

Assessment of costs related to cancer treatment

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SUMMARY

INTRODUCTION: Cancer patients and their caregivers incur costs not covered by the Sistema Único de Saúde – SUS (Unified Health System) during their treatment, with expenses related to transportation, symptomatic medications, food, loss of working days, and others.

OBJECTIVE: To evaluate the costs incurred and not covered for cancer patients and their caregivers during cancer treatment at SUS.

METHODS: This is a cross-sectional study of 110 cancer patients undergoing chemotherapy, radiotherapy, and 88 caregivers in the last month prior to their inclusion in the study. We correlated costs with clinical and sociodemographic variables such as gender, race, age, marital status, education, occupation, place of birth, origin, monthly income, family income, housing, comorbidities, types of cancer, and staging.

RESULTS: We observed that the average cost for study patients was R\$ 747.92, which corresponds to 78.4% of the minimum wage, and the average cost for caregivers was R\$ 118.86, which is 12.46% of the minimum wage. Among all variables analyzed, the average overall monthly cost for patients was positively correlated with the occupation ($p = 0.021$) and origin ($p = 0.038$) variables. For the other variables, no significant associations were detected.

CONCLUSION: The positive correlation found between occupation and origin variables with costs incurred and not covered for patients suggests that the creation of programs that enable the payment of costs not covered by SUS and the decentralization of access to cancer treatment could potentially facilitate patients' adherence to cancer treatment.

KEYWORDS: Neoplasms. Medical oncology. Health expenditures. Unified Health System. Caregivers.

INTRODUCTION

Every year, there are approximately 12.7 million new cancer cases worldwide. It is estimated that, in Brazil, in the 2018-2019 biennium, there were 600,000 new cases¹.

In this context, major advances in the early diagnosis of certain types of cancer and a greater understanding of the pathogenesis of neoplasms have led to the development of strategies to prevent and reduce the

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risk of death of cancer patients. However, this success has been accompanied by a substantial increase in healthcare costs for cancer treatment². In fact, cancer is currently the second most expensive disease in the United States, behind heart disease, with an annual cost estimated at 157 billion for 2020³. Therefore, with the increasing costs for the diagnosis and treatment of cancer, the financial concerns of patients, families, physicians, health systems, and contributors have been progressively accentuated⁴.

Cancer patients are particularly under personal financial risk of new financial charges not covered by insurance sources and associated with their treatment, such as transport, symptomatic medications, inputs, etc⁵. This financial burden caused by the treatment is part of what we currently call “financial toxicity”. These costs can have significant negative consequences for patients and their families⁶ that are comparable to other toxic and devastating effects from the diagnosis and treatment of cancer⁷.

To assess the total costs of disease, both the direct (those directly associated with the diagnosis and treatment of cancer) and indirect costs (economic losses caused by cancer, such as loss of productivity) need to be evaluated. By ignoring productivity losses, we may underestimate the true cost of a disease. Likewise, the informal care provided by family members or friends also leads to a loss of productivity and, therefore, should also be considered since this is an important element of care for many cancer patients⁸.

The objective of this study was to evaluate the indirect and not covered costs of cancer treatment in a population of cancer patients in the northeast of Brazil treated in the Single Health System (SUS) and their caregivers.

METHODS

This is a cross-sectional study that was conducted in the clinical oncology service of the Cancer Hospital of Maranhão Dr. Tarquínio Lopes Filho, located in the city of São Luís - MA, after approval by the Medical Ethics Committee of the Faculty of Medicine of ABC (CAAE: 79225417.1.0000.0082).

We included in the study patients over 18 years, with a good understanding of the Portuguese language and with a confirmed diagnosis of a malignant neoplasm. We admitted patients on free demand under chemotherapy or chemotherapy combined with radiotherapy treatment. We also included the

caregivers of these cancer patients, aged over 18 years, with a good understanding of the Portuguese language and who accompanied the patients during the cancer treatment (chemotherapy/radiotherapy sessions).

Patients who agreed to participate in the research signed the Informed Consent Form and filled out a form with their socioeconomic and demographic data. The patient data form included identification data (initials, gender, age, race, marital status, education, occupation, nationality, origin, comorbidities, and medications in use) and socioeconomic information (the type of occupation, aid from the INSS, number of dependents, monthly income, family income, housing, and means of transport). Patients and caregivers answered a detailed questionnaire to analyze the time spent on and the financial costs of transportation, food, oral medications not covered or provided by SUS, housing, and other inputs required during the last month of treatment.

The cost-time questionnaire comprises the evaluation of the amounts spent on transportation, medicines, food, and raw materials and the time (minutes or hours) spent in activities related to the cancer treatment. The time was converted into money by the calculation of the average value of an hour of work, using as a basis the minimum wage in 2018, which corresponds to R\$ 954.00. Thus, for example, we assumed that a work month comprised a maximum of 40 hours/week for 4 weeks. A similar procedure was used to calculate the value of the caregivers' time. This conversion of hours into reais was made so that we could include the hours spent as part of the additional total costs incurred and not covered.

Regarding the transport, for patients who used a car, the conversion was made by dividing the mileage from their residence to the treatment locations (hospitals, pharmacies, and health care units) by the fuel price in 2018. As for public transport (bus, alternative transportation), the value considered was the transport fee multiplied by the number of trips; for taxi rides, we considered the amount charged by the professional for each commuting; for cyclists or for those who walked, no expense was computed.

We only included the cost of medicines bought by the patients; those obtained from health units were not considered. For the calculation, the patients filled out the name of the medication, dosage, and amount used per month. For raw materials, the patients listed and filled out the amount spent related to the treatment

in the last month. The currency used for all items was real and, for the conversion, we used as a basis the minimum wage in 2018.

The survey data were organized in descriptive tables for better visualization. For data analysis, we used the statistical software SPSS v. 19, considering a significance level of 5%. To compare the averages of the final overall monthly cost for patients between the groups regarding caregivers, INSS, origin, type of neoplasia, staging, occupation, and educational level, we used the statistical one-way ANOVA test. Previously, we tested the data homogeneity of variances (Levene test) and normality (Shapiro-Wilk test) as assumptions of the ANOVA technique.

RESULTS

The clinical and pathological characteristics of the 110 patients included in this study are described in Table 1. Approximately 69 patients (62.73%) were females, with a mean age of 55.45 years. The patients had a variety of solid tumors, and the most

predominant type of neoplasia was in the GIT (n=47; 42.73%), and staging 4 was the most frequent (n=64; 58.19%). Regarding the level of schooling, most patients had up to incomplete secondary education, i.e., 59.09% (n=65). In relation to the occupation, the group that includes unemployed individuals/home-makers/informally employed individuals was the most prominent (n=56; 50.91%). The low educational level and the high percentage of patients without a fixed income (formal work/retirement), in this population, reflect the low Human Development Index of Maranhão, considered the 2° (second) worse among the states of the federation⁹.

In Table 2 it is possible to see the overall average of hours spent by patients, in a month, on transportation, consultations, treatment with chemotherapy and radiotherapy, purchase of medicines, and other activities and their proportional relationship with the minimum wage in 2018. The total average of hours was 17.45 ± 11.69 (4.50 - 114.50 hours).

After converting time into money, we obtained a general average of 134.15 ± 142.63 reais (0 - 840.71

TABLE 1. GENERAL PROFILE OF CANCER PATIENTS TREATED IN THE PUBLIC SERVICE OF THE CITY OF SÃO LUÍS - MA.

Variable		N (Total = 110)	% (Total = 100%)
Sex	Female	69	62.73
	Male	41	37.27
Type of neoplasms	Head and neck CA	3	2.73
	Lung CA	8	7.27
	Genitourinary CA	23	20.91
	Breast CA	20	18.18
	Sarcoma	5	4.54
	CNS	4	3.64
	GIT	47	42.73
Staging	2	13	11.82
	3	33	30.00
	4	64	58.19
Follow-up	With a caregiver	88	80.00
	Without a caregiver	22	20.00
Time of diagnosis	<6 months	43	39.09
	6-12 months	36	32.73
	> 12 months	31	28.18
Ethnicity	White	34	30.91
	Non-white	76	68.09
Formal education	Up to incomplete secondary	65	59.09
	Complete secondary	27	24.55
	Up to complete tertiary	18	16.37
Occupation	Formal employment	13	11.82
	Unemployed/Homemaker/Informally employed	56	50.91
	Retired	41	37.27

Variable		N (Total = 110)	% (Total = 100%)
Natural from	Maranhão	106	96.63
	Others	4	3.64
Origin	Capital	55	50.00
	Interior	55	50.00
Associated diseases	DM	8	7.27
	SAH	27	24.55
	SAH + DM	9	8.18
	SAH + Hypercholesterolemia	1	0.91
	Hyper-Hypothyroidism	3	2.73
	Hypercholesterolemia	1	0.91
	Others	3	2.73
	No Comorbidities	58	52.73
INSS	No	85	77.27
	Yes	25	22.73
Car	No	90	81.82
	Yes	20	18.18
Housing	Rented	14	12.73
	Financed	1	0.91
	Owned	95	86.36
Monthly income	Up to 1 minimum wage	67	60.91
	2-3 Minimum wages	22	20.00
	3-6 Minimum wages	3	2.73
	No income	18	16.36
Family income	Up to 1 minimum wage	13	11.82
	2-3 Minimum wages	54	49.09
	3-6 Minimum wages	40	36.36
	No income	1	0.91
Transportation	Car	56	50.91
	Bus	54	49.09
Variable		Mean ± SD	Min. - Max.
Age (years)	Female (n=69)	53.80 ± 12.70	24 - 81
	Male (n=41)	58.24 ± 14.34	26 - 84
	Overall (n=110)	55.45 ± 13.44	24 - 84

TABLE 2. IMPACT OF DIRECT AND INDIRECT COSTS OF CANCER TREATMENT IN HOURS/MONTH BASED ON THE MINIMUM WAGE (2018) FOR PATIENTS. SÃO LUÍS - MA.

Variable (patients)		Mean ± SD	Min. - Max.	% Minimum wage ¹
Transport (h/month)	Female (n=69)	7.57 ± 6.18	0.66 - 31	35.81%
	Male (n=41)	7.70 ± 6.35	0.66 - 28	37%
	Overall (n=110)	7.62 ± 6.22	0.66 - 31	36.29%
Consultations (h/month)	Female (n=69)	2.70 ± 2.06	0.33 - 12	4.55%
	Male (n=41)	2.55 ± 1.84	0.16 - 7	4.06%
	Overall (n=110)	2.64 ± 1.97	0.16 - 12	4.35%
CT and RT (h/month)	Staging 2 (n= 13)	11.36 ± 29.68	0 - 110	80.7%
	Staging 3 (n= 33)	6.68 ± 3.98	1 - 18	27.89%
	Staging 4 (n= 64)	5.24 ± 2.55	0 - 16	17.16%
	Overall (n=110)	6.40 ± 10.45	0 - 110	25.6%
Purchase of medication (h/month)		0.62 ± 0.65	0 - 3	0.24%
Other activities (h/month)		0.17 ± 0.76	0 - 6	0.02%
Total (h/month)		17.45 ± 11.69	4.50 - 114.50	190.3%

Legend: 1 = Minimum wage in 2018 - R\$ 954.00

reais), which corresponds to 14.06% of the minimum wage (Table 3). The overall average cost for patients, in reais, regarding transportation, medication, raw materials, alternative therapies, telephone, food, housing, and exams was R\$ 613.76 ± 662.03 reais (0 - 5,390 reais) corresponding to 64.33% of the minimum wage. The average total cost (time + money) was 747.92 ± 693.78 reais (103.84 - 5,475.44 reais), which corresponds to 78.40% of the minimum wage. The final average total cost (time + money + companion) reached 89.06% of the minimum wage, with an average expense of 849.65 ± 103.84 reais (751.69 - 5,474.44), as shown in Table 3.

When we correlated the cost incurred by patients with other clinical and socioeconomic variables presented in Table 4, we found a statistically significant difference for the “occupation” ($p = 0.021$) and “origin” ($p = 0.038$) variables. For the other variables, no statistically significant associations with costs incurred by patients were found.

DISCUSSION

Several risk factors have been described for the development of financial toxicity, such as female gender, younger age, non-white race/ethnicity, greater distance from treatment centers, and unemployment³. In the present study, patients analyzed predominantly presented some of these risk factors: 62.73% were

females, 69.09% were non-white, 50.91% were unemployed/homemakers/informally employed, and 50% were from the interior of the state of Maranhão.

A cross-sectional study involving 334 women with cervical cancer carried out in the Kisumu on Jaramogi Oginga Odinga Teaching and Referral Hospital (JOOTRH) showed that patients who had formal employment had proportionally less financial challenges, while participants who had completed only primary education reported greater financial challenges in comparison with those with other levels of education¹⁰. The occupation variable in this study was also statistically significant (Table 4), and this finding was also observed in a cross-sectional analysis carried out on women with metastatic breast cancer ($n=145$). This study showed that financial toxicity is common among low-income women with the disease and is directly related to a worse quality of life and general distress related to cancer⁷.

Most cancer patients were at the same level of staging, i.e., 4 (58.19%), something that is also considered a risk factor for increased costs with cancer treatment. Although all cancer patients are vulnerable to financial toxicity, patients with advanced or metastatic cancer seem to be particularly sensitive to it⁷. The paradigm for metastatic cancer treatment is often sequential and involves chemotherapy or immunotherapy that lasts for several months to years for continued treatment. Its diagnosis and treatment have

TABLE 3. IMPACT OF DIRECT AND INDIRECT COSTS OF CANCER TREATMENT IN REAIS BASED ON THE MINIMUM WAGE (2018) FOR PATIENTS AND CAREGIVERS. SÃO LUÍS - MA.

Variable (patients)	Mean ± SD	Min. - Max.	% Minimum wage ¹	
Time in cash	134.15 ± 142.63	0 - 840.71	14.06%	
Transport (real)	188.46 ± 160.97	0 - 800	19.75%	
Medications (real)	106.38 ± 143.97	0 - 800	11.15%	
Raw materials (real)	21.51 ± 112.93	0 - 900	2.25%	
Alternative therapy (real)	12.82 ± 115.26	0 - 1200	1.34%	
Telephone (real)	23.74 ± 26.99	0 - 167	2.49%	
Food (real)	48.32 ± 69.09	0 - 427	5.06%	
Housing (real)	24.58 ± 107.64	0 - 720	2.58%	
Exams (real)	187.95 ± 554.82	0 - 4,700	19.70%	
Cost in cash (real)	613.76 ± 662.03	0 - 5,390	64.33%	
Overall cost (time + money) (real)	747.92 ± 693.78	103.84 - 5,475.44	78.40%	
Variable (caregivers)	Mean ± SD	Min. - Max.	% Minimum wage ¹	
Total (real)	Female (n=72)	111.91 ± 209.12	0 - 1,180.58	11.73%
	Male (n=16)	150.09 ± 110.20	0 - 304.09	15.73%
	Overall (n=88)	118.86 ± 194.94	0 - 1,180.58	12.46%

Final overall cost (Patients + Caregivers) 849.65 ± 103.84 751.69 - 5,474.44 89.06%

Legend: 1 = Minimum wage in 2018 - R\$ 954.00

TABLE 4. COMPARISON OF AVERAGES OF THE MONTHLY FINAL OVERALL COST (IN REAIS) FOR PATIENTS BASED ON THE QUALITATIVE VARIABLES OF THE STUDY.

Variable		Mean ± SD	p-value*
Follow-up	With a caregiver (n = 88)	908.66 ± 795.76	0.100
	Without a caregiver (n = 22)	613.62 ± 486.23	
INSS	Yes (n = 25)	840.87 ± 781.98	0.823
	No (n = 85)	879.47 ± 651.73	
Occupation	Formal employment (n=13)	869.13 ± 755.44	0.021
	Unemployed/Homemaker/Informally employed (n=56)	570.24 ± 470.85	
	Retired (n=41)	579.12 ± 751.62	
Formal education	Up to incomplete secondary (n=65)	621.17 ± 649.64	0.450
	Complete secondary (n=27)	664.11 ± 675.89	
	Up to complete tertiary (n=18)	494.89 ± 440.56	
Type of neoplasm	Head and neck CA (n=3)	506.86 ± 194.57	0.212
	Lung CA (n = 8)	821.24 ± 653.07	
	Genitourinary CA (n = 23)	872.75 ± 670.78	
	Breast CA (n = 20)	636.65 ± 415.94	
	Sarcoma (n = 5)	459.39 ± 362.56	
	CNS (n = 4)	352.54 ± 240, 72	
	GIT (n = 47)	849.65 ± 751.68	
Staging	2 (n=13)	717.26 ± 619.56	0.412
	3 (n=33)	744.60 ± 456.78	
	4 (n=64)	930.71 ± 884.55	
Origin	Capital (n=55)	998.19 ± 889.55	0.038
	Interior (n=55)	701.11 ± 551.61	

* ANOVA one-way test.

unique financial implications due to the chronicity of therapy, the costs incurred and not covered by insurance or SUS, the cumulative effects associated with the treatment, additional expenses, difficulty in maintaining employment when undergoing this therapy, and the decline of health⁸. However, this variable did not present a “p” value statistically significant in this study. Some factors that could have interfered in this outcome were the limitation of patient assessment (which comprised only 1 month of treatment), the inclusion of patients in the initial stages (2 and 3), in addition to the sample size.

In the analysis of the average monthly costs for patients, the final value of R\$ 849.65 is very representative of their average monthly income, considering the receipt of up to one minimum wage of R\$ 954.00, in 2018 (60.91% of the cases), as shown in Table 3. In a Swedish study, indirect costs (work hours lost) were responsible for more than 50% of the total costs incurred and not covered for patients aged less than 65 years¹¹. In a study conducted in Australia, the indirect costs for the treatment of breast cancer (e.g., custom wigs, bras, prostheses, etc.) totaled up to 62% of the total cost and were even greater in younger women¹².

Of the indirect costs analyzed, the transport was the highest, i.e., R\$ 188.46 per month (Table 3). When

a patient is submitted to radiotherapy and chemotherapy, travel expenses constitute the main component of the overall cost¹³ which, among others, corroborates the findings of the present study, in which patients coming from the interior of the state had increased costs, with a statistically significant difference in overall costs in comparison with patients from the capital (Table 4; p=0.038).

The percentage of indirect costs varies according to the methods used and differences in health systems between countries. As is in many studies, indirect costs amount to up to half of the total costs, which are essential to evaluate the total costs incurred and not covered in the cancer treatment¹⁴.

In 2011, a study carried out in the department of pulmonary diseases of a University in Greece with 128 patients with lung cancer followed-up for 32 months showed that patients lost a total of 27,050 days of productivity and their caregivers lost a total of 1,337 days of productivity. Although no monetary value was assigned to this loss of productivity, certainly the potential for monetary gain by the patient and caregiver were affected¹⁵.

Our study was the first step to identify possible factors related to direct and indirect costs not covered during cancer treatment in a state of the northeast

region of Brasil. However, the cross-sectional approach did not allow for the follow-up of patients during the entire course of the disease, which can be seen as a limitation. In the present study, all methods of therapy were analyzed jointly. Therefore, any differences in costs incurred and not covered by patients or carers could not be evidenced for specific treatments. The small sample size also had no statistical power for detecting small differences in costs incurred and not covered for patients and caregivers based on several of their socio-demographic and clinical variables.

CONCLUSION

The direct and indirect healthcare costs are quite significant for cancer patients and their caregivers considering the low average monthly income found

in the study sample. The prevention of cancer or its early detection is, without a doubt, the best alternative for the reduction of costs incurred and not covered associated with cancer treatment. As strategies to tackle this public health problem, we can mention the strengthening of treatment financing programs for patients and caregivers, as well as the decentralization of access to cancer treatments in order to reduce the commuting of patients from the interior of the state to the capital in order to undergo treatment.

Author's Contribution

JKLA: Data curatorship (Lead)/Writing - original draft (Lead); LMS: Data Curatorship (Lead)/Supervision (Equal); CAS: Research (Equal); ISO: Research (Equal); GMF: Research (Equal); ADG: Supervision (Equal)/Writing - revision and editing (Equal).

RESUMO

INTRODUÇÃO: Pacientes oncológicos e seus acompanhantes incorrem em custos não cobertos pelo Sistema Único de Saúde (SUS) durante o seu tratamento, com gastos relacionados a transporte, medicações sintomáticas, alimentação, perda de dias de trabalho dentre outros.

OBJETIVO: Avaliar os custos incorridos e não cobertos pelo SUS por pacientes com câncer e seus acompanhantes durante a realização do tratamento, oncológico.

MÉTODOS: Trata-se de um estudo transversal realizado com 110 pacientes oncológicos em tratamento com quimioterapia ou quimioterapia e radioterapia e 88 acompanhantes, no último mês, antes de sua inclusão no estudo. Correlacionamos os custos dispendidos com variáveis clínicas e sociodemográficas como sexo, idade, raça, estado civil, escolaridade, ocupação, naturalidade, procedência, renda mensal, renda familiar, moradia, comorbidades, tipo de neoplasia e estadiamento.

RESULTADOS: Observamos que a média do custo global dos pacientes do estudo foi de R\$ 747,92, que corresponde a 78,4% do salário mínimo e a média do custo dos acompanhantes foi de R\$ 118,86 reais que equivale a 12,46% do salário mínimo. Dentre todas as variáveis analisadas, a média do custo global mensal dos pacientes correlacionou-se positivamente com a variável ocupação ($p=0,021$) assim como com a variável procedência ($p = 0,038$). Para as demais variáveis, não foram detectadas associações significantes.

CONCLUSÃO: A correlação positiva encontrada entre ocupação e procedência com custos incorridos e não cobertos por pacientes sugere a criação de programas que viabilizem o pagamento dos custos não cobertos pelo SUS e a descentralização do acesso ao tratamento oncológico podem potencialmente facilitar a aderência do paciente ao tratamento oncológico.

PALAVRAS-CHAVES: Neoplasias. Oncologia. Gastos em saúde. Sistema Único de Saúde. Cuidadores.

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