Economic burden of breast cancer to the households in Punjab, India

Abstract

Introduction: Breast cancer is on rise and cervix cancer is on declining mode according to the cancer registry data in India. The major mode of financing treatment is out-of-pocket (OOP) and this can push 25% of the cancer affected households below the poverty line. **Materials and Methods:** A cross-sectional descriptive study with a household perspective was done in the state of Punjab. By using probability proportional to the size method and systematic random sampling, the sample was drawn from every district of Punjab. A face-to-face semi-structured interview schedule was administered to 221 patients. **Results:** The direct cost contributed 79% toward the total cost-of-illness. The cost of drugs (36.23%) followed by cost of hospitalization (27.05%) and productivity loss (13.44%) were the main contributors toward the total cost of illness. The contribution of indirect cost is 21 per cent of the total cost. The cost of treatment depends upon type of facility used (more in private as compared to the public), stage of cancer (stage above first stage cost more than the first stage), and age at the time of diagnosis aged above sixty incurred more expenditure as compared to the aged below sixty. The 84% of the households had experienced the catastrophic health expenditure (CHE) and 51% of the households had faced distress financing (DF). The main financial coping strategies*(*multiple strategies) used were saving (74%), borrowing at low rate of interest (88%), social nets (55%), and selling financial assets (30%).

Key words: Breast cancer, catastrophic health expenditure, coping strategies, distress financing

INTRODUCTION

The analysis of population-based cancer registry reveals that the incidence of breast cancer is on rise and that of cervical cancer is declining in India. According to the cancer registry, the age-adjusted incidence rate (AAR) for India is 27.0/100,000 women and for the Punjab, the AAR varies from 37.3/100,000 women per year in one district to 17.31/100,000 women in another district (for the year 2012–2013).[1] This may be because of socioeconomic changes, rapid industrialization and urbanization resulting in lifestyle changes (late marriage, late first child bearing, and dietary changes), associated changes in menstrual pattern, and increased longevity (as older women are more likely to develop breast cancer) that contributes toward the increasing incidence of breast cancer in India.[2-10]

Studies at global level showed that cost of treatment of breast cancer is higher immediately after the diagnosis, and hospitalization is the major contributor toward the total cost. Mean indirect cost is higher than the mean direct cost, and total cost depends upon age at the time of diagnosis and stage of cancer.[11-18]

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The public expenditures on cancer in India remain $10/person (as compared with more than $100/person in high-income countries with an equivalent number of cancer patients). Out-of-pocket (OOP) payments, which account for more than three quarters of cancer expenditure in India, are one of the greatest threats to the patients and their families. Cancer diagnosis is increasingly responsible for catastrophic health expenditures (CHEs). The treatment expenditures on cancer not only affect the patient, but also the welfare and education of the generations of the patient's family.[19]

Literature also showed that the households with a cancer patient experienced significantly higher OOP health expenditure per capita as compared with households having noncancer patient. The likelihood of experiencing CHE in case of cancer was 160% more than for any other disease in India. In case of rural households affected with the cancer, the incidence of borrowing, financial gifts from relatives/friends, and selling of assets are higher as compared to urban households. Lower income group face distress financing even seeking treatment in public sector.[20,21]

Punjab the state where economic boom is since green revolution, but Punjab is also the state where OOP health expenditure constitutes 85% of the total health expenditure of the state. A single episode of hospitalization even in public hospital for any cause costs Indian Rupee (INR) 9985.27 (third highest among the states), which impose a greater economic burden to the households while seeking treatment.

Research objectives

- To estimate the costs, i.e., direct and indirect cost due to breast cancer to households in Punjab
- To assess the proportion of households that incurred CHEs and had undergone DF
- To describe the financial coping mechanisms of households to cover the cost of illness.

MATERIALS AND METHODS

A cross-sectional descriptive study with a household perspective was done. The patients with primary diagnosis as breast cancer, diagnosed in between April 2012 to March 2013, not having any co-morbidities (that was not related with cancer) (self-reported) were included in the study. From 22 districts of Punjab, 3230 breast cancer patients fulfilled the inclusion criteria, with 95% as confidence interval and 5% margin of error, the sample size arrived was 234. This sample size from each district was calculated by probability proportional to the size method and systematic random sampling:

Sample size from district A = x/X × 234

Where,

X = Total number of eligible samples in Punjab

x = Total number of eligible samples in District A

234 = The total sample size required

With a response rate of 94%, a total of 221 households were studied. A semi-structured interview schedule was administered face-to-face by researcher herself to every respondent (patient). The interview schedule was pilot-tested in Chandigarh and according to the responses, the changes was made. The revised interview schedule was used for data collection. The wages for the housewife were calculated on the basis of global substitution method.

Definition
Productivity costs
Measures production lost because of morbidity and mortality. These estimations are done on the basis of human capital approach.[22]

Human capital approach
Measures the lost production, in terms of lost earnings, of a patient or caregiver. The human capital approach often incudes the value of household work, usually valued as the opportunity of cost of hiring a replacement from the labor market.[23]

Global substitution method
A general housekeeper was chosen as substitute for all the unpaid housework that household member actually do. This was called the "global substitute" method. Total housework time was then valued at a housekeeper's wage rate in the market.[24]

According to the latest report by Government of India for minimum wage, the Punjab state had mentioned daily wages for domestic work as INR 240.64 (for 8 h).[25]

OOP health expenditure
OOP health expenditure included all types of health-related expenses incurred at the time the household received the services. It includes consultation fees, medicines, hospitalization charges, and diagnostic charges.[26]

CHE
CHE was defined as OOP expenditure (excluding reimbursement, if any) ≥40% of the total nonfood expenditure of the household.[27]

DF
It is defined as financial activities, such as taking loans from banks/ money lenders or selling economic productive assets (fertile land, commercial vehicle, property as source of income etc.).[27]

Social nets
Social nets the monetary assistance from relatives or friends for financial crisis.[24]

Statistical analysis
To assess the economic impact of breast cancer, the study population was stratified into three income groups based on the annual income of the household. Continuous variables were reported as means or sum. Continuous variables were compared using t-test. Categorical variables were reported as proportions (%). The multivariate logistic regression model was constructed by taking variables, which were significant in Chi-square test ($P < 0.05$).

Limitation

Productivity loss was calculated on subjective scale. Wages of the housewfe was calculated on the basis of global substitution method. There was a possibility of recall biases of expenditures on treatment. The data on income and expenditure could be biased.

Ethical consideration

written informed consent was obtained from every participant.

RESULTS

The mean and median age at the time of diagnosis was 50.15 years and 49.0 years, respectively, and the 79% of the patients were below the age of 60 years. The 56% of sample was from rural areas. The average household size was 6.24; with mean independent and dependent members per household were 1.72 and 4.52, respectively. The 84% of the sample was literate and mean level of education was 10 years. The majority of the sample was housewife (99%). The majority (71%) of the head of the households were self-employed. The mean annual income of the household was INR 442,262.44. The food expenditure was 47% (42% of total income) and nonfood expenditure was 53% (47.9% of the total income) of the total expenditure. The mean per capita income was INR 78,924.33. Majority of the studied population was diagnosed at second stage (57%) of the breast cancer and 58% of the studied population had utilized private healthcare facility. The type of facility used by the patients was not dependent upon the income of the households* as well as place of the residence* (*$P < 0.01$), the lower- and middle-income class patients had equally utilized private and public facility, but upper class patients had utilized private facilities more than the public facilities. The utilization of the facility had shown relationship with the stage, third and fourth stage patients had visited public facility more than the patients with stage first and second.

As per Table 1, the direct cost and indirect cost contributed 79% and 21%, respectively, toward the total cost of illness. The drug cost (36.23%) was the main contributor toward the total cost of illness, followed by total hospitalization cost (27.05), which also includes the cost of surgery. The total direct cost was 3.8 times higher than the indirect cost. The major contributor toward total direct cost was total medical cost (95.69%), which was influenced by drug cost (45.70%). The indirect cost was defined by productivity losses (64.90%) followed by wages losses of the care taker (22.25%).

As shown in Table 2, the mean total medical cost in stage first was 2.72 times more in private healthcare facility as compare to the public healthcare facility ($P < 0.01$), for second stage, it was 2.49 times more in private sector ($P < 0.01$), for third stage, it was 2.38 times more in private sector ($P < 0.01$) and for fourth stage, it was 2.36 times more in private sector ($P = 0.05$). In public sector, the cost of treatment of second stage was 1.61 times the first stage, the third stage is 2.21 times the first stage, and the

Table 1: Components of the cost-of-illness breast cancer

Direct cost (*n*=221)	In INR	Percentage of total cost of illness (direct cost + indirect cost)
Total screening cost	4,147,700.00	3.98
Total hospitalization cost*	28,200,041.00	27.05
Total radiotherapy cost	6,963,220.00	6.68
Total drug cost	37,766,768.00	36.23
Total consultation cost	2,002,940.00	1.92
Total medical cost	79,080,682.00	75.87
Total nonmedical cost (transportation, food, and lodging)	3,558,980.00	3.41
Total direct cost	82,639,662.00	79.28
Indirect cost		
Total wage loss of the patients	2,068,475.73	1.98
Total wage loss of the caretakers	4,804,447.84	4.61
Expenditure on hired help	707,000.00	0.68
Productivity loss	14,014,584.40	13.44
Total indirect cost	21,594,507.97	20.72
Total cost of illness		
Direct cost + indirect cost	104,234,170	100

*Cost of hospitalization also includes cost of surgery

fourth stage is 2.38 times the first stage. In private sector, the cost of treatment of second stage was 1.47 times the first stage, third stage was 1.93 times the first stage, and fourth stage was 2.14 times the first stage. As the stage advanced, the cost of chemotherapy and hospitalization increased. The average cost of per day hospitalization in public sector was INR 8834.98 and in private sector was INR 16,300.68, i.e., 1.86 times higher than the public sector. The cost of single chemotherapy in public sector decreases from first stage to another, but the total cost of chemotherapy increases. In private sector, the mean cost of per chemotherapy and total cost of chemotherapy increases with the stage.

In studied population , the total direct cost of was found to depend upon age at the time of diagnosis, type of facility used and the stage at which cancer is diagnosed, keeping other variables constant. the cost of treatment is more in study population, with age above sixty years as compared the age below sixty, more in private facility as compared to the public facility, more in stage 2nd or above as compared to stage 1st.

The major mode of financing of treatment by studied population was OOP (91%). Only 9% of the households have financed by insurance (partially payment).

Out of 221 households, 185 (84%) had experienced CHE at 40% nonfood expenditure threshold. The households of lower income class were 39.38 times and middle-income class were 5.79 times more likely to incur CHE than upper income class households, keeping other variables constant. The households who had utilized private facilities

Table 2: Direct cost according to the stages in INR				
Procedure-type of facility/ stage of cancer	First (*n*)	Second (*n*)	Third (*n*)	Fourth(*n*)
Mean total hospitalization cost**				
Public	47,884.62 (13)	70,878.05 (41)	103,600.00 (27)	104,592.38 (13)
Private	109,660.00 (17)	151,675.25 (80)	189,575.00 (24)	325,666.67 (6)
P	≤0.05	≤0.05	≤0.05	≤0.05
Mean total chemotherapy cost				
Public	51,930.77 (13)	88,368.32 (41)	107,337.11 (27)	128,015.62 (13)
Private	114,925.88 (17)	221,133.99 (80)	248,167.00 (24)	311,616.71 (6)
P	≤0.05	≤0.05	≤0.05	≤0.05
Mean total medical cost				
Public	112,665.38 (13)	181,670.76 (41)	248,983.44 (27)	269,227.38 (13)
Private	307,111.76 (17)	453,108.61 (80)	592,809.50 (24)	659,000.83 (6)
P	≤0.05	≤0.05	≤0.05	≤0.05

**Hospitalization cost includes cost of surgery

were 62.2 times more likely to incur CHE than public facilities users, keeping other variables constant. The likelihood of incurring CHE increased by 16.29 times, with the stage second and above as compared to stage first of cancer. Keeping other variables constant [Table 3].

According to Table 4, the coping process used by the households having insurance (9% of total households) was savings (85%), borrowing at low interest (55.0%), social nets (55.0%), selling of financial assets (30%), and by financial aids (5.0%). None of the households, who had insurance, had experienced the distress financing. The most prevalent financial coping mechanism for the households who financed the treatment exclusively by OOP (91% of households) was borrowing at low interest rate (88%), social nets (77%), savings (73%), and sold financial assets (55.7%) followed by delaying payment of preexisting loans (54%).

The 51 % of the studied population experienced distress financing and it depend upon per capita income, stage of cancer and place of residence keeping other factor constant. the households with lower per capita income were 7.12 times more likely to experience DF than the upper per capita income class. The patients with cancer stage second or above were 5.12 times more prone to DF as compared to the patient of stage first. The urban households are 52.80 % less likely to face distress financing as compared to the rural households [Table 3].

Annual household income had shown significant association with the reduced food expenditure, reduced expenditure on education, reduced expenditure on social events, and early entry into the labor market. The 37.8% of lower income class and 21.1% of the middle income class had reduced expenditure on the food. Expenditure on education was reduced by 48.8% of the lower income households and 27.6% of the middle income households. The 46.6% of lower income class and 51.3% of the middle income class had reduced expenditure on social events. The 15.0% of the lower income class and 3.9% of the middle income class households had members who entered into the labor market prematurely. None of the above said strategies were adopted by the upper income households.

Table 3: Correlates of catastrophic health expenditure and distress financing		
Independent variable	Multivariate regression Exp(B [*P*])	
	Catastrophic health expenditure	Distress financing
Place of residence		
Rural	0.588 (*P*=0.340)	Reference
Urban	Reference	0.482 (*P*=0.031)
Stage of cancer		
Stage 1	Reference	Reference
Above stage 1	16.288 (*P*=0.000)	5.121 (*P*=0.010)
Type of institute		Not in model
Public	Reference	
Private	41.401 (*P*=0.000)	
Annual income category		
Lower income category	18.423 (*P*=0.004)	1.488 (*P*=0.570)
Middle income category	4.910 (*P*=0.081)	1.409 (*P*=0.608)
Upper income category	Reference	Reference
Per capital annual income category		
Lower	2.433 (*P*=0.160)	7.148 (*P*=0.000)
Upper	Reference	Reference
Log of total direct cost	Not in model	2.806 (*P*=0.280)
Constant	0.004	0.000
Total sample	221	221

DISCUSSION

The age at the time of diagnosis had an impact over indirect cost of illness. The mean age of diagnosis in Western world is 60,[15,22] whereas in Punjab, 79% has been diagnosed before the age of 60.

Global literature shows that the major contributor toward the total cost of illness of breast cancer was indirect cost[11,13,15,17] whereas in the present study, the main contributor was direct cost. The possible reason could be the work force participation of the women of the countries (where study was conducted) was more than the current study (only 0.5 per working in sample). The wages were estimated for the housewife by "global substitution method," taking domestic

Table 4: Coping mechanism adopted by the households			
Coping process#	n (%)		
	Total (n=221)	Financing by OOP (n=201)	Financing by insurance and OOP (n=20)
Borrowing at low interest rate (0-15% per annum)	187 (84.6)	176 (87.6)	11 (55.0)
Using social nets (monetary assistance from relatives and friends)	165 (74.7)	154 (76.6)	11 (55.0)
Savings	164 (74.2)	147 (73.1)	17 (85.0)
Uses financial assets (shares, mutual funds, and gold)	118 (53.4)	112 (55.7)	6 (30.0)
Delay payment of preexisting loans	108 (48.9)	108 (53.7)	0 (0.0)
Sells economic productive assets	91 (41.2)	91 (45.3)	0 (0.0)
Renting out	73 (33.0)	73 (36.3)	0 (0.0)
Delay payment of bills	44 (19.9)	44 (53.7)	0 (0.0)
Pawn jewelry	37 (16.7)	37 (18.4)	0 (0.0)
Borrowing at a high rate of interest (≥15% per annum)	35 (15.8)	35 (17.4)	0 (0.0)
Credit from local shop	35 (15.8)	35 (17.4)	0 (0.0)
Financing by aid (government/nongovernment)	31 (14.0)	30 (14.9)	1 (5.0)

#Multiple strategies used. OOP = Out-of-pocket

worker as substitute to the housewives, who were paid even lower than unskilled worker in Punjab. The major contributor toward indirect cost was productivity loss, which also hold true for present study. In Indian scenario, the literature also show contribution of indirect cost toward the cost of illness was low in case of women as the work participation of the women has been low.[23]

The drugs contributed most toward the direct cost in Punjab, whereas in global studies, it was the cost of hospitalization. This could be because of different prospectives of the global studies in India, the drug costs was the major contributor toward the OOP expenditures on cancer treatment.[20]

As the stage advanced, the cost of treatment also increased.[16] The average cost of hospitalization for cancer was 2.5 times higher than hospitalization for any reason;[24] in case of breast cancer, it was 2.82 times. The cost of treatment depend on stage of the cancer, age at the time of diagnosis and, type of facility used.

The chances of incurring CHE in case of cancer were 160 times higher than any other illness[20] and in case of breast cancer, about 84% of the households experienced CHE. In India, cancer treatment was distress financed by 13.3–47.5% of the households and in case of breast cancer, in Punjab, it had been faced by 51% households. The public hospital provided little protection toward CHE and distress financing.

The financial coping strategies adopted by households having cancer patient were predominately saving, borrowing money, utilization of social nets, and selling of assets. These were the main strategies adopted by Punjab households for financing the cancer treatment.

In the present study, when the treatment was sought in public sector healthcare facility, the 46% households had faced distress financing, as compared to the 54% of households who sought treatment in private facility. The percentage of borrowing was greater among the households who had sought treatment in private sector (17%) as compared to the public sector (14%). These findings were in tune with the findings of literature.[24]

In the present study, the strategies (multiple strategies used) adopted by the rural households were borrowing (91%), social nets (76%), and selling of assets (52%); these findings were similar with the findings of literature.[24]

The finding of this study reflected that though the upper income class households had experienced the CHE and distress financing, the repercussion of the distress financing for them is nil. The distress financing had shown maximum impact on the lower income class followed by middle income class. The possible reason behind that could be as the lower income class households may be deprived of the assets and they may have less approach to the formal credit market, their reliance was more on the strategies to reduce the expenditure or trying to increase the source of income.

As the upper income class had assets and they had better access to the formal or informal credit market, the incidence of distress financing was more in upper income class as compared with the lower income class households who was not able to borrow or sell assets.[25] The present study contradicts the finding, the reason behind was the distress financing (methodology) was said if the household had sell economic productive assets or borrowed the sum at high interest rate (selling of fertile land and selling of commercial vehicle borrowing at interest rate higher than 15% per annum). These strategies were not adopted by the upper income class households as they sell their surplus assets (shares, mutual funds, etc.) and borrow at much lower interest (interest rate ≤15% per annum).

The governmental financial aids were in the form of Mukhyamantri Cancer Rahat Kosh, under which the patient not having any kind of insurance was eligible for the benefits. This is a supply-side financing scheme with the maximum limit for a patient is INR 150,000. As per the government's list of beneficiaries, out of 221 studied population, 201 patients were on the list, but only 30 patients had told that they were informed by the hospital authority about the sanctioned amount. The patients also informed that the cost of treatment changed (it increased) after they got amount sanctioned. According to these 30 patients, government's aid had not helped them, as the amount paid by them before and after the approval was the same.

The adoption of strategies such as financial gift from the employee/friends/relative, savings, financial aids, and using financial assets would have less impact on economic well-being of the family as compared to the strategies such as borrowing at high interest,

selling of economic productive assets, and selling of properties. Credits from the local shops, borrowing at low interest, and delay in payment of bills have the short-term effect depending upon the amount of loan. Delay in payment of preexisting loans, delayed redemption of pawned jewelry, and pawn jewelry would affect the household as these were informal loans system in Punjab. Renting out, cut spending on food, and cut spending on social events were short-term measures to cope with the economic burden. Cut spending on education and early entry of the household member into the labor market had repercussion of the costs even on the next generation.

Literature shows that due to exorbitant spending on the cancer treatment, the likelihood of falling into poverty was much higher than the cardiovascular disease and communicable diseases.[20,24] In the present study, it was difficult to comment upon the percentage of households falling into the poverty because of the cost of illness, but there were fair chances of households who had sell their economic productive assets or borrowed at high rate of interest would fall into medical poverty trap.

CONCLUSION

The direct cost was main contributor toward the total cost of illness. The drug costs were major contributor toward the direct cost of illness and productivity loss was toward indirect cost of illness. About 80% of the households had experienced the CHE and it was significantly associated with the use of private facility, second or above stage of cancer, and the lower annual income of the household. Around 50% of the households had faced distress financing and it was significantly associated with the lower per capita annual income and rural place of residence and stage of cancer. Insurance had failed to prevent the CHE, but prevent the household to face distress financing. The stage of cancer is deciding factor for cost of illness, CHE and DF. There should be early detection by mass screening and follow-up of identified cases. The cost of drugs should be reduced by the generic substitutes and the revival of the Jan Aushadhi store in every secondary and tertiary healthcare center. The limit of existing social health insurance should be increased or there should be a provision of add-on insurance to cover costly diseases.

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Conflicts of interest

There are no conflicts of interest.

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