

Diabetic foot cost

Custo com pé diabético

Costo del pie diabético

RESUMO

Objetivo: conhecer os custos com tratamento do pé diabético no Brasil. Método: Revisão narrativa com pesquisas feitas no Brasil através de artigos publicados nos períodos de 2011 a 2021. Resultados: Foram encontrados três artigos relacionados ao tema proposto. Nos estudos 1 e 2 foram realizadas pesquisas de custos com tratamento de pé diabético através de análises retrospectivas em prontuários de pacientes em instituições hospitalares, e no estudo 3 um levantamento de estimativa de custo no Brasil tanto a nível ambulatorial quanto hospitalar, utilizando diferentes metodologias. Como resultados, estimou-se os valores médios por paciente para o tratamento hospitalar do pé diabético de R \$4.367,05 no estudo 1 e R \$4.735,98 no estudo 2. Já no estudo 3, as estimativas foram de Int \$27,7 (13%) milhões para atendimento de pacientes internados e de Int \$333,5 (87%) milhões para o atendimento ambulatorial. Conclusão: Os resultados dos estudos apontam elevados custos com tratamento do pé diabético.

DESCRIPTORES: Pé diabético; Úlcera; Amputação; Diabetes Mellitus; Custos e Análise de Custo.

ABSTRACT

Objective: to know the costs of treating diabetic foot in Brazil. Method: narrative review with research carried out in Brazil through articles published from 2011 to 2021. Results: Three articles related to the proposed theme were found. In studies 1 and 2, cost surveys for diabetic foot treatment were carried out through retrospective analysis of medical records of patients in hospital institutions, and in study 3 a cost estimate survey in Brazil, both at outpatient and hospital levels, using different methodologies. As a result, the mean values per patient for the hospital treatment of diabetic foot were estimated at R\$ 4,367.05 in study 1 and R\$ 4,735.98 in study 2. In study 3, the estimates were Int \$ 27, 7 (13%) million for inpatient care and Int\$333.5 (87%) million for outpatient care. Conclusion: The results of the studies indicate high costs with the treatment of diabetic foot.

DESCRIPTORS: Diabetic Foot; Ulcer; Amputation; Diabetes Mellitus; Costs and Cost Analysis.

RESUMEN

Objetivo: conocer los costos del tratamiento del pie diabético en Brasil. Método: revisión narrativa con investigaciones realizadas en Brasil a través de artículos publicados entre 2011 y 2021. Resultados: se encontraron tres artículos relacionados con el tema propuesto. En los estudios 1 y 2, se realizaron encuestas de costos para el tratamiento del pie diabético a través del análisis retrospectivo de historias clínicas de pacientes en instituciones hospitalarias, y en el estudio 3, una encuesta de estimación de costos en Brasil, tanto a nivel ambulatorio como hospitalario, utilizando diferentes metodologías. Como resultado, los valores medios por paciente para el tratamiento hospitalario del pie diabético fueron estimados en R \$4.367,05 en el estudio 1 y R \$4.735,98 en el estudio 2. En el estudio 3, las estimaciones fueron Int \$27,7 (13%) millones para atención hospitalaria e Int\$333,5 (87%) millones para atención ambulatoria. Conclusión: Los resultados de los estudios indican altos costos con el tratamiento del pie diabético.

DESCRIPTORES: Pie Diabético; Úlcera; Amputación; Diabetes Mellitus; Costos y Análisis de Costo.

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INTRODUCTION

Diabetes mellitus (DM) is a relevant health problem due to its global socioeconomic impact and its increasing incidence has taken on epidemic proportions in most countries, especially in developing countries, with a projection of reaching 300 million diabetics worldwide in 2030. The increase in population aging, obesity, sedentary lifestyle and changes in lifestyle, in particular food, are related as decisive influences for the growth in the number of diabetics.¹

Government costs for DM care are two to three times higher than those paid to non-diabetic patients. Diabetes represents an important burden in economic terms both in terms of direct costs to the health system and to society with indirect costs attributed to early mortality, and temporary and permanent disabilities resulting from its complications. Global spending on diabetes in 2015 was estimated at US\$673 to US\$ billion, with a projection for 2040 in the range of US\$802 to US\$1.452 billion. For Bra-

zil, the estimated cost in 2015 was US\$ 22 billion, with a projection of US\$ 29 billion for 2040.²

Diabetic foot ulcer (DFU), or diabetic foot, is considered a serious complication of DM due to the high risk of extremity amputations causing high rates of morbidity and mortality and occupying a large proportion of hospital beds, especially in developing countries where the problems are exacerbated mainly by the lack of access to health systems.²

The International Working Group on the Diabetic Foot defines the diabetic foot as “infection, ulceration and/or destruction of soft tissue, associated with neurological alterations and various degrees of peripheral arterial disease (PAD) in the lower limbs”. These ulcers affect approximately 26 million people worldwide each year, causing high rates of morbidity and mortality and high global cost.³

Conducting cost survey studies in health, in turn, represents an important tool to support decision-making by managers to institute preventive measures,

as well as better structuring the hospital system to serve this clientele.⁴

In this sense, it is essential to develop research whose results point to the improvement of health services and consequent contribution to the improvement of collective health. Thus, in this study, the question is, what is the estimated cost of treating diabetic foot in research conducted in Brazil in the last decade?

Based on these premises, the objective was to know the costs of treating diabetic foot in Brazil. For this, a narrative review was carried out with research carried out in Brazil through articles published in the period from 2011 to 2021.

By describing the results, this study intends to contribute as a relevant management tool for the establishment of health measures that aim to minimize the risk of complications, reduce costs and improve the quality of life of patients with diabetic foot. The study aimed to: Know the costs of diabetic foot treatment through studies carried out in Brazil, published from 2011 to 2021.

METHOD

This is a Narrative Review of Literature from secondary sources in order to provide data on the costs of treating diabetic foot in Brazil. The literature review has been considered an instrument of great relevance for studies in the field of health, since it synthesizes research on a given topic based on scientific knowledge. This research method aims to obtain an understanding of a particular phenomenon based on previous studies.⁵

For data collection, searches were carried out in the Virtual Health Library (VHL) database, from October to November 2021, based on the following health descriptors (DeCS): Diabetic foot (Pé diabético), Diabetic Foot Ulcer (Úlceras do Pé Diabético), Amputation (Amputação), Diabetes Mellitus, Health Cost (Custo em Saúde), Hospital Cost (Custo Hospitalar) and Health Savings (Economia em Saúde), forming search strategies with the help of the Boolean operator AND, such as the associated search for the descriptor diabetic foot AND costs. Filters were also used for the English and

Portuguese languages, publication period from 2011 to 2021, and Brazil as an affiliation country.

113 publications were found, however, articles related to costs with diabetic foot treatment from studies carried out in Brazil, published between 2011 and 2021, in Portuguese and English, were selected as inclusion criteria. Articles that were unavailable in full, that were repeated and that did not meet the aforementioned inclusion criteria were excluded. Therefore, three articles remain, one published in English in 2018, and two published in Portuguese in 2014 and 2015.

The selected articles were read in full and their results were grouped into analyzed and discussed based on the literature related to the proposed theme. For the characterization and analysis of the study, a table was initially created to briefly demonstrate the selected articles containing title, authorship, language, database, journal and year of publication, and its objectives with a focus on cost estimation, as shown in table 1. Afterwards, its methods were described and the results

of the studies were discussed.

RESULTS AND DISCUSSION

In studies 1 and 2, cost surveys for diabetic foot treatment were carried out through retrospective analysis of medical records of patients in hospital institutions, and in study 3 a cost estimate survey in Brazil at both outpatient and hospital levels, using different methodologies.

Study 1 was performed in a medium-complexity hospital for the treatment of vascular diseases, with a sample of patients undergoing surgical procedures with diabetic foot injuries, including: debridement, fasciotomies, minor and major amputations, cleaning and surgical dressing. Data was collected from January 2011 to April 2012.⁶

For the cost study, the values transferred to the institution by the Unified Health System (SUS) and by private health plans were verified, referring to each patient, from data provided by the hospital's accounts department, having as a reference the values used by the institution

Table 1 - Summary of articles selected for the study.

Title	Author	Language, database, journal and year of publication	Objective
E1. Estimation of the cost of treating diabetic foot, how to prevent and save resources (Estimativa do custo de tratar o pé diabético, como prevenir e economizar recursos) ⁶	Oliveira, Alexandre Faraco de; De Marchi, Ana Carolina Bertoletti; Leguisamo, Camila Pereira; Baldo, Guilherme Valdir; Wawginiak, Thiago Andrade.	Portuguese. LILACS. Ciênc. saúde coletiva, 2014.	Estimate the cost of hospital treatment with diabetic foot.
E2. Financial analysis of hospitalizations of diabetics undergoing lower limb amputation in a public hospital (Análise financeira das internações de diabéticos submetidos à amputação de membros inferiores em hospital público) ⁷	Silva, Renata Santos; Haddad, Maria do Carmo Lourenço; Rossaneis, Mariana Angela; Gois, Marcos Fabrício Franco.	Portuguese. LILACS.Semina: Ciências Biológicas e da Saúde, Londrina, 2015.	To analyze the cost calculated in 2006, resulting from the hospitalization of diabetic patients who underwent lower limb amputations.
E3. Annual Direct Medical Costs of Diabetic Foot Disease in Brazil: A Cost of Illness Study. (Custos médicos diretos anuais da doença do pé diabético no Brasil: um estudo de custo da doença) ⁸	Toscano, Cristiana M; Sugita, Tatiana H; Rosa, Michelle Q M; Pedrosa, Hermelinda C; Rosa, Roger Dos S; Bahia, Luciana R.	English MEDLINE. Int J Environ Res Public Health, 2018.	To estimate the annual costs for the clinical management of patients with diabetic foot in Brazil.

Source: Virtual Health Library (adapted by the study author).



itself, in the calculation of patients served by health insurance plans.⁶

The medical records of 35 patients were analyzed, of which two patients were hospitalized twice, once three times and one had six hospitalizations, totaling 44 hospitalizations. Most patients 31 (88.5%) were under SUS care, and the mean length of stay was 11.93 days. Hospitalizations took patients to the operating room for 61 opportunities and required 67 surgical procedures, with 24 (68%) patients suffering some type of amputation. The research had a predominance of the elderly population, with 25 (71.5%) patients over 60 years of age, and the gender distribution was homogeneous, with 18 men and 17 women.⁶

For the 44 hospitalizations, the estimated total cost was R\$ 192,150.40 and each hospitalization had an estimated average cost of R\$ 4,367.04, with 39 SUS hospitalizations and 4 for health insurance plans.⁶

Study 2 analyzed 21 medical records of diabetic patients who underwent lower limb amputation in 2006, in a public university hospital in Paraná, a regional reference center for the SUS with approximately 250 municipalities in Paraná and more than 100 cities in other states.⁷

For the research, data on the cost of hospitalization, such as length of stay, cost of the surgical procedure, total daily expenses, medicines used, hospital medical material in general and diagnostic tests obtained through the Diagnostic and Therapy Support Service.⁷

The average length of stay per patient was 14 days, resulting in a total value of R\$99,455.74 of all costs considered, with an average value of R\$4,736.40 per patient. It was observed that most of the cost was due to the hotel service, with 64% of the total hospitalizations.⁷

Ages between 40 and 90 years were found, with an average age of 65 years, however the predominant age group was 70 to 79 years, representing 32% of the sample. Regarding gender, 09 admissions were male (43%) and 12 were female

(57%).⁷

In Study³, a study of the cost of the disease was carried out with an approach based on the prevalence of the population in the year 2014, from the perspective of the Unified Health System, considering only the direct medical costs. The population estimate of individuals over 18 years old from the National Institute of Geography and Statistics was 148,696,000 in 2014. The original 2013 National Health Survey database was used to estimate the prevalence of diabetic individuals with foot ulcers and individuals who required amputation. The estimated prevalence of diabetics with foot ulcers was estimated at 5.27%, and those who required amputation was 1.36%.⁸

Two methodologies were adopted to estimate the economic cost of the disease: one for outpatients and another for inpatients.

To assess outpatient costs, a micro-cost approach based on the use of health resources was used. A panel of 12 specialists in diabetic foot disease from different reference centers in the country provided information on the use of resources for the following health components: imaging and laboratory tests; medicines; non-pharmacological procedures and therapies; (debridement and dressings, in addition to important supplies, such as orthopedic shoes and crutches); and visits by health professionals. Costs with imaging and laboratory tests, non-pharmacological, therapies and visits by health professionals were obtained from the National Standardized Pricing of the SUS. Drug costs were estimated based on the average price of drugs purchased by the government. The unit cost of health resources was multiplied by the quantity, resulting in an estimated average cost for each hypothetical outpatient case.⁸

To estimate costs with hospitalized patients, the methodology of gross cost calculation based on reimbursement of hospitalized patients is used. For hospitalization expenses, hospitalization data and respective costs were collected from the National Hospitalization Informa-

tion System (SIH-SUS/Sistema Nacional de Informações de Internações). Diabetic foot disease-related codes from the International Classification of Diseases (ICD-10) were used as the cause of hospitalization for analysis.⁸

The result of outpatient charges and costs, assuming that 9.2 million adults have diabetes in Brazil, it was estimated that 829,724 of diabetics have neuroischemic foot, of which 43,726 have foot ulcers. It was estimated that most of these patients would be treated as outpatients (n = 42,983), and of these, half would have an infected ulcer (n = 21,492). For the number of amputations, the estimate was 11,284 individuals and, therefore, require post-amputation follow-up and clinical management.⁸

The direct medical costs of diabetic foot disease in Brazil were estimated considering the 2014 purchasing power parity (PPP) (1 Int\$ = R\$ 1,748). The estimated mean cost of outpatient treatment was Int\$343.7 for neuroischemic foot without ulcer, Int\$408.1 for uninfected foot, Int\$1617 for infected foot ulcer and Int\$599.8 for clinical follow-up and management of amputees. The total annual direct medical costs resulting from outpatients in the base case was Int\$335.5 million. The highest percentage in the cost split (85%) was for treating patients with neuroischemic foot without ulcer Int \$285.2 million, while costs for infected foot ulcers were estimated at Int\$24.7 million, uninfected ulcers at Int\$8.7 million and follow-up management of amputees was Int\$6.7 million.⁸

Regarding hospitalization costs, during 2014, a total of 22,244 patients diagnosed with diabetes mellitus (ICD10 E10, E11, E13, and E14) who underwent procedures related to diabetic foot disease were hospitalized. The majority of these hospitalizations were reported to have been treated for diabetic foot (n = 12,994), representing 58% of these admissions. As expected, the highest average cost per patient was for those undergoing lower limb amputation/di-

sarticulation. Total estimated costs for these conditions were Int\$9.89 million.⁸

In addition, 28,133 patients were hospitalized due to another diagnosis of complications related to diabetic foot disease, mainly gangrene in diabetics (n = 15,419). The mean hospitalization costs for these combined conditions related to diabetic foot disease was Int\$983. The total costs for these conditions were Int\$17.83 million. When considering all hospitalizations, the total cost of hospitalizations for diabetic foot disease in Brazil in 2014 was Int\$27,721,038.⁸

Finally, the estimated total annual direct medical costs were Int\$27.7 (13%) million for inpatient care and of Int \$333.5 (87%) million for outpatient care, resulting in a total economic burden of \$361 million in 2014.⁸

Whereas in 2014, Brazilian GDP was Int\$3.307 trillion, of which 8.3% Int\$274.48 billion was spent on health. Of these, public health expenditures represent 42.5% (Int \$116.73billion). The study estimated that the annual direct medical costs of diabetic foot disease in 2014 were Int\$361 million, which represents 0.31% of public health expenditures in the period.⁸

The results of Studies 1 and 2 revealed methodological proximity and in the results, considering the average hospitalization of 11.3 and 14 days, and the estimated mean values for the hospital treatment of diabetic foot of R\$ 4,367.05 in E1 and R\$ 4,735.98 in E2. In these studies, the evaluated population was restricted to two referral hospitals. It was also observed the prevalence of elderly patients and high rates of amputation in the populations studied.

In Study³, the research was more robust, using epidemiological data and national costs, using different methodologies to estimate both outpatient and hospital costs. Although the authors report that there are several reasons to believe that hospital costs are underestimated, the estimated cost burden of diabetic foot disease was significant, in view of the results of estimates of Int\$27.7 (13%)

million for inpatient care and Int\$333.5 (87%) million for outpatient care. It was also observed in this study that the highest cost per hospitalized patient was

pense for monitoring and managing amputees was Int\$6.7 million.

According to the International Working Group on the Diabetic Foot, diabetic foot ulcers precede 85% of amputations, and annually, 1 million individuals with diabetes mellitus (DM) undergo an amputation worldwide, translating to three per minute.³

Given the representativeness of factors that lead to unfavorable outcomes in wound healing, it is necessary to institute measures capable of controlling these factors and thus providing greater resolution in the healing of diabetic ulcers. Therefore, it is necessary to establish a set of integrated actions preferably developed by qualified professionals in an integrated network whose efforts are focused on patient education and regular care by a multidisciplinary team with general practitioners, endocrinologists and nurses. Research confirms this operating model as a determining factor in reducing amputations from 50 to 70%.⁹

In addition, factors such as the aging of the population and the growth in the incidence of chronic-degenerative diseases, such as DM, require greater investment in health policies that aim to achieve a better quality of life for patients with these diseases, seeking to avoid or prolong the appearance of complications resulting from these pathologies.⁹

Studies of estimates raised for a particular disease, type of injury or health status in the general population can support managers on the distribution of costs by category, as well as their economic losses. Research on the economic burden of the disease makes it possible to assess which health problems have the greatest economic impact, as well as support the decision of which diseases require greater allocation of resources in relation to prevention and even cure. Although studies on cost of diseases make a partial economic analysis, given that they do not take into account the analysis of safety, efficacy and effectiveness of actions, this type of study is relevant to public health, as it manages to quantify the resources spent

for those undergoing lower limb amputation/disarticulation, with estimated total costs for these conditions Int\$9.89 million, at the outpatient clinic the ex-

Diabetic foot ulcer (DFU), or diabetic foot, is considered a serious complication of DM due to the high risk of extremity amputations causing high rates of morbidity and mortality and occupying a large proportion of hospital beds

by the health system.¹⁰

Furthermore, the use of information on the costs and benefits of health interventions can help to establish priorities for the allocation of resources, provided they are carried out systematically, with a clear definition of its methods, making economic evaluations in health more transparent, relevant and directed to the needs of managers involved in the deci-

sion-making process.⁴

CONCLUSION

The results of the studies point to high estimates of costs with the treatment of diabetic foot, which leads to a reflection on the growing costs in the health sector and the need to invest in health policies to institute measures for the promotion,

prevention and treatment of the disease that, in order to guarantee the continuity of care and improve the quality of life of this population. Studies on the costs of the disease become relevant in order to support the decisions of managers, with the intention of achieving economic balance with expenses with health services.

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