

Analysis of the direct cost of medical and surgical care for breast cancer. Comparative study between early and advanced stages in the third level medical facility

Análisis del coste directo de la atención médica y quirúrgica del cáncer de mama. Estudio comparativo entre etapas temprana y tardía en tercer nivel de atención

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Abstract

Background: Management of breast cancer is increased by late diagnoses. **Objective:** To analyse direct costs of breast cancer in early and advanced stage in a third level medical facility at Mexican Social Security Institute. **Method:** Observational study, direct costs of care in breast cancer in initial and advanced clinical stages are compared. Variables analysed were laboratory and diagnostic imaging studies, drugs, as well as hospitalization costs. The evaluated period included from the first care to the completion of the treatment. Costs were determined according to the table of Unit Costs by Level of Medical Care for the year 2019 of the Mexican Social Security Institute. Student's t test was used to determinate differences between groups, as well as descriptive statistics. **Results:** The advanced stage compared to the initial stage, causes a greater number of laboratory-cabinet studies, surgeries, day/bed and interconsultations. The average cost of breast cancer care per patient is \$99,280.36 (US\$5,230.78) and \$148,023.60 (US\$7,789.92) for the initial and advanced stages, respectively ($p = 0.024$). **Conclusions:** Cost of medical attention in the initial stage is lower than that of the advanced stage.

Keywords: Breast cancer. Direct cost. Medical attention. Late diagnosis.

Resumen

Antecedentes: Los diagnósticos tardíos elevan los costes de atención del cáncer de mama. **Objetivo:** Analizar los costes directos de la atención del cáncer de mama en etapa temprana y avanzada en el tercer nivel de atención en el Instituto Mexicano del Seguro Social (IMSS). **Método:** Estudio observacional que compara los costes directos de atención en cáncer de mama en estadios clínicos inicial y avanzado. Los datos analizados fueron estudios de laboratorio, gabinete, tratamiento y hospitalización. El tiempo evaluado incluyó desde la primera atención hasta la finalización del primer tratamiento. Se determinaron los costes de acuerdo con la tabla de Costes Unitarios por Nivel de Atención Médica para el año 2019 del IMSS. Se utilizó la prueba t de Student para diferencias entre grupos, así como estadística descriptiva. **Resultados:** El estadio avanzado, comparado con el estadio inicial, ocasiona un número mayor de estudios de laboratorio-gabinete, cirugías, día/cama e interconsultas.

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*El coste promedio de la atención del cáncer de mama por paciente es \$99,280.36 (US\$5,230.78) y \$148,023.60 (US\$7,789.92) para los estadios inicial y avanzado, respectivamente ($p = 0.024$). **Conclusiones:** El coste de la atención médica del estadio inicial es menor que el del estadio avanzado.*

Palabras clave: Cáncer de mama. Coste directo. Atención médica. Diagnóstico tardío.

Introduction

Breast cancer is a problem of public health worldwide¹. In the Americas, it is the most common type of cancer and the second leading cause of cancer death in women. Each year, over 462,000 women are diagnosed, and almost 100,000 die from this disease^{2,3}. By the year 2030, we could be experiencing a 34% rise in the number of cases reported⁴.

According to the National Cancer Institute, in 2020, projected medical spending for the management of breast cancer reached \$16.5 billion, followed by colorectal cancer (\$14 billion), lymphoma, lung cancer, and prostate cancer, each with \$12 billion⁵.

In Mexico, in 2017, 24 out of every 100 hospital discharges due to cancer in individuals younger than 20 years old, were due to breast cancer, making it the leading cause of hospital discharge for malignant tumors. Based on sex, 1 out of every 100 men and 37 out of every 100 women were discharged after diagnosis of malignant breast tumors⁶. In 2019 and 2020, a total of 88,683 and 60,421 deaths were reported due to malignant tumors, respectively.

There are very few of studies worldwide on breast cancer-related spending. Back in 2006, in the United States alone, the annual spending on treatment was \$13.9 billion. In Europe, the annual spending was \$8.7 billion in 2009⁷. In Colombia, Latin America, a study on breast cancer spending conducted in 2016 revealed spending of \$65,603,537 for regional cancer and \$144,400,865 for metastatic cancer⁸.

The Mexican Institute of Social Security (IMSS) is a Mexican and Latin American health care institution of paramount importance. At the end of 2018, it had a total of 2910 operative units under the Regular Regime and 4386 medical care units at all levels⁹ under the IMSS-BIENESTAR, providing coverage to 53,533,650 beneficiaries, which is representative of nearly 50% of the entire Mexican population^{9,10}. This institution was the basis on which this study was conducted to compare the direct medical spending associated with breast cancer in its early and advanced stages at Hospital de Especialidades de Puebla of IMSS, Puebla, Mexico.

Method

This was an observational cost study that compared direct medical spending in patients with breast cancer in the early and advanced stages of the disease. The study included health records of breast cancer patients of any age and sex who were beneficiaries of the Mexican Institute of Social Security (IMSS) and treated at Hospital de Especialidades de Puebla, Centro Médico Nacional General de División Manuel Ávila Camacho, a third-level center with complete health records, confirmed histopathological reports, who had received medical and surgical treatment. Patients who required emergency surgery were excluded, and those who died prior to hospital discharge were removed from the study.

The variables of interest were sex, socioeconomic level, age, lab test results and imaging modalities, hospitalization days per patient, medical and surgical treatments performed, and number of inter-consultations to determine the direct spending per patient.

Data were collected from the patients' health records. The sample included health records from patients from the participant medical unit who met the inclusion criteria from 2017 through 2018.

The sample size was estimated considering that the incidence rate of breast cancer is 3.5% in first-time consultations at this hospital for a total of 960 patients per year, 80% precision, 95% confidence interval, 5% tolerated error, and accounting for a probable 10% loss per group. A total of 23 patients per group were included in the sample.

A total of 30 health records were revised per group. The patients were divided into 2 groups to audit spending:

- Early stage: including operable patients.
- Advanced stage: including patients with locally advanced—inoperable—and advanced stages.

For definition purposes, groups were divided into early and advanced stages based on the classification established by the Spanish Society of Medical Oncology (SEOM)¹¹.

Spending was studied based on the IMSS Unit Costs of Health and Social Care table for 2019 as published in the *Gaceta Oficial de la Federación*¹⁰.

In the two groups, follow-up started from the moment the patients started treatment at the third-level center until they were discharged after completing their first cycle of medical treatment.

The patients' socioeconomic status was determined using data from the Asociación Mexicana de Agencias de Inteligencia de Mercado y Opinión (2018), including 7 levels from highest to lowest: A/B, C+, C, C-, D+, D, and E¹². For study purposes, these 7 levels were grouped into 3: A/B and C+ (high socioeconomic level); C, C-, and D+ (medium level); and D and E (low level).

Descriptive statistics with measures of central tendency and dispersion were performed. All variables showed a normal distribution according to the Shapiro-Wilk test. To compare inter-group spending, the Student t test was used. P values ≤ 0.05 were considered statistically significant. IBM Statistical software Package for Social Sciences, version 23 for Windows was used for data analysis.

The study received proper authorization from the ethics and research committee with no. R-2019-2101-022. Additionally, the study complies with the ethical guidelines on health research. It did not require any funding or prior written informed consent, and the participants' anonymity was preserved at all times. The results were used solely for scientific purposes.

Results

A total of 60 patients were included in the study, 30 (50%) in group #1 and another 30 (50%) in group #2.

In group #1, all 30 patients (100%) were women, with a mean age of 57.7 years (range, 40-78; standard deviation, 9.72). Nine patients (30%) were of low socioeconomic level, and 21 (70%) of medium socioeconomic level. The mean numbers of lab and imaging tests performed, hospitalization days per patient, surgeries, medical treatments, and inter-consultations were 9.7, 3.23, 2.77, 1, 10.7, and 3.43, respectively.

In group #2, 29 patients (96.7%) were women, and 1 (3.3%) was a man, with a mean age of 59.3 years (range, 36-95; standard deviation, 14.07). Eight patients (26.7%) were of low socioeconomic level, 21 (70%) of medium socioeconomic level, and 1 (3.3%) of high socioeconomic level (Table 1). The mean numbers of lab and imaging tests performed, hospitalization days per patient, surgeries, medical treatments, and inter-consultations were 19.03, 3.56, 6-73, 1.13, 10.43, and 3.53, respectively.

Regarding the patients' clinical stage, patients from group #2 were older than those from group #1, more

Table 1. Sex and socioeconomic level of the population included

	Early stage	Advanced stage	p
Sex			
Men	0	1	0.313
Women	30	29	
Socioeconomic level			
High	0	1	0.589
Medium	21	21	
Low	9	8	

Table 2. Number of studies, therapies, days/bed, and inter-consultations of the patients included

	Mean	Min.	Máx.	SD	p*
Age (years)					
ES	57.7	40	78	9.72	0.407
AS	59.33	36	95	14.07	
Lab tests					
ES	9.7	0	35	7.14	0.517
AS	19.03	0	62	15.89	
Imaging tests					
ES	3.23	0	8	2.06	0.614
AS	3.57	0	12	2.43	
Days/bed					
ES	2.77	0	9	2.23	0.311
AS	6.73	0	35	7.41	
Surgical therapy					
ES	1	0	3	0.78	1
AS	1.13	0	2	0.43	
Medical therapy					
ES	10.77	0	40	13.44	0.832
AS	10.43	0	58	15.07	
Inter-consultation					
ES	3.43	0	10	2.04	0.314
AS	3.53	0	16	3.8	

AS: advanced stage; ES: Early stage; max.: maximum; min.: minimum; SD: standard deviation.

*Student t test.

lab and imaging tests were performed, longer hospital stays were reported based on the number of hospitalization days per patient, and more medical and surgical acts, and inter-consultations occurred, yet without any statistically significant differences being reported ($p \geq 0.05$) (Table 2).

Regarding the direct health care spending, group #2 presented a significant increase compared to group #1, with statistically significant differences being reported in lab ($p = 0.018$) and imaging tests performed ($p = 0.05$), and hospitalization days per patient ($p = 0.006$) (Fig. 1).

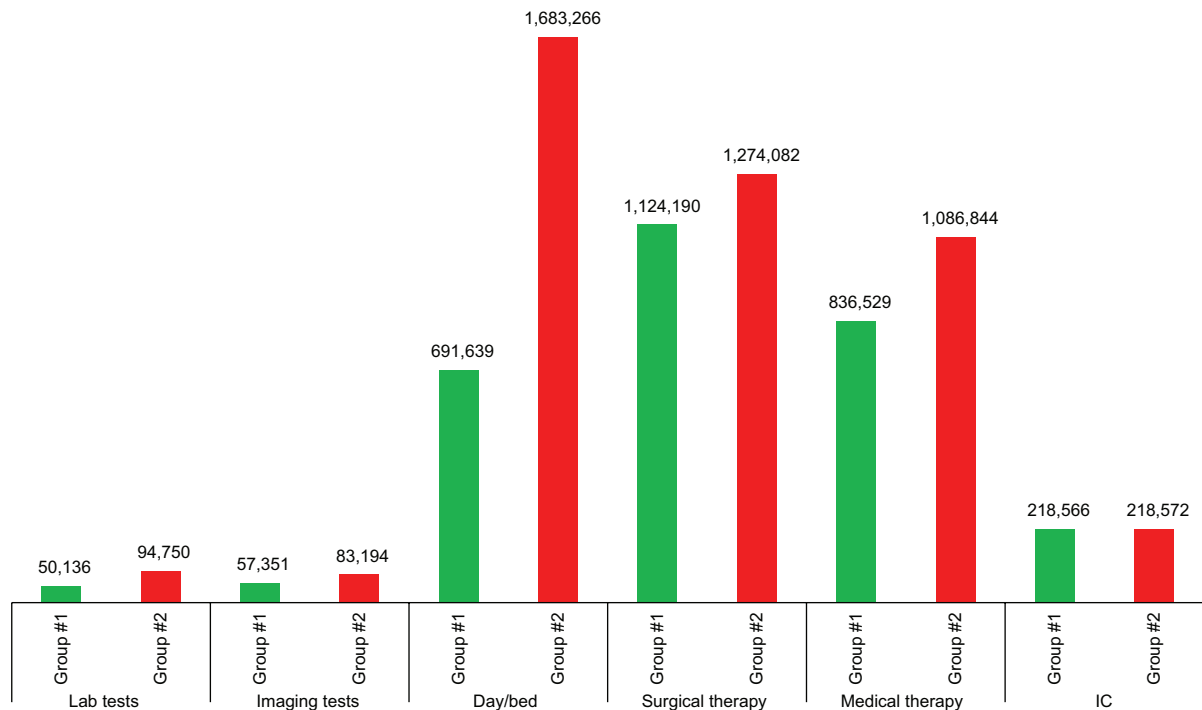


Figure 1. Spending on lab and imaging tests, hospitalization (days/care), medical therapies (Med Tx), surgical therapies (Surg Tx), and inter-consultations (IC).

The average spending of breast cancer care per patient was \$99,280.36 and \$148,023.60 for early and advanced stages, respectively, in 2019, at third-level IMSS centers, with an exchange rate in October 18, 2019, of \$18.98 per US dollar and \$21.35 per euro. These data are supported by the total direct spending associated with the health care provided to both patient groups ($p = 0.024$) as shown on figure 2.

We should mention that this study only evaluates direct health care spending, not indirect spending (disability, transportation expenses, psychological implications, etc.).

Breast cancer is a global issue of public health. The impact of late-stage diagnosis affects prognosis, quality of life, and health care spending for these patients¹³⁻¹⁵.

When looking at the study results, we should mention that non-medical spending (such as transportation, trips from home to the hospital, among others) were not taken into consideration. The economic impact caused by managing this disease in its advanced stages is clearly identified compared to management in the early stages.

The analysis of direct health care spending gives us a panoramic view on the efficiency of policies and programs related to breast cancer care in different stages.⁴ Staging breast cancer allows for a simple

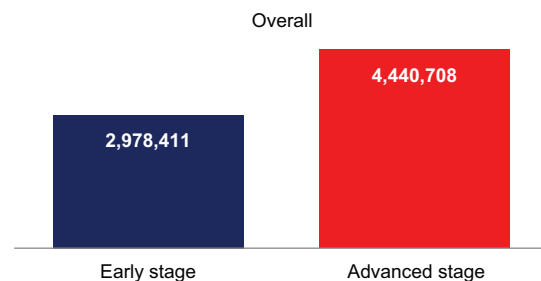


Figure 2. Difference in overall spending (in Mexican pesos) of direct medical care provided to both groups of patients ($p = 0.024$).

presentation of spending because it divides the classification according to SEOM staging, which is based on the treatment used¹¹.

Regarding the age of breast cancer presentation, both groups had similar mean ages (57.7 and 59.3 years) with no statistically significant differences being reported ($p = 0.40$). While low socioeconomic level can be considered a factor for delayed diagnosis, the analysis showed a similarity in both groups, with a predominance of the medium socioeconomic level, followed by the low one, once again without statistically significant differences being reported ($p > 0.05$).

Patients in advanced breast cancer stages required more lab and imaging tests, which ends up increasing spending. These results are consistent with a study published in *The Lancet Oncology* in 2013 that claimed breast cancer was the disease associated with the highest health care spending of all, €6-73,000 million (representative of 13% of all cancer-related spending)¹⁶.

Statistically significant differences were found in spending regarding lab and imaging tests, and hospitalization days per patient between both groups, with more spending associated with group #2 (advanced stage). However, no statistically significant differences in surgical treatment, medical treatment, and interconsultation spending were reported between the two groups.

The results obtained in this study—based on SEOM classification—prove that spending increases when breast cancer is diagnosed in advanced compared to early stages¹⁷.

Within the IMSS, the average annual spending per patient was estimated at \$110,459 in 2006. Stage I breast cancer diagnosed in 2002 amounted to \$74,522, compared to \$102,042 for stage II, \$154,018 for stage III, and \$199,274 for stage IV¹⁴.

Similarly, in Colombia, the spending estimated for the management of breast cancer was higher in regional and metastatic stages (65,603,637 and 144,400,865 Colombian pesos, respectively), while the in situ stage was associated with the lowest spending of all (8,996,987 Colombian pesos)⁸.

In Spain, in 2015, spending according to the Basque Health System was €9838 for stage 0, €17,237 for stage I, €22,145 for stage II, and €28,776 for stage III¹⁸.

In the present study that evaluated breast cancer spending in the IMSS, spending for the management of early-stage care was \$99,280.36 (\$148,023.60 for advance-stage care). We should mention that exchange rate back in October 18, 2019, was 18.98 pesos per US dollar and 21.35 pesos per euro for a total of \$5230.78 and €4650.13, respectively for early stage cancer and \$7798.92 and €6933.18 for advanced stage cancer.

In economic terms, we should consider the significant increase in spending due to permanent disabilities resulting from neoplastic diseases. For example, in Madrid, Spain, in 2012, 42.28% (31,554) out of a total of 74,631 permanent disability pensions were absolute pensions, with average pension amounts of €1211.94¹⁹. In Mexico, breast cancer is the leading cause of disability due to malignant diseases (16%), followed by colon and brain cancer²⁰.

Based on these results, there is a clear need for early and timely diagnosis in these patients to reduce the economic impact caused by health care when diagnosed in advanced stages.

Regarding health care at the early stages of the disease, from an economic perspective, there would be fewer hospitalization days, medical, and surgical therapies. As a matter of fact, this could be achieved through a training program for the personnel taking care of these patients at the primary level of medical care.

This study on the direct costs associated with breast cancer care can lay the foundations for future research, including the costs of preventing this disease, which would impact health care programs and policies in Mexico and across the world.

One limitation of this study is that it only evaluates the direct costs associated with breast cancer care at the IMSS and in no other public and private centers. It would have been interesting to compare health care spending in other public (Secretaría de Salud, Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado, Petróleos Mexicanos, etc.) and private institutions (Grupo Hospital Ángeles or Christus Muguerza, among others).

We should also mention that IMSS provides medical care to 50% of the Mexican population, which is one of the strengths of the study¹¹.

In addition, we should track down patients with recurrences, control and reconstruction therapies that are crucial for the patient's social reintegration.

Conclusions

Health care spending for the management of early-stage breast cancer is lower compared to advanced stages of the disease, thus stressing the need for implementing preventive measures for early breast cancer care.

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Conflicts of interest

None reported.

Ethical disclosures

Protection of human subjects and animals in research. The authors declare that no experiments were performed on humans or animals for this study.

Patients' data protection. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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