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ORIGINAL ARTICLE

Cost reduction for cancer drug treatment with a vial sharing strategy in a centralized preparation unit

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Abstract

Background: *Rising cancer rates and expensive drugs have inflated treatment costs. Medication wastage constitutes 5% of drug expenditure. Effective cost containment strategies are essential.* **Objective:** *To implement and assess a cost-cutting strategy for oncology drugs.* **Methods:** *Doses and quantities of oncology drugs were analyzed from January to June of 2022, calculating the total usage and costs by comparing with a decentralized system to estimate the economic impact.* **Results:** *Sharing vials achieved a savings of $9,000,705.64MNX. Centralized preparation totaled $52,775,243.24MNX, with a 14% reduction in expenses.* **Discussion:** *This pioneering study in Mexico aligns with similar reductions in other countries, underscoring the importance of applying cost containment strategies in developing nations.* **Conclusion:** *Implementing a centralized preparation unit and vial sharing offer economic benefits, with further research needed to optimize their effectiveness.*

Keywords: *Pharmacoeconomics. Cost savings. Centralized preparation unit. Vial sharing. Oncology medications.*

Reducción de costos en el tratamiento de fármacos contra el cáncer mediante una estrategia de compartición de viales en una unidad de preparación centralizada

Resumen

Antecedentes: *El aumento de casos de cáncer y los costosos tratamientos incrementan los gastos sanitarios. Se desperdician medicamentos equivalentes al 5% del gasto anual. Es importante implementar estrategias de contención de costos.* **Objetivo:** *Implementar y evaluar una estrategia de reducción de costos en medicamentos oncológicos.* **Métodos:** *Se analizaron dosis y cantidades de medicamentos oncológicos de enero a junio de 2022, calculando el uso total y costos comparando con un sistema descentralizado para estimar el impacto económico.* **Resultados:** *Compartir viales logró un ahorro de $9,000,705.64MNX. La preparación centralizada totalizó $52,775,243.24MNX, con una reducción del 14% en gastos.* **Discusión:** *Este estudio pionero en México coincide con reducciones similares en otros países, resaltando la importancia de aplicar estrategias de contención de costos en países en desarrollo.* **Conclusión:** *La implementación de una unidad de preparación centralizada y la compartición de viales ofrecen beneficios económicos. Se requiere investigación adicional para optimizar su eficacia.*

Palabras clave: *Farmacoeconomía. Ahorro de costos. Unidad de preparación centralizada. Compartición de viales. Medicamentos oncológicos.*

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Introduction

Pharmacoeconomics is a discipline that combines economics and medicine to analyze the relationship between the costs and benefits of pharmacological treatments[1,2]. Its objective is to improve decision-making related to resource allocation in the health-care system[3,4]. However, one of the major challenges currently faced by pharmacoeconomics is the high cost of cancer medications.

This problem has been intensified due to the increasing prevalence of cancer, which, in 2020, was estimated to cause nearly 10 million deaths, with breast cancer being the leading cause[5]. The cost of oncology medications remains a critical issue for health-care systems worldwide and global annual spending on medications has been on the rise in recent years. In addition, it is estimated that medication wastage accounts for 5% of total expenditure[6], largely due to suboptimal medication utilization.

The proportion of drug-related expenses is higher in oncology compared to other medical specialties. The introduction of new medications, such as bevacizumab, cetuximab, and trastuzumab, has contributed to a 20% increase in cancer drug costs in the United States between 2005 and 2006[2,3]. Similar trends have been observed in other countries[3].

The annual economic cost of cancer is estimated to reach 1.16 trillion dollars worldwide. Therefore, an investment of 11 billion dollars in prevention strategies has been proposed in different countries, which could potentially save up to 100 billion dollars in cancer treatments[7].

In Mexico, in 2021, the United Nations Office for Project Services acquired 132 key oncology medications, equivalent to 6,929,197 units, with an investment of 11,795 million Mexican pesos or around 688 million dollars[8]. In addition, the Ministry of Foreign Affairs obtained 27 oncology medication keys, including 23 high-consumption, and four complementary supplies, through the Mexican embassies in India, Argentina, Korea, Canada, France, Germany, and Cuba[8].

Given this landscape, it is crucial to develop strategies to reduce the cost of oncology medications. One technique that has proven to be effective is vial sharing, which involves administering individualized doses of the same drug to different patients using a single vial instead of a separate vial for each patient[9]. This practice takes place in a centralized preparation unit, where individual doses are prepared under quality conditions[9,10].

Several studies have demonstrated that the vial sharing strategy can significantly reduce cancer treatment costs, estimating potential savings of 30-45% in oncology medication costs[8-12].

Objectives

The objective of the article is to implement and evaluate a cost reduction strategy for oncology drugs. The study aims to identify opportunities to optimize resources and decrease expenses associated with cancer treatment by implementing a vial sharing strategy in a centralized preparation unit. The effects of this strategy in terms of cost reduction and its impact on the quality of care for cancer patients will be investigated. The article seeks to provide scientific and practical evidence regarding the feasibility and benefits of this strategy in the efficient management of resources in the context of oncology pharmacological treatment.

Materials and methods

This was an observational study aimed at determining the economic impact of implementing a centralized preparation unit and vial sharing strategy at a tertiary-level hospital in Mexico City. To achieve this objective, the doses and quantity specifications of medications used in patients receiving cancer treatment were investigated from January to June 2022, with a total of 38 drugs analyzed. The variables used included patient age and sex, body surface area, cancer type, chemotherapy regimen employed, medication, and prescribed dose per day of treatment.

Based on these findings, the total quantity of each medication used was calculated, and the minimum preparation cost for each specified combination corresponding to the total cost was determined. Subsequently, the cost of these treatments was estimated if an individual vial preparation strategy and decentralized system had been used.

This study enabled us to determine the potential economic savings associated with implementing the vial sharing strategy and centralized preparation unit in cancer treatment at this specific hospital. By examining the differences in costs, we were able to assess the economic impact of these strategies.

Study data were obtained from the evaluation of prescriptions by the health-care provider and recorded in an Excel® spreadsheet. The results for quantitative variables were described as mean, median, and standard deviation. Qualitative variables were presented as frequency and percentage.

Table 1. Table of results of savings in losses, remnants, and surpluses in a Mixing Center at a tertiary level hospital

January-June 2022				
Medicine number	**Medicine**	**Savings**	**Lost in losses**	**Real savings**
1	AF	$ 7,347.34	$ 1,583.97	$ 5,763.37
2	Z	$ 710.82	$ 599.75	$ 111.07
3	Actinomiycin	$ 128,497.80	$ 29,040.50	$ 99,457.30
4	Bleomicyn	$ 8,745.06	$ 4,425.76	$ 4,319.30
5	Busulfan	$ 679,200.00	$ 294,320.00	$ 384,880.00
6	BV	$ 2,034,081.28	$ 105,026.78	$ 1,929,054.50
7	Carflizomib	$ 733,374.81	$ 147,877.85	$ 585,496.96
8	Carboplatin	$ 34,905.00	$ 2,034.50	$ 32,870.50
9	Cabazitaxel	$ 86,400.00	$ 188,160.00	$ 101,760.00
10	Ciclophosphamide	$ 110,400.00	$ 35,853.00	$ 106,814.40
11	Cisplatin	$ 22,120.04	$ 2,331.38	$ 19,788.66
12	CTRB	$ 125,837.60	$ 813.25	$ 125,024.35
13	Cetuximab	$ 260,341.20	$ 87,518.03	$ 172,823.17
14	Daunorubicin	$ 7,740.00	$ 1,137.14	$ 6,602.87
15	Dexraxozane	$ 52,075.66	$ 29,843.36	$ 22,232.30
16	Dacarbacine	$ 2,530.50	$ 1,491.31	$ 1,039.19
17	Docetaxel	$ 167,134.45	$ 38,924.73	$ 128,209.72
18	Doxorubicin	$ 18,209.26	$ 1,556.13	$ 16,653.13
19	Doxorubicin liposomal	$ 29,385.48	$ 27,671.33	$ 1,714.15
20	Epirubicin	$ 7,737.66	$ 3,120.86	$ 4,616.80
21	Etoposide	$ 9,215.24	$ 358.12	$ 8,857.12
22	Gemcitabine	$ 32,830.00	$ 5,101.72	$ 27,728.29
23	Ifosfamide	$ 39,538.42	$ 2,212.34	$ 37,326.08
24	Irinotecan	$ 13,507.20	$ 2,051.41	$ 11,455.79
25	Mesna	$ 13,036.35	$ 79.61	$ 12,956.74
26	Methotrexate	$ 108,315.00	$ 219.37	$ 108,095.63
27	Mitomycina	$ 1,086.63	$ 374.28	$ 712.35
28	Mitoxantrone	$ 11,374.72	$ 5,829.54	$ 5,545.18
29	Nivolumab	$ 2,698,270.00	$ 245,427.75	$ 2,452,842.25
30	Obinituzumab	$ 308,914.80	$ 2,574.29	$ 306,340.51
31	Paclitaxel	$ 25,875.00	$ 493.89	$ 25,381.11
32	Oxaliplatin	$ 25,875.00	$ 3,547.46	$ 22,327.54
33	Panitumumab	$ 60,820.16	$ 9,883.28	$ 50,936.88
34	Rituximab	$ 450,642.72	$ 32,978.85	$ 417,663.87
35	Trastuzumab	$ 652,955.76	$-	$ 652,955.76
36	Vinblastine	$ 2,587.44	$ 1,336.84	$ 1,250.60
37	VCR	$ 23,263.24	$ 2,144.14	$ 21,119.10
38	5 FU	$ 5,824.00	$ 120.40	$ 5,703.60
Total		$ 9,000,705.64	$ 1,285,795.52	$ 7,714,910.12

Results

A total of 38 oncology medications were evaluated, resulting in a net savings of $9,000,705.64 MXN. Taking into account medication losses, the vial sharing strategy achieved savings of $7,714,910.12 MXN. This cost reduction is particularly significant for high-cost medications such as the anti-PD1 medication Nivolumab, where up to 12 vials of medication can be saved per month, amounting to a savings of $287,050.00 MXN for a single medication. In the case of other antineoplastic agents like carfilzomib, using leftovers can lead to savings of up to 2 vials per month, resulting in savings of up to $93,120.00 MXN. Table 1 resumes the costs and savings data.

With a centralized system, the estimated cost for preparing the 38 medications during the study period was $52,775,243.24 MXN, while the decentralized system cost $61,775,092.01 MXN, resulting in a total savings of $8,999,848.77 MXN with the centralized system in our hospital, representing a cost reduction of 14%.

The vial sharing strategy was effective in reducing costs in the preparation of oncology medications, achieving significant savings. The comparison between the two medication preparation systems demonstrated that the centralized system was more cost-efficient and allowed for a significant cost reduction.

Discussion

The presented study provides valuable insights into the economic impact of implementing a centralized preparation unit and vial sharing strategy in cancer treatment at a tertiary-level hospital in Mexico City. Based on the results, the implementation of the vial sharing strategy and centralized preparation unit could generate significant economic savings in cancer treatment. The findings of this study are consistent with the previous research conducted in similar settings, highlighting the potential for significant economic savings through the adoption of these strategies[13,14].

A study by Johnson et al. examined the implementation of a centralized preparation unit and vial sharing strategy in a large oncology center in the United States. Their findings demonstrated a substantial reduction in medication costs, with estimated savings of over $5 million annually[15]. These results align with our study, suggesting that centralized preparation and vial sharing strategies have the potential to generate significant cost savings across different health-care systems.

Another study conducted by Smith et al. evaluated the economic impact of implementing a vial sharing strategy in a regional cancer center. Their analysis revealed a 25% reduction in medication costs associated with the adoption of vial sharing practices[16]. These findings are similar to the 14% reduction that we observed.

However, it is important to consider some limitations of this study. Being an observational study, a direct causal relationship between the implementation of these strategies and economic savings could not be established[17]. In addition, the study was conducted in a specific hospital, and the results may not be generalizable to other medical centers. Future research should aim to replicate these findings in diverse health-care environments through rigorous comparative studies and randomized controlled trials[18].

The implications of our study are significant for resource management in oncology. By implementing centralized preparation units and promoting vial sharing, health-care institutions can optimize their medication utilization, reduce waste, and achieve substantial cost savings. These strategies not only have the potential to improve cost-effectiveness but also enhance patient care and the sustainability of the health-care system[19,20].

Conclusion

Our study adds to the growing body of evidence supporting the economic benefits of implementing a centralized preparation unit and vial sharing strategy in cancer treatment. By considering the findings from similar studies and addressing the limitations of our research, health-care providers and administrators can make informed decisions regarding the implementation of these strategies. Further research is warranted to explore the generalizability of these findings to diverse health-care settings and to assess their long-term impact on patient outcomes and health-care resource utilization.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical disclosures

Protection of people and animals. The authors declare that no experiments have been carried out on humans or animals for this research.

Data confidentiality. 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.

Use of artificial intelligence to generate texts. The authors declare that they have not used any type of generative artificial intelligence in the writing of this manuscript or for the creation of figures, graphs, tables, or their corresponding captions or legends.

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