

The Direct Medical Costs of Breast Cancer in Iran: Analyzing the Patient's Level Data from a Cancer Specific Hospital in Isfahan

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ABSTRACT

Background: Breast cancer is one of the main causes of mortality and morbidity world-wide. The estimation of the direct medical costs of breast cancer can help payers of the cost to understand the burden of breast cancer on their limited financial resources as well as the society.

Methods: We used a cross-sectional study to calculate the direct medical costs of breast cancer among women in Isfahan, Iran. The medical records of all patients which were registered in Seyed Al-Shohada Hospital between March 2005 and March 2010 were reviewed. The relevant data from patients' profiles extracted. The direct medical costs of received services were calculated with both public and private tariffs.

Results: The total numbers of 467 patients in various disease stages were included into the study. The average age of patients was 49 years. The average direct cost per patient per month in stages I to IV were 222.17, 224.61, 316.51 and 828.52 US\$, respectively. The surgery cost was the main cost driver for stages I and II with private tariffs. However for stages III and IV, the medication cost was the main cost component for managing breast cancer.

Conclusions: The direct economic cost of breast cancer in Iran is very high; nonetheless, as the age of breast cancer in Iran is nearly 10 years lower than Western countries, the burden of the disease in Iran is expected to be significantly high. Medication therapy is the main cost component of the breast cancer.

Keywords: Breast cancer, costs analysis, direct medical cost, Iran

INTRODUCTION

Breast cancer is one of the main causes of mortality and morbidity world-wide and is increasing continuously, particularly in developing countries.^[1,2] It is reported that 23% (1.38 million) of the total new cancer cases and 14% (458,400) of the total cancer deaths in 2008 occurred because of breast cancer.^[3] Breast cancer is also the first cause of cancer deaths in women.^[4] It is estimated that 1.2 million new cases were diagnosed each year

collectively.^[5] Its prevalence in Western Europe and Northern America is between 8% and 10% and in Asian countries is approximately 1%.^[6] In Iran, 6.7 women per 1,000 women are diagnosed with this disease.^[7] Breast cancer is 21.4% of all cancers among Iranian women.^[8]

Breast cancer is known as one of the high-cost diseases world-wide.^[9] Considering the fact that financial and human resources are limited for health-care services,^[10] the estimation of the direct medical costs of breast cancer can help health policy makers and payers of the cost to understand the burden of breast cancer on their limited financial resources as well as the society.^[11] This may guide them to allocate their limited resource more efficiently.^[12] The aim of this study was to assess the direct medical cost of managing breast cancer in Isfahan, Iran.

METHODS

This study is a cross-sectional study to calculate the direct medical costs of managing breast cancer among women in Isfahan-Iran. We used the medical records of all registered patients in Seyed Al-Shohada hospital (SSH), a unique specialized cancer hospital in Isfahan province, from March 2005 to March 2010.

Data collection

The required data including the age of patients, the first visit date, diagnostic tests, pathologic reports, type of surgery, radiation therapy and the type of treatment protocol, were extracted from patients' medical records.

Patients' profiles were reviewed by considering the inclusion criteria, which were registration between March 2005 and March 2010, completion of treatment in the SSH and completed profile. The uncompleted patients' profiles were deleted from the data set. The total number of 393 profiles were met the inclusion criteria for data extraction. The required information was extracted from patients' profiles, summarized into the structured checklists by one of the researchers (F.Y). The collected data was imported into the SPSS 16.0.1 (IBM) software for analysis.

Staging

We used tumor-node-metastasis (TNM) system of American Joint Committee on Cancer^[13] for staging

patients' disease. This system is based on tumor size (T), number of lymph nodes involved (N) and the presence or absence of distant metastasis (M). Patients were divided into stages I, II, III and IV based on their pathology reports. The TNM staging was performed by three of the researchers (Farkhondeh Yazdanpanah, A.R.N and F.M).

Direct medical costs

The direct medical costs of health-care services are the cost of services used in prevention, diagnosis, treatment and rehabilitation of illness or disorder in question; these include the cost of drugs, medical visits, hospitalization and diagnostic services.^[14] The direct medical cost were calculated for each patient's group separately based on their utilized services.

For managing breast cancer, usually a combination of surgery, chemotherapy, radiotherapy and hormone therapy (only for receptor positive patients) are used. In exception of medication prices, which were the same in public and private sections, the prices of surgery, radiotherapy, laboratory and diagnostic services and physicians' visits for each patient were calculated based on both public and private medical tariffs in 2011. As the SSH is a public hospital, we calculated the cost of services with public tariffs first and then estimated the costs of services with official private tariffs. Nevertheless as the private tariffs can represent more realistic cost of the services, we analyzed our findings mainly based on the private tariffs. We used health-care payer perspective for calculating these costs.^[15]

The cost of medication was calculated for each patient according to the type of chemotherapy regimen, type of prescribed medication and supportive therapy, hormonal drugs and the cost of managing chemotherapy adverse reactions.

For calculating the cost of surgery, we calculated the prices of physicians' visit, hospital care, hospital bed and pathology tests.

Patients' radiation therapies were varied in their type and their amount (Gray) of radiation. We calculated the cost of radiation by considering both of these factors.

Laboratory and diagnostic services were included initial tests, chemotherapy tests, follow-up tests, mammograms and other diagnostic radiologic services. We integrated all these costs to calculate the costs of clinical tests.

The number and the costs of specialists' visit also integrated to calculate the total direct medical cost of breast cancer.

As we used official private tariffs, which is issued by Ministry of health annually and is the same across the country, we generalized our findings to the whole country.

RESULTS

The total numbers of 614 patients' files were recorded in SSH between March 2005 and March 2010. Inclusion and exclusion criteria were used to selected relevant profiles for data extraction. The total numbers of 221 files were excluded due to the uncompleted patients' profile. This was mainly because of patients' suspending treatment and leaving the hospital. The total number of 393 profiles were met the inclusion criteria for data extraction.

Out of 393 patients' profile, 319 had treated only in one stage of the disease in 5 years and had no change in their disease status. But, 74 patients had changes in their disease stages and received their services for two stages accordingly. Thus, we evaluated the direct medical cost of the breast cancer for 467 patients ($[74 \times 2] + 319$) in various stages; 21.9% of patients were under 40 years and 61.3% of patients were between 40 and 60 years. Mean age was 49.42 (± 10.73) years (the age range 24-79 years).

As Table 1 shows, more than 41% of patients are placed in stage IV and nearly 59% of patients were in stages I to III. Among 74 patients who were transferred directly to stage IV, 8% were from of stage I and 47% and 45% were from of stages II and III, respectively.

In order to identify the pattern of prescribed chemotherapy protocols for patients, we adjusted Boutayeb classification^[16] and calculated their costs based on their Iranian prices in 2011. The results are summarized in Table 2.

Table 2 shows that the cost variation of chemotherapy regimens extremely high. The therapeutic regimen of AC4T4, (which is included cyclophosphamide-adriamycin) (AC), used every 3 weeks for four cycles and followed by paclitaxel (T), which is given every 3 weeks for four cycles, was the most abundant prescribed regimens (41%) for patients in the early stages (stages I to III).

Figure 1 shows that how the frequency uses of these regimens have changed between 2005 and 2010. As it is clear from the figure, the utilization

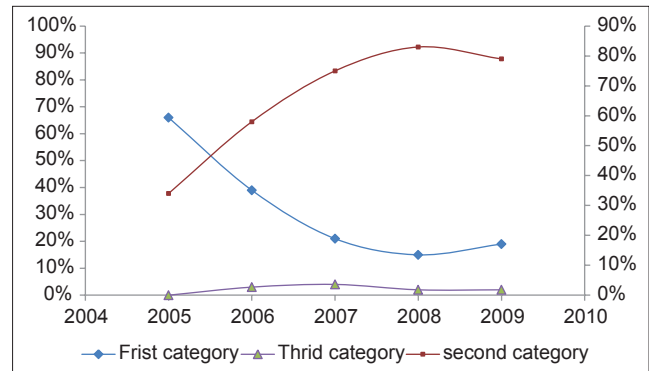


Figure 1: The percentage of prescription chemotherapy protocols during the study time

Table 1: Distribution of patients' age within the disease stages

Stage	Number (%)	Mean age (SD)
I	19 (4.1)	47.92 (13.36)
II	132 (28.3)	48.38 (10.29)
III	124 (26.5)	50.42 (10.76)
IV	192 (41.1)	49.58 (10.77)
Total	467 (100)	49.42 (10.73)

SD=Standard deviation

Table 2: Chemotherapy protocols and their prices

Chemotherapy protocols	Min price (\$)	Max price (\$)
CMF or only anthracycline	122.34	668.84
Anthracycline and taxane	1,508.97	9,543.23
Anthracycline and taxane and trastuzumab	12,234.91	89,722.67

CMF=Cyclophosphamide-methotrexate-5-fluorouracil

of group one has decreased from 66% in 2005 to 19% in 2010. But, the utilization of group 2 has increased from 34% in 2005 to 79% in 2010. The prescribing of the group 3 has remained almost the same during the study time.

The recorded dates of the 74 patients who had been treated in two stages of the disease showed that they were transferred to stage IV in just few months; and hence were not completed their treatment protocols in the early stages. Thus, we ignored these months in our analysis and focused on their treatment costs in stage IV.

Patients' records show that during the 5 years, most patients (41.1%), who were treated in this SSH, were in stage IV. One explanation for this fact is that 118 patients were registered directly in stage IV during the study. The disease stages of 74 patients,

which were registered in the early stages were also changed from the lower stages to stage IV during the study. These findings also confirm that patients in the early stages were diagnosed in stage II and III. This may result from low awareness of breast cancer and its early symptoms in Iranian women.

The average total direct medical cost of breast cancer based on the public and private tariffs is shown in Table 3. The table shows that treatment cost of managing stage IV was the highest cost between the others ($P=0.001$). However considering the private tariffs, stage III had the greatest direct medical cost between the disease stages.

Furthermore, the average of direct costs per month with private and public tariffs for every patient in each stage has been calculated. The results show that the cost per month in patients in stage IV is much more than the cost of other stages.

The average cost for one woman with breast cancer in 5 years, regardless of their changes in disease stage (393 patients) with private tariff

was 10,905.37\$ in 2010. Given the prevalence of breast cancer within the female population in Iran (0.7%)^[7] nearly, 250,000 women are suffering from breast cancer in the country. The direct medical cost of managing breast cancer in 2011 was 2.7 billion (thousand million) \$.

As Table 4 illustrates, medication cost is the main cost driver of all patient groups when considering public tariffs. The percentage of medication cost has also increased significantly alongside with increasing of the disease stage. This has increased to 87.8% of total treatment cost in stage IV [Table 4]. The same pattern is also repeated with private tariffs except for stage I and II, which the cost of surgery become the main cost component of total direct medical cost of managing breast cancer.

DISCUSSION

The findings of this study show that 21.9% of patients were younger than 40 years and 61.3%

Table 3: The average treatment cost per month based on private and public tariffs

Stage	Total cost (Dollar)				Cost (Dollar) Month	
	Means		Max	Min	Mean	
	Private	Public (SD)			Private	Public (SD)
I	8,467.31	4,386.13 (2.90)	1,168.29	895.64	222.17	115.11 (7.52)
II	8,704.33	4,692.31 (3.03)	14,358.98	896.18	224.61	121.41 (1.20)
III	10,886.02	6,845.05 (1.02)	59,624.29	2,368.11	316.51	197.82 (3.10)
IV	8,934.58	8,077.41 (9.18)	59,808.47	242.83	828.52	735.20 (6.97)
Total	9,314.16	6,834.44 (8.41)	59,808.47	242.83	608.68	447.56 (6.30)

SD=Standard deviation

Table 4: The distribution of various treatment costs within the disease stages

Stage	Medication cost (%)		Surgery cost (%)		Radiotherapy cost (%)		Lab cost (%)		Visit (%)	
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
	I	29,254.12 (51.3)	29,254.12 (26.6)	10,668.86 (18.7)	50,143.66 (45.5)	10,254.5 (18)	15,074.12 (13.7)	5,113.84 (9)	11,455.01 (10.4)	1,728.38 (3)
II	248,888.21 (54.7)	248,888.21 (29.4)	76,343.82 (16.8)	358,815.99 (42.9)	73,540.26 (16.2)	108,104.19 (12.7)	42,534.07 (9.3)	95,276.31 (11.2)	13,848.28 (3)	33,235.88 (3.8)
III	430,528.62 (69.1)	430,528.62 (43.5)	72,732.43 (11.7)	341,842.42 (34.5)	67,359.92 (10.8)	99,019.08 (10)	38,943.77 (6.3)	87,234.05 (8.8)	13335.22 (2.1)	32004.53 (3.2)
IV	1,362,098.73 (87.8)	1,362,098.73 (79.4)	0 (0)	0 (0)	95,264.68 (6.1)	140,039.09 (8.2)	69,361.95 (4.5)	155,370.76 (9)	24,138.83 (1.6)	57933.20 (3.4)
Total	2,070,769.68 (77.1)	2,070,769.68 (56.6)	159,745.11 (5.9)	750,802.07 (20.5)	246,419.36 (9.2)	362,236.48 (9.9)	155,953.63 (5.8)	349,331.13 (9.5)	53,050.71 (2)	127,321.73 (3.5)

of patients aged 40-60 years; the mean age was 49.42 (± 10.73). These results are similar to other Iranian-based studies, which showed that the average diagnosis age of breast cancer patients varied between 43 and 49 years.^[17-20] However when comparing the results with some Western countries,^[21,22] it is noticeable that the diagnosis age of breast cancer in Iran is almost 10 years lower than Western countries. Including its reasons can be pointed young population structure in Iran relative to Western countries.^[23]

Although, it seems that patients' age does not have a significant impact on the direct medical costs of breast cancer management,^[24] but given that 21.4% of all cancers is breast cancer^[8] and is the most common cancer among women,^[25,26] and considering the fact that women play an important role in 4th decade of their life, in both household and community, this low diagnosis age in Iran would be highly remarkable and may impose higher economic burden due to life and productivity lost compared with Western countries.

The curves in Figure 1 shows the prescription of anthracycline plus taxan plus trastuzumab (third category) started from 2007 and increased to 4% in 2008 (only for patients with human epidermal growth factor receptor 2 positive receptor), but despite of its positive effects,^[27] its prescription reduced to 2% in 2009 and remained unchanged through the following year. This low rate prescription could be explained by taking the high cost of trastuzumab into account [Table 2]. Some patients' profiles support this hypothesis as well. These records showed that in some cases, patients were refused to take trastuzumab because of their financial difficulties. This may explain why women with lower socio-economic status, have lower survival rates.^[28] It is showed that the cost of one course of trastuzumab is more than 20 times of AC60 regimen and the cost of treating one patient with trastuzumab is 8.4 times the costs of treating with anthracyclines plus taxan, and is nearly 60 times the cost of chemotherapy based on anthracycline alone.^[16]

The result in Table 3 shows that considering public tariffs, the cost of treatment for stage IV was the highest of the rest of the other stages. However when considering private medical tariffs, the most cost was spent in stage III. This may resulted from higher surgery tariff in the private sector,

longer life expectancy of patients in stage III and consequently longer follow-up time.

In addition to the total cost per disease stages, treatment cost per month of various disease stages also show that treatment cost of stage IV in the private sector is nearly 2.6 times the cost per month of stage III [Table 3]. Likewise, the cost per month in stage III is approximately 1.7 times more than stages I and II [Table 3].

The findings of this study show that as the disease stage increase, the medication cost of treatment increases accordingly so that 87.8% of the total direct medical cost in stage IV is devoted to medications.

Although the price of medicines is the same in public and private sectors, the medication cost was not the main cost component of the treatment in stages I and II in the private sector, mainly because the price of surgery in the private sector is much higher than the public price. Nevertheless, the medication cost remained the mainstay cost of treatment in stages III and IV with both private and public tariffs. This may encourage health decision makers to advise the most cost-effective medicines for managing breast cancer.

In a similar study in Brazil in 2010, the direct costs of treatment for each patient for stages I-IV were 21658, 48295, 63,662 and 63,697 US\$ respectively.^[29] The results of this study also show that the direct treatment costs in the stages III and IV were significantly higher than the early stages; though their cost are much higher than the costs in Iran.

In another study in the US in 2004, the mean direct cost of treatment per patient was 35568\$ and the mean total direct cost per patient per month was 2896\$.^[30] Although in the US study, the direct cost of treating for co-morbidity disease has been calculated, but compared with the costs obtained in our study is much greater.

In a study in Sweden in 2005, the mean direct cost of treatment for patients in stage IV was 93700€,^[31] which is very higher than this cost in Iran (8934\$). This difference could be originated from low-cost health services in Iran as well as failure to prescribe expensive drugs [Figure 1].

Assessment of direct costs of breast cancer has been done in some other countries,^[29-31] but it is not always possible to compare the results of these studies because of various methodology used to calculate the cost of treatment, different

perspective and various socio-economic conditions.^[32-34] Nonetheless, all studies^[30,31] confirm that medication therapy was the most costly part of treatment in III and IV stages, which is also compatible with the results of our study.

As the treatment regimens, drug price and official private tariffs are almost the same across the country, it is logical to generalize the results to the whole country. However, considering the fact that the actual private tariffs are even higher than official private tariffs,^[35] the actual costs could be even higher than the calculated costs in this study.

CONCLUSIONS

The direct economic cost of breast cancer in Iran is very high; nonetheless, as the age of breast cancer in Iran is nearly 10 years lower than Western countries, the burden of the disease in Iran is expected to be significantly high. This could show that the early detection of disease through a national screening program could reduce the direct and indirect costs of the disease significantly.

As the medication therapy is the main cost component of the breast cancer, cost-effectiveness analysis of alternative therapy may help health policy makers to manage breast cancer more efficiently.

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