

Determining Breast Cancer Treatment Costs Using the Top Down Cost Approach

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ABSTRACT

Objective: Breast cancer is the most common type of cancer among women in Turkey, with approximately 15,000 breast cancer diagnoses each year. In this study, our goal was to determine annual direct medical costs of all breast cancer patients in Turkey with top down cost approach.

Materials and Methods: Data regarding patients who have been diagnosed with breast cancer and received health services from any hospital in Turkey in 2014 were used for the purpose of the study. Data were obtained from the MEDULA System for a total of 126,664 patient. Treatment of costs of patients were calculated based on types of patient admissions (inpatient/outpatient/intensive care) and costs of drugs and medical equipment. Indirect costs and out of pocket costs were not included.

Results: Total medical costs of 126,664 patients was calculated as \$116,792,107,9, with an average treatment cost per patient of \$922,1. Based on types of patient admission, intensive care treatment had the highest average cost with \$2,916.5. In metastatic breast cancer patients, average annual treatment cost per patient is \$2,326,6, which is 2.8 times higher compared to non-metastatic breast cancer patients.

Conclusion: In order to ensure effective resource allocation at micro and macro level, healthcare administrators have to learn costs of diseases with high incidence such as breast cancer. Results obtained from studies on disease costs calculated using the top down cost approach provide data on actual health services use and therefore are seen as important tools for healthcare administrators in terms of effective resource allocation.

Keywords: Breast cancer, disease cost, treatment cost, top down cost approach

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Introduction

Increase in population and lifespan seen throughout the world during last years have resulted in a significant increase in new cancer cases. According to prediction based on current data; approximately 26.4 million annual new cancer cases and 17 million deaths caused by cancer is expected by the year 2030. In 2012, breast cancer was the most common type of cancer among women with more than 25% diagnosis rate among all types of cancer. 1.3 million women are diagnosed with breast cancer and 465,000 women lose their lives due to breast cancer annually. Breast cancer occurs due to many risk factors including early menstruation, late menopause, lactating, and obesity. Breast cancer incidence increases with age. Approximately 80% of breast cancer cases are women aged 50 and above. Breast cancer cases which occur at younger ages have a rather aggressive progression, with a lower survival rate compared to older patients. Similar to the global trend, the most prevalent type of cancer in women in Turkey is breast cancer which comprises 24.9% percent of all cancer cases. In Turkey, breast cancer incidence is 43.0/100,000, with approximately 15,000 women being diagnosed with breast cancer each year (1-5).

In parallel with increase in cancer cases, cancer spending has also significantly increased throughout the world. In majority of developed countries, cancer causes significant increase in national healthcare spending. Drug treatments and hospital admissions comprises the majority of such spending. In the USA, a large share of cancer-based spending is transferred to breast cancer treatment, also medical costs increase as the disease progresses. A study using Medicaid (fee-for-service program) data in the USA found that annual treatment cost of a patient with breast cancer diagnosis is around \$16,345. In the USA, another study using Medicare data found that lifelong treatment cost for patients diagnosed between the ages 65-69 was \$37,306, whereas such cost for patients diagnosed over the age of 85 was \$19,493.

In another study conducted in the USA, Blumen et al. (12) found that the total treatment cost for a patient 12 months after breast cancer diagnosis was approximately \$60,000. In a study conducted in Vietnam, Hoang Lan et al. (13) found that 5-year breast cancer treatment cost for a patient was \$975; breast cancer cases in Vietnam were seen in younger women compared to developed countries, and diseases were usually diagnosed during second stage (6-11).

Disease costs studies based on the principle of measuring the financial burden on the society caused by diseases are conducted for the purpose of determining the financial burden of a medical condition which has an impact on a certain society in terms of use of medical services and loss of production. Information obtained through such studies are used to determine the impact of diseases on the society, thereby assisting policy makers and decision makers in projecting future healthcare costs and making decisions regarding resource allocation. Top down medical costs is a method used frequently in disease costs studies on annual direct medical costs in which data on resource use related to the disease are obtained via the national healthcare system (14-19).

Total healthcare spending in 2017 in Turkey has been calculated as 38,551 million \$, total healthcare spending had a 4.5% share in Gross Domestic Product (GDP). In Turkey, there are no studies on the share of cancer treatments in total healthcare spending. Due to limited resources allocated to healthcare, conducting studies on costs of diseases such as breast cancer which have a significant disease burden on countries is crucial for many countries (20, 21).

In this study, our goal was to use the top down approach in order to determine treatment costs of breast cancer in Turkey from Social Security Institution's (SSI) perspective.

Materials and Methods

Study design and study sample

In order to determine treatment costs of breast cancer patients from SSI's perspective using the top down cost approach, we have used the MEDULA System, which has been created by SSI for the purpose of compiling invoice information obtained from healthcare services servers in electronic format and payment for services, in order to obtain data on outpatients and inpatients with breast cancer diagnosis who have been treated in hospitals contracted by SSI between January-December 2014. Based on data obtained from MEDULA, we were able to gather information on age, sex, outpatient/inpatient admission diagnosis, the procedure/operation/treatment for outpatient/inpatient, laboratory and radiology tests conducted for outpatient/inpatient, services provided to inpatients at intensive care, drugs used in and prescribed by the hospital, comorbidity diseases, and length of stay.

Evaluation of direct medical costs

Data obtained through MEDULA were used to obtain the information below regarding outpatients and inpatients who have applied to a hospital with breast cancer diagnosis in 2014:

- The procedure/operation/treatment at the polyclinic/clinic (along with the ICD-10 code)
 - Laboratory and radiology tests for outpatients/inpatients
 - Services provided to inpatients at intensive care (length of stay for intensive care, drugs used, treatments etc.)
- Drugs used in and prescribed by the hospital for outpatients/inpatients

- Complications occurred during or after the treatment/procedure/operation
- Comorbidities
- Length of stay

In Turkey, the principles of payments made by the SSI for all services offered in health institutions are regulated by Health Application Notification (SUT). SUT is a legislative announcement which provides guidance, guiding, pricing, and other implementation details of the state's health-related social policies.

Health Application Notification procedure scores of surgeries, laboratory and radiology examinations, clinical and intensive care administrations used in calculating medical costs have been calculated using SUT 2014 APP 2B-List of Procedure Scores per Service and APP 2C-List of Procedure Scores based on Diagnosis, with unit prices calculated from SSI's perspective. The list of drugs used were determined using the RX Media Program based on prices paid by the public in 2014 and deemed to units used in the hospital for calculations. At the same time, prices of drugs prescribed were determined by using the RX Media Program based on prices paid by the public in 2014, which was multiplied by the amount of drugs prescribed to determine the total drug costs.

Treatment costs of patients were displayed according to types of patient admission (Outpatient/Inpatient/Intensive Care) and costs of prescribed drugs and medical equipment. At the same time, patients with comorbidity were classified according to Charlson's Comorbidity Index (CCI) and medical costs of breast cancer were calculated based on whether comorbidity is present. CCI has a score for each comorbidity and the scores of comorbidities in this study are as below:

- Diabetes Mellitus = 1 point
- Primary Hypertension = 1 point
- Hypertensive Heart Disease = 1 point
- Chronic Ischemic Heart Disease = 1 point
- Chronic Obstructive Lung Disease = 1 point
- Asthma = 1 point

In addition, metastatic diseases receive 6 points in this index. Based on the classification made according to total scores of patients, the intensity of comorbidities are mild for patients who scored 1-2, medium for patients who scored 3-4, and severe for patients who scored 5 and above; breast cancer medical costs were calculated using this classification.

We were not able to calculate medical costs of breast cancer based on stages due to the fact that the data did not include disease stages. We were able to determine stage IV breast cancer patients in accordance with The **Tumor-Node-Metastasis** (TNM) classification only; we have compared medical costs of stage I-II-III patients and that of stage IV patients.

The data obtained from the SSI MEDULA system did not include the first diagnosis dates of the patients. For this reason, it was not determined which patient was newly diagnosed and which patient was in the follow-up period. However, it is known that medical costs of newly diagnosed/active treatment and follow-up patients differ significantly. Expert opinions were consulted to determine newly diagnosed/active treatment patients and follow-up patients. According to expert opinions, patients who underwent breast cancer surgery in 2014 were identified as newly diagnosed patients and metastatic patients which determined according to TNM classification were accepted as active treatment patients. Breast cancer treatment costs were also determined based on data of these patients.

Statistical Analysis

Data from the MEDULA system were obtained in accordance with the International Classification of Diseases 10th Revision (ICD-10) code of the C50 – Breast Malign Neoplasm in excel file format 7 sepa-

Table 1. Summary Statistics for Breast Cancer Patients, 2014, Turkey

	n	%
Age groups	126,664	
18-39	10.994	8.7
40-64	85.554	67.5
65+	30.116	23.8
Sex		
Male	2.432	1.9
Female	124.232	98.1
CCI ¹		
Charlson score of zero	70.510	55.7
Charlson score of 1-2	45.790	36.2
Charlson score of 3-4	5.841	4.6
Charlson score of 5+	4.523	3.6
Comorbidities		
Yes	56.154	44.3
Primary Hypertension		45.8
Diabetes		22.3
Chronic Ischemic Heart Disease		13.2
Astyma		12.3
COPD ²		5.6
Hypertensive Heart Disease		0.8
Metastasis		
Yes	7.678	6.1
Malignant Neoplasm of Lung		52.4
Malignant Neoplasm of Brain		20.4
Malignant Neoplasm of Liver		16.0
Malignant Neoplasm of Bone		11.2

¹Charlson Comorbidity Index

²Chronic Obstructive Pulmonary Disease

rate folder. Data files were extracted into separate Microsoft Access (MS Access) (Microsoft; USA) files to create a database, modifications necessary for analysis were made by using MS Access and Microsoft Structured Query Language (MS SQL) (Microsoft; USA) program later on, after which data were transferred to Statistical Packages for the Social Sciences 18.0 (IBM Corp.; Armonk, NY, USA). Following such modifications, patient numbers from all files were matched with 126,664 patient data from the initial diagnosis file in order to extract data.

In the first stage, total cost of breast cancer treatment, average treatment cost per patient with standard deviation (SD) and the percentage of total treatment cost according to the type of patient admissions and prescribed drugs and medical equipment were displayed. In the further stage, parametric tests were applied to determine the relationship between cost of breast cancer treatment and independent variables (patient with and without comorbidity, metastatic/non-metastatic patient, patients' CCI score, patients with 1 or more than one metastasis, newly diagnosed and follow-up patients). Because the sample size was 126,664, distribution of the cost of treatment was assumed to be normal and parametric tests were applied. Independent Samples T-Test was analyzed for variables composed of two groups, One-Way ANOVA was applied for variables composed of more than two groups.

This article does not contain any studies with human participants or animals performed by any of the authors. Therefore, ethical approval and informed consent were not required.

Results

Among 126,664 patients included in the study, 98.1% were women and 1.9% were men, 67.5% were between the ages of 40-64, and the average age was 55.7 years (SD: 12.3). 44.3% of breast cancer patients had a comorbidity. Among patients with comorbidities, 45.8% had primary hypertension, 22.3% had diabetes, 13.2% had chronic ischemic heart disease, 5.6% had chronic obstructive lung disease (COPD), 12.3% had asthma, and 13.2% had hypertensive heart disease. Metastasis was detected in 6.1% of patients. Among patients who have metastasis, 52.4% had malignant neoplasm of lung, 20.4% had malignant neoplasm of brain, 16.0% had malignant neoplasm of liver, and 11.2% had malignant neoplasm of bone (Table 1). %85.9 of patients were outpatients, whereas 12.8% were inpatients and 1.3% were admitted to intensive care (Figure 1).

Total medical costs of 126,664 patients with breast cancer diagnosis who have received services from hospital contracted with SSI throughout Turkey between January-December 2014 was calculated as \$116,792,107.9, with an average treatment cost per patient of \$922.1. Total medical cost of outpatients was \$73,534,475.5, total

Table 2. Distribution of Breast Cancer Treatment Cost by Patient Hospital Admission, 2014, Turkey

	n	Total (\$)	Mean (\$)	SD	%
Outpatient	124.308	73,534,475.5	591.6	1.560.3	63.0
Inpatient	18.479	23,159,274.9	1.253.3	2.243.6	19.8
Intensive care	1.815	5,293,348.4	2.916.5	3.874.8	4.5
Drugs and medical equipments	71.333	14,805,009.2	207.5	360.1	12.7
Total Cost	126,664	116,792,107.9	922.1	2.226.8	100.0

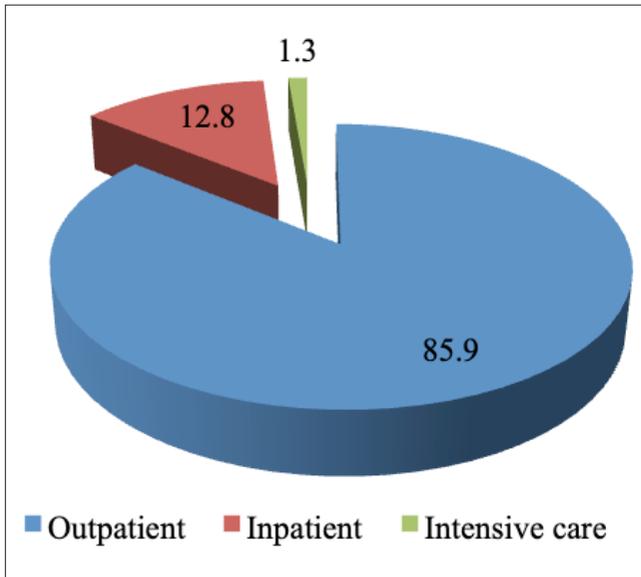


Figure 1. Distribution of Patients Hospital Admission Types, 2014, Turkey

medical cost of inpatients was \$23,159,274.9, total cost of patients admitted into intensive care was 5,293,348.4, and total cost of drugs and medical equipment \$14,805,009.2. 63.0% of total medical costs of breast cancer for 1 year were due to outpatients, whereas this ratio was 19.8% for inpatients, 12.7% for drugs and medical equipment and 4.5% for intensive care treatment (Table 2).

Average medical cost per breast cancer patient with comorbidity was found to be higher compared to average medical cost per patient without comorbidity ($p < 0.05$). Average medical cost was 968.8\$ for breast cancer patients with comorbidity. Also, it was found that medical costs of metastatic patients were higher compared to non-metastatic patients ($p < 0.05$). Average medical cost was found to be 2,326.6\$ for metastatic breast cancer patients, whereas average medical cost was found to be 831.4\$ for non-metastatic breast cancer patients. Among metastatic breast cancer patients, it was found that medical costs, particularly that of inpatients and outpatients, were significantly high compared to non-metastatic patients (Table 3).

According to the classification made based on CCI, average medical cost per breast cancer patient was significantly high in terms of severe

Table 3. Distribution of Breast Cancer Treatment Cost by Presence of Comorbidity and Metastasis, 2014, Turkey

	Yes			No			p value
	Total (\$)	Mean(\$)	SD	Total (\$)	Mean(\$)	SD	
<i>Comorbidity</i>							
Outpatient	33,411,643.1	608.0	1.546.5	40,122,832.4	578.5	1.548.7	$p < 0.05$
Inpatient	11,046,563.8	1.238.3	951.8	12,112,711.1	1.267.3	974.2	
Intensive care	3,179,728.6	2.917.2	669.3	2,113,619.9	2.915.4	495.0	
Drugs and medical equipments	6,763,838.2	208.9	311.1	8,041,170.9	206.4	274.6	
Total Cost	54,401,773.6	968.8	1.396.8	62,390,334.3	884.9	1.132.8	
<i>Metastasis</i>							
Outpatient	9,300,064.5	1.254.9	2,246.2	64,234,411.0	549.5	1.482.3	$p < 0.05$
Inpatient	4,361,820.2	1.860.9	3,726.9	18,797,454.7	1.165.0	1.866.5	
Intensive care	1,810,492.2	3.063.4	7,243.7	3,482,856.2	2.845.5	5.461.7	
Drugs and medical equipments	2,391,178.7	351.0	523.1	12,413,830.6	192.4	264.8	
Total Cost	17,863,555.5	2.326.6	3.798.8	98,928,552.4	831.4	2.010.7	

Table 4. Distribution of Breast Cancer Treatment Cost According to Charlson's Comorbidity Index Classification, 2014, Turkey

	Mild			Moderate			Severe			p
	Total (\$)	Mean (\$)	SD	Total (\$)	Mean (\$)	SD	Total (\$)	Mean (\$)	SD	
Outpatient	25,316,412.6	563.3	1.453.2	3,082,548.5	543.0	1.387.7	5,012,682.0	1.156.6	2.084.9	$p < 0.05$
Inpatient	7,499,605.3	1.148.8	3.432.3	1,169,710.8	1.162.7	3.542.9	2,377,247.7	1.713.9	5.073.9	
Intensive care	1,618,631.0	2.911.2	4.312.6	396,675.3	2.333.4	5.418.9	1,164,422.2	3.198.9	6.890.5	
Drugs and medical equipments	4,885,674.6	229.3	398.7	554,424.1	202.1	792.3	1,323,739.5	455.0	891.9	
Total Cost	39,320,323.5	858.7	2.012.8	5,203,358.7	890.8	2.705.8	9,878,091.3	2.184.0	3.963.4	

comorbidity classification ($p < 0.05$). Average medical cost per patient was calculated as \$2,184.0 for breast cancer patients with severe comorbidity, of which 51.0% was due to outpatients. It was found that average medical cost per patient for breast cancer patients with comorbidities at mild or moderate level were similar (Table 4).

Average medical cost per patient was calculated for metastatic breast cancer patients based on whether they had one or more than one metastasis and it was found that average medical cost per patient was \$3,251.4 for patients with more than one metastasis, which was higher compared to those with one metastasis ($p < 0.05$) (Table 5).

In terms of average medical cost per breast cancer patients for patients who are newly diagnosed/active treatment and follow-up (remission), average medical cost per patient was \$5,112.6 for newly diagnosed/active treatment patients. This average cost was approximately 14 times higher than the average medical costs of follow-up patients ($p < 0.05$) (Table 6).

Discussion and Conclusion

The goal of this study was to determine annual direct medical cost of patients with previous or new breast cancer diagnosis who have received inpatient or outpatient care between January-December 2014 in a hospital in Turkey contracted by SSI. Interpretations were made by taking into consideration that the number of studies conducted on the issue in Turkey and throughout the world are few and medical costs predictions from various countries are heterogeneous in terms of demographics, culture, healthcare system structure, and current resources.

According to data obtained, total medical costs of 126,664 patients with breast cancer diagnosis was calculated as \$116,792,107.9, with an average treatment cost per patient of \$922.1. %85.9 of patients were outpatients, whereas 12.8% were inpatients and 1.3% were admitted to intensive care. Total medical cost of outpatients was \$73,534,475.5, total medical cost of inpatients was \$23,159,274.9, total cost of patients admitted into intensive care was \$5,293,348.4, and total cost of drugs and medical equipment were \$14,805,009.2. 63.0 % of total annual medical cost of breast cancer is due to outpatients. A majority of treatment services provided to breast cancer patients such as radiotherapy, adjuvant and non-adjuvant chemotherapy, and certain hormone treatments do not require in-patient admission (2). Therefore, outpatient medical costs are expected to have a higher share in total cost. Indeed, Allaire et al. (3) and Bonastre et al. (22) have similarly found that a majority of breast cancer medical costs is due to outpatient treatments and the cost of outpatient treatment is significantly higher compared to that of inpatient treatment. In another study, Ekwueme et al. (23) studied medical costs of breast cancer treatment for women between ages 19-44 who are subscribed to Medicaid at national level in the USA and calculated monthly average medical cost per patient to be \$5.711. In the same study, monthly average medical cost of outpatient patients with cancer diagnosis was found to be \$4.058, whereas monthly average medical cost of inpatient patients with cancer diagnosis was \$1.003 and average cost of prescribed drugs was \$539. In contrast, a study by Lindgren et al (24) conducted in Sweden in order to calculate breast cancer costs found that cost of inpatients are higher than that of outpatients. Again, a study by Ivanauskienė et al. (25) found that average cost of inpatients newly diagnosed with breast cancer was 1655€ in 2011, whereas the average cost for outpatients was 564€.

Table 5. Distribution of Metastatic Breast Cancer Treatment Cost According to 1 or More Metastasis, 2014, Turkey

	1 Metastasis			>1 Metastasis			p
	Total(\$)	Mean(\$)	SD	Total(\$)	Mean(\$)	SD	
Outpatient	7,991,349.4	1.221.0	2.176.3	1,308,715.2	1.511.2	2.567.8	$p < 0.05$
Inpatient	3,435,734.1	1.742.3	3.761.9	926,086.1	2.489.5	5.807.6	
Intensive care	1,521,515.8	3.286.2	9.872.9	288,976.4	2.257.6	8.862.9	
Drugs and medical equipments	1,991,926.6	457.0	921.4	399,251.9	612.2	983.7	
Total Cost	14,940,526.0	2.203.9	3.879.0	2,923,029.5	3.251.4	5.613.3	

Table 6. Distribution of Metastatic Breast Cancer Treatment Cost According to Newly Diagnosed/Active Treatment or Follow-Up Patients, 2014, Turkey

	Newly Diagnosed/ Active Treatment Patients			Follow-Up Patients			p
	Total(\$)	Mean(\$)	SD	Total(\$)	Mean(\$)	SD	
Outpatient	44,929,024.1	3.225.4	3.772.9	28,605,451.3	259.2	374.4	$p < 0.05$
Inpatient	20,299,880.9	1.924.5	3.122.8	2,859,394.1	360.5	1.231.8	
Intensive care	5,177,849.8	3.447.3	8.712.9	115,498.6	369.0	1.457.8	
Drugs and medical equipments	5,607,260.3	476.6	599.9	9,197,748.8	175.0	468.9	
Total cost	76,014,015.2	5.112.6	5.022.7	40,778,092.7	364.8	712.6	

In this study, it was determined that cost of breast cancer treatment has statistically significant difference according to all independent variables used in the study (patient with and without comorbidity, metastatic/non-metastatic patient, patients' CCI score, patients with 1 or more than one metastasis, newly diagnosed and follow-up patients).

44.3% of breast cancer patients had a comorbidity. Average medical cost was \$968.8 for breast cancer patients with comorbidities. According to the classification made based on Charlson's Comorbidity Index, average medical cost per breast cancer patient was significantly high in terms of severe comorbidity classification with \$2,184.0. According to Radice and Redaelli (2003), medical costs during initial diagnosis phase of breast cancer was higher for patients with comorbidities compared to patients with no comorbidity and follow-up costs for breast cancer patients was particularly higher for patients with comorbidity. In another study conducted in Germany, Gruber et al. (27) found that 90% of all medical costs of breast cancer patients between ages 30-45 was due to breast cancer treatment, whereas only 50% of all medical costs of breast cancer patients between ages 80-90 was due to breast cancer treatment, which was explained as a result of increase in severity of comorbidities with age and consequent increase in medical costs (26).

In our study, we determined that 6.1% of breast cancer cases develop metastasis. In study, average medical cost for metastatic breast cancer patients was 2.8 higher compared to average medical cost for non-metastatic breast cancer patients. This conclusion is in parallel with conclusion of studies from the literature. In a study based on Medicare costs, Rao et al. (28) calculated the average medical cost for a metastatic breast cancer patient as \$35,164. In a study conducted in Lithuania, Ivanauskienė et al. (25) found the average medical cost for patients with newly diagnosed breast cancer was 2580€, whereas the average medical cost for patients with newly diagnosed "metastatic" breast cancer was 3687€. In the same study, the average medical cost was 2409€ for stage I breast cancer patients and 3688€ for stage IV patients. In another study, Blumen et al. (12) found that average medical cost for stage IV breast cancer patients was significantly high compared to that of stage I, II, or III patients. Similarly, in a study on the costs of different types of cancer in England, Laudicella et al. (29) found that, in terms of colorectal and breast cancers, the medical costs of patients at later stages (stage III-IV) were higher compared to the medical costs of stage I-II patients.

Average medical cost per patient for 1 year for newly diagnosed breast cancer patients was found to be quite high at \$5,112.6. These high costs can be attributed to the fact that this 1-year period is a process during which initial treatment such as surgical, chemotherapy and radiotherapy are administered and diagnosis studies of doctors are carried out. For example, in a study conducted in 2013 on medical cost of breast cancer in Vietnam, Hoang Lan et al. (13) found that initial medical costs, for example chemotherapy costs, have a large share (64.9%) in total cost. In a study conducted in Belgium, it was found that the average medical cost for female breast cancer patients was 10.071€ for the initial diagnosis year, which was down to 3.245€ for the second year. Similarly, Blumen et al. (12) studied breast cancer medical costs for the initial year and the following second year and found that the initial year' average cost of \$47.452 went down to \$5.636 for the second year (30).

Early diagnosis in breast cancer lowers medical costs whereas medical costs increase as the disease progresses, which was shown in this study using average medical costs of metastatic and non-metastatic breast cancer patients. Lack of palliative care centers, which can be seen throughout the world and are slowly being integrated into Turkey's healthcare system, can be considered as one of the main reasons. In Turkey, metastatic patients receive medical treatment towards pain relief at hospital services and intensive care rather than palliative care centers. Many studies from the literature point out to the fact that palliative care center are more cost-effective compared to hospital services and intensive care.

In addition, late-stage care in Turkey is usually administered at home. As a result, patients return to the hospital in case of a severe complication, which lowers life quality of patients and increases medical care costs. Considering the increase in prevalence of cancer in Turkey, increasing the number of palliative care centers to a required amount and preventing unnecessary treatments and procedures by administering proper care would both improve quality of life of patients at last stage while ensure more effective use of resources in terms of healthcare spending.

Optimizing and establishing cancer care, establishing and maintaining accompanying health policies is a difficult and complex issue. Healthcare administrators need such cost studies, which are used as evidence-based data in order to eliminate inequalities in terms of treatment and care of cancer patients and allocate resources effectively. We hope that this study, which is on breast cancer with high incidence and costs, serves as a solid evidence for healthcare administrators and political decision makers.

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References

1. Globocan. GLOBOCAN 2012: Estimated Cancer Incidence, Mortality and Prevalence Worldwide in 2012. 2012. Available from: URL: <http://globocan.iarc.fr/Default.aspx>.
2. Davies EL. Breast Cancer. *Medicine* 2016; 44: 42-46. [CrossRef]
3. Allaire BT, Ekwueme DU, Guy GP Jr, Li C, Tangka FK, Trivers KE, Sabatino SA, Rodriguez JL, Trogon JG. Medical Care Costs of Breast Cancer in Privately Insured Women Aged 18-44 Years. *Am J Prev Med* 2016; 50: 270-277. (PMID: 26775906) [CrossRef]
4. Ilter H, Keskinkılıç B. Cancer Statistics of Turkey 2014, Republic of Turkey, Ministry of Health, Directorate General of Public Health, Ankara. 2017. Available from: URL: https://hsgm.saglik.gov.tr/depo/birimler/kanser-db/istatistik/2014-RAPOR_uzuunuun.pdf.

5. Tuncer M. National Cancer Program 2009-2015. Republic of Turkey, Ministry of Health, Department of Cancer Control. Ankara. 2009. Available from: URL: http://www.iccp-portal.org/system/files/plans/Turkey%20NATIONAL_CANCER_PROGRAM2-1.pdf.
6. Hassett MJ, Elkin EB. What Does Breast Cancer Treatment Cost and What Is It Worth? *Hematol Oncol Clin N Am* 2013; 27:829-841. (PMID: 23915747) [[CrossRef](#)]
7. Pallis A, Tsiantou V, Simou E, Maniadakis N. Pharmacoeconomic considerations in the treatment of breast cancer. *Clinicoecon Outcomes Res* 2010; 2: 47-61. (PMID: 21935314) [[CrossRef](#)]
8. Barron JJ, Quimbo R, Nikam PT, Amonkar MM. Assessing the economic burden of breast cancer in a US managed care population. *Breast Cancer Res Treat* 2008; 109: 367-377. (PMID: 17674201) [[CrossRef](#)]
9. Will BP, Berthelot JM, Le Petit C, Tomiak EM, Verma S, Evans WK. Estimates of the lifetime costs of breast cancer treatment in Canada. *Eur J Cancer* 2000; 36: 724-735. (PMID: 10762744) [[CrossRef](#)]
10. Khanna R, Madhavan SS, Bhanegaonkar A, Remick SC. Prevalence, healthcare utilization, and costs of breast cancer in a state Medicaid fee-for-service program. *J Womens Health* 2011; 20: 739-747. (PMID: 21417935) [[CrossRef](#)]
11. Max W, Sung HY, Stark B. The economic burden of breast cancer in California. *Breast Cancer Res Treat* 2009; 116: 201-207. (PMID: 18683041) [[CrossRef](#)]
12. Blumen H, Fitch K, Polkus V. Comparison of treatment costs for breast cancer, by tumor stage and type of service. *Am Health Drug Benefits* 2016; 9: 23-32. (PMID: 27066193)
13. Hoang Lan N, Laohasiriwong W, Frederick Stewart J, Dinh Tung N, Coyte PC. Cost of treatment for breast cancer in central Vietnam. *Glob Health Action* 2013; 6: 18872. (PMID: 23394855) [[CrossRef](#)]
14. Hodgson TA, Meiners MR. Cost-of-illness methodology: A guide to current practices and procedures. *Milbank Mem Fund Q Health Soc* 1982; 60: 429-462. (PMID: 6923138) [[CrossRef](#)]
15. Songer TJ, Ettaro L. Studies on the Cost of Diabetes. Available from: URL: <http://www.pitt.edu/~tjs/coi/Costofillness.PDF>.
16. Tarricone R. Cost-of-illness analysis. What room in health economics? *Health Policy* 2006; 77: 51-63. (PMID: 16139925) [[CrossRef](#)]
17. Costa N, Derumeaux H, Rapp T, Garnault V, Ferlicq L, Gillette S, Andrieu S, Vellas B, Lamure M, Grand A, Molinier L. Methodological considerations in cost of illness studies on Alzheimer disease. *Health Econ Rev* 2012; 2: 18. (PMID: 22963680) [[CrossRef](#)]
18. Bendeck M, Serrano-Blanco A, Garcia-Alonso C, Bonet P, Jorda E, Sabes-Figuera R, Salvador-Carulla L. An integrative cross-design synthesis approach to estimate the cost of illness: An applied case to the cost of depression in Catalonia. *J Ment Health* 2013; 22: 135-154. (PMID: 23323630) [[CrossRef](#)]
19. Greenberg D, Ibrahim MIBM, Boncz I. What are the challenges in conducting cost-of-illness studies? *Value Health Reg Issues* 2014; 4: 115-116. (PMID: 29702798) [[CrossRef](#)]
20. TÜİK. Health Expenditure Statistics 2017. Turkish Statistical Institute Press Release: Ankara. 2017. Available from: URL: <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=27621>.
21. Keshavarz K, Kebriaeezadeh A, Alavian SM, Sari AA, Dorkoosh FA, Keshvari M, Malekhosseini SA, Nikeghbalian S, Nikfar S. Economic Burden of Hepatitis B Virus-Related Diseases: Evidence From Iran. *Hepat Mon* 2015; 15: e25854. (PMID: 25977694) [[CrossRef](#)]
22. Bonastre J, Jan P, Barthe Y, Koscielny S. Metastatic breast cancer: We do need primary cost data. *Breast* 2012; 21: 384-388. (PMID: 22520336) [[CrossRef](#)]
23. Ekwueme DU, Allaire BT, Guy GP, Arnold S, Trogdon J. Treatment costs of breast cancer among younger women aged 19-44 years enrolled in Medicaid. *Am J Prev Med* 2016; 50: 278-285. (PMID: 26775907) [[CrossRef](#)]
24. Lindgren M, Wilking N, Jönsson B, Rehnberg C. Resource use and costs associated with different states of breast cancer. *Int J Technol Assess Health Care* 2007; 23: 223-231. (PMID: 17493308) [[CrossRef](#)]
25. Ivanauskienė R, Domeikienė A, Kregždytė R, Milašauskienė Ž, Padaiga Ž. The cost of newly diagnosed breast cancer in Lithuania, 2011. *Medicina (Kaunas)* 2015; 51: 63-68. (PMID: 25744777) [[CrossRef](#)]
26. Radice D, Redaelli A. Breast Cancer Management: Quality-of-Life and Cost Considerations. *Pharmacoeconomics* 2003; 21: 383-396. (PMID: 12678566) [[CrossRef](#)]
27. Gruber EV, Stock S, Stollenwerk B. Breast cancer attributable costs in Germany: a top-down approach based on sickness funds data. *PLoS one* 2012; 7: e51312. (PMID: 23251495) [[CrossRef](#)]
28. Rao S, Kubisiak J, Gilden D. Cost of illness associated with metastatic breast cancer. *Breast Cancer Res* 2004; 83: 25-32. (PMID: 14997052) [[CrossRef](#)]
29. Laudicella M, Walsh B, Burns E, Smith PC. Cost of care for cancer patients in England: evidence from population-based patient-level data. *Br J Cancer* 2016; 114: 1286-1292. (PMID: 27070711) [[CrossRef](#)]
30. Broekx S, Den Hond E, Torfs R, Remacle A, Mertens R, D'Hooghe T, Neven P, Christiaens MR, Simoens S. The costs of breast cancer prior to and following diagnosis. *Eur J Health Econ* 2011; 12: 311-317. (PMID: 20306109) [[CrossRef](#)]