giver/s. The wage loss due to sickness

accounted for over one-fourth (27.37%) of the total cost. Total wage loss due to illness of patients and caregivers was NPR 2, 69,482.30 in a year. The bigger amount of wage loss was due to the illness of the patient (67%), whereas the wage loss of caregivers was NPR 87, 888 (32%). The details are presented in table 4 below

Table 4. Absenteeism /wage loss due to sickness (tobacco-related cancer).

Wage loss (Productivity loss)	Number of days unable to work	Per day wages	Total income loss due to illness	Percent
Patient	232.2	782.1	181594.8	67.38
Caregiver 1	109.9	729.4	80154.0	29.75
Caregiver 2	10.5	734.8	7733.6	2.87
Total			NPR 2, 69,482.3	100

DISCUSSION

The four major NCDs such as cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes are major causes of death globally as well as in Nepal. Cancer ranks among the second number globally and a fifth leading cause of death in Nepal and accounted for an estimated 11,525 deaths in 2015.⁸ The burden of the disease is higher in low and middle-income countries, including Nepal, in comparison to highly developed countries. Cancer treatment cost remains costly requiring sophisticated infrastructure, highly specialized health personnel, and expensive drugs. Patients from poor countries, such as Nepal, can hardly afford these expensive treatments.⁹

According to this study, the average total cost of tobacco-related cancer was found to be NPR 9, 81,370 in Nepal. The average direct medical cost accounted for more than half of the total cost of tobacco-related cancer (60 %), which remained significantly higher than the direct cost incurred by patients in Sri Lanka (35%).¹⁰ However, cancer patients in Nepal spent on indirect expenses (including non-medical costs and wages loss) more than one-third (40%) of total tobacco-related cancer costs, which is lower than the amount cancer patients spent in other countries, such as Thailand and the United States.¹¹⁻¹² Studies have shown that the average cost of tobacco-related cancer is significantly higher than the average income of the patients, sufficient to cause financial catastrophe.¹³⁻¹⁴

In addition, the study found a vast disparity among the spending groups. The high-spending groups spent NPR

9,49,360, whereas the low-spending groups could only afford NPR 2,08,626.5 in direct medical costs. This indicates that the high spending group spent more than 5 times the medical cost borne by the low spending group, and they have access to better health facilities and treatment when it comes to direct medical costs. The study conducted in the United Kingdom stated that if all patients had a high spending capacity, an additional 3000 lives could be spared every five years, which asserts the fact that the lower the income, the higher the number of cases and fatalities due to cancer¹⁵⁻¹⁶. On the other hand, tobacco use in poor households exacerbates poverty through increased healthcare expenditures, lower income, and reduced productivity. Simultaneously, spending on tobacco consumption diverts limited family income from spending on foods, nutrition, education, and health care, causing people to fall below the poverty line¹⁷. This suggests that an appropriate strategy is urgently needed to reduce this difference and safeguard poor people from financial hardship as a result of tobacco-related cancer.

In most countries, tobacco consumption tends to be higher among poor people and less educated people in comparison to their more affluent and better-educated counterparts, and this contributes to unbalanced diseases and deaths among the poor.¹⁷ This study has found that in Nepal, mostly illiterate people are the victims of tobacco-related cancer, which accounted for 27 %, followed by 19 % of those attending only informal education. The result is consistent with the findings that there is a higher risk of malignant diseases, particularly tobacco-related cancers, among those with the lowest educational attainment category in the United States.¹⁸

The study has further found that one-fourth (27.2 %) borrowed from relatives, 27.2 % from household savings, and 15.5 % sold their property to meet their financial obligations. In Southeast Asia, the diagnosis and treatment of cancer are disastrous, with over 75 % of patients experiencing death or financial catastrophe within one year.¹⁹ In Pakistan, the financial burden of cancer was mostly borne by the patient or the family where 42 % of patients perceived the financial burden as significant and another 27 % perceived it as unmanageable. In most cases, the average monthly cost of treatment far exceeds the monthly household income.²⁰ In Vietnam, approximately 37 % of the households with cancer victims were impoverished by the cancer diagnosis and treatment costs.²¹ In Haiti, it was found that two-thirds of women suffered financial catastrophe because of self-financing for both non-medical costs and medical costs for out-of-facility care;

52 % of the participant managed the expenses using debt, and 20 % sold property/assets.²²

The treatment cost of tobacco-related cancer is relatively high in Nepal. The medical costs alone accounted for NPR 5,88,822, and about 15.5 % of the households have sold their property for treatment of tobacco-related cancer in 2019. The government of Nepal has provided a subsidy of NPR 1,00,000 to the poor for the treatment of cancer, which is less than one-fourth of the total medical cost.²³ The insurance benefits package hardly covers the treatment cost of cancer. Therefore, the government of Nepal should increase the rate of subsidy for poor patients suffering from tobacco-related cancer in order to protect them from falling below the poverty line. At present in Nepal, the tax on tobacco products is approximately 30 %, which is the lowest compared to south Asian countries²⁴⁻²⁵ and much lower than the global standard of at least 75% as recommended by WHO and the World Bank. Hence, it is imperative that the government increases the tax on tobacco products to reach the level as suggested by WHO, and the increased additional revenue could be used to subsidize the medical expenditure of the patients. Empirical evidence has shown that increasing the tax on tobacco products is a cost-effective method for increasing government revenue and reducing tobacco consumption, thus creating a win-win for the government and public health. Furthermore, it has been estimated that tobacco consumption is reduced by about 4 % in high-income nations and up to 5 % in low- and middle-income countries when tobacco prices are raised by 10 %.²⁶

The study is limited to a cost analysis of tobacco-related cancer only. It is only based on direct and indirect costs related to hospital care-seeking patients and does not include other intangible costs.

CONCLUSIONS

The economic burden of tobacco-related cancer in Nepal is significant. Moreover, treatment of cancer is costly, and patients in Nepal can hardly afford the expenses. Therefore, enrolling the clients into health insurance and increasing the government subsidy by raising taxes on tobacco products can be a sustainable source of health financing to protect patients from falling into poverty and reduce tobacco consumption among youth and the poor.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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