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# **ORIGINAL ARTICLE**

# HEMODIALYSIS TREATMENT AND ITS FINANCIAL IMPACTS IN NORTHEAST BRAZIL TRATAMENTO HEMODIALÍTICO E SEUS IMPACTOS FINANCEIROS NO NORDESTE DO BRASIL TRATAMIENTO DE HEMODIÁLISIS Y SUS REPERCUSIONES FINANCIERAS EN EL NORDESTE DE BRASIL

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Objective: to analyze the records on the accomplishment of hemodialysis treatment and its financial impacts in Northeast Brazil, between 2014 and 2017. Method: this is a quantitative, descriptive and ecological study, with data from the Outpatient Information System. The options related to hemodialysis were selected, resulting in eight types of procedures. Data were analyzed by means of descriptive and simple statistics and presented as tables. Results: there were 11,837,165 hemodialysis procedures. There was higher prevalence of hemodialysis in Bahia (24.6%) and in elective character (97.9%). Moreover, the financial impact exceeding R\$ 2.2 billion, higher prevalence of burden in Bahia (24.6%) and the procedure carried out up to three times per week are responsible for 93.6% of the total costs. Conclusion: there was a growing behavior in the number of hemodialysis procedures, implying increased public costs and becoming an economic burden for the Unified Health System. This study provides subsidies to encourage the adherence, strengthening and enhancement of Basic Care, especially in relation to the increased quality of care to users with risk factors. Descritores: Epidemiology; Public Health; Nephrology; Renal Dialysis; Healthcare Costs; Costs and Cost Analysis.

#### **RESUMO**

Objetivo: averiguar os registros sobre a realização de tratamento hemodialítico e seus impactos financeiros no Nordeste do Brasil, entre 2014 e 2017. Método: trata-se de estudo quantitativo, descritivo e ecológico, com dados do Sistema de Informações Ambulatoriais. Selecionou-se as opções referentes à hemodiálise, resultando em oito tipos de procedimentos. Analisaram-se os dados por meio de estatística descritiva simples que se apresentaram em tabelas. Resultados: realizaram-se 11.837.165 procedimentos hemodialíticos. Evidenciou-se maior prevalência de hemodiálise na Bahia (24,6%) e em caráter eletivo (97,9%). Destaca-se, ainda, o impacto financeiro superior a R\$ 2,2 bilhões, maior prevalência de ônus na Bahia (24,6%) e o procedimento realizado na modalidade de no máximo três vezes por semana responsabilizou-se por 93,6% do total dos custos. Conclusão: conclui-se que, houve comportamento crescente na realização de hemodiálises, implicando no incremento dos custos públicos e tornando-se um fardo econômico para o Sistema Único de Saúde. Ressalta-se que, esse estudo fornece subsídios para incentivar a adesão, o fortalecimento e valorização da Atenção Básica, especialmente em relação ao aumento da qualidade assistencial aos usuários com fatores de risco. Descritores: Epidemiologia; Saúde Pública; Nefrologia; Diálise Renal; Custos de Cuidados de Saúde; Custos e Análise de Custo.

Objetivo: analizar los registros sobre la realización de tratamiento de hemodiálisis y sus repercusiones financieras en el noreste de Brasil, entre 2014 y 2017. Método: se trata de un estudio cuantitativo, descriptivo y ecológico, con datos del Sistema de Informaciones Ambulatorias. Se seleccionaron las opciones relacionadas con la hemodiálisis, resultando en ocho tipos de procedimientos. Los datos fueron analizados mediante estadística descriptiva y sencilla y presentados en tablas. Resultados: fueron realizados 11,837,165 procedimientos hemodialíticos. Se observó una mayor prevalencia de la hemodiálisis en Bahia (24,6%) y en el carácter electivo (97,9%). Además, el impacto financiero superior a los R\$ 2,2 mil millones, mayor prevalencia de carga en Bahia (24,6%) y el procedimiento realizado en un máximo de tres veces por semana fueron responsables de 93,6% de los costos totales. *Conclusión*: se concluye que hubo un comportamiento creciente en la realización de hemodiálises, implicando el aumento de los gastos públicos y convirtiéndose en una carga económica para el Sistema Único de Salud. Cabe destacar que este estudio proporciona subvenciones para fomentar la adhesión, el fortalecimiento y la mejora de los cuidados básicos, especialmente en relación con el aumento de la calidad de la atención a usuarios con factores de riesgo. Descriptores: Epidemiología; Salud Pública; Nefrología; Diálisis Renal; Costos de la Atención en Salud; Costos y Análisis de Costo.

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## How to cite this article

Souza Júnior EV de, Santos GS, Jesus ALO de, Souza DF de, Maia TF, Jesus MAS de, et al. Hemodialysis treatment and its financial impacts in northeast Brazil. J Nurs UFPE on line. 2019;13:e239674 DOI: https://doi.org/10.5205/1981-8963.2019.239674

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## **INTRODUCTION**

Hemodialysis (HD) is a procedure of extracorporeal blood purification through vascular access. <sup>1,2</sup> The blood is directed to an equipment called hemodialyzer, which performs the functions of preparation, heating, evaluation and provision of dialysis solution, filtration in a permeable membrane, routing of blood by means of a pump for monitoring various parameters such as blood and dialysate pressure, concentration and flow, ultrafiltration volume, among others. <sup>3,4</sup>

HD machines have technological resources essential for the maintenance of the quality and safety of the sessions, such as alarm systems that notify any complication in the procedure.<sup>3,4</sup> Generally, HD sessions are conducted obeying the frequency of three times/week with a duration of three through four hours.<sup>5,6</sup> However, depending on the user's residual renal function, the frequency and duration of the procedure may vary. Therefore, the monthly average is around 11 through 14 sessions/user.<sup>5</sup>

HD constitutes the most widespread dialytic therapy for individuals with chronic renal failure (CRF).<sup>6</sup> It is a progressive and irreversible clinical condition in which there is loss of renal function (endocrine, tubular and glomerular) characterized by Glomerular Filtration Rate (GFR)<sup>6,7</sup> equal or less than 15 ml/min/1.73m<sup>2</sup>.<sup>8</sup>

Estimates show that, in 2013, in Brazil, 100,397 people were undergoing dialysis treatment, with 90.8% undergoing HD.9 In 2014, there was a growth of 11.6%, totaling 112,004 individuals enrolled in programs for dialysis. Among these, 58% were male and 66.4% were in the age range from 19 to 64 years.<sup>10</sup>

Due to the increased life expectancy and, consequently, the population aging, there is increase in prevalence and incidence of Chronic Noncommunicable Diseases (CNCD), such as Arterial Systemic Hypertension (ASH) and Diabetes Mellitus (DM). They are diseases scientifically considered as the main etiologies of CRF and risk factors for its progression.<sup>6,10</sup>

In recent years, the worldwide prevalence of CRF requires increasing attention healthcare systems and professionals, because the pathology associates directly to a high rate of morbidity and therapies that significantly burden the budget and health care in many institutions worldwide. 11-13

Moreover, health care to the user diagnosed with CRF constitutes one of the main actions of high complexity of the Unified Health System (UHS) and is responsible for consuming high financial values intended to ambulatory care, 12 around 10% of the budget of the Ministry of Health. 14

The growing increase in health costs has drawn the attention of managers, health professionals and of paying sources for the problem.<sup>12</sup> In this way, research studies on the financial impacts of diseases in the health system constitute an important tool to subsidize the rational allocation of inputs involved in the work process.<sup>12</sup>

## **OBJECTIVE**

• To analyze the records on the accomplishment of hemodialysis treatment and its financial impacts in Northeast Brazil, between 2014 and 2017.

#### **METHOD**

This is quantitative, ecological descriptive study carried out with data from the Outpatient Information System (OIS). This administrative system contains information regarding the provision of outpatient services in the UHS scope. Integrated to the OIS is the Authorization to High-Cost/Complexity Procedures (APAC), which involves procedures of these two types, such as HD and chemotherapy. 15

Data were collected in September 2018 relating to the appointments conducted in Northeast Brazil, considered the second region with higher population, and organized into nine Federal Units (FU),<sup>16</sup> as shown in table 1. On the OIS platform, all options regarding HD were selected, according to Table 1, with their respective codes of national coverage in the UHS network, obeying the records dated 2014-2017. Four procedures were repealed, which hampered the collection of these variables.

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Table 1. Federal Units of Northeast Brazil. Jequié (BA), Brazil, 2014-2017.

		1 /		
FU	CAPITAL	HDI*	POPULATION**	TERRITORY
Maranhão	São Luis	0.639	7,035,055	331,936.949 km <sup>2</sup>
Piauí	Teresina	0.646	3,264,531	251,611.929 km <sup>2</sup>
Ceará	Fortaleza	0.682	9,075,649	148,887.633 km <sup>2</sup>
Rio Grande do Norte	Natal	0.684	3,479,010	52,811.107 km <sup>2</sup>
Paraíba	João Pessoa	0.658	3,996,496	56,468.435 km <sup>2</sup>
Pernambuco	Recife	0.673	9,496,294	98,076.021 km <sup>2</sup>
Alagoas	Maceió	0.631	3,322,820	27,848.140 km <sup>2</sup>
Sergipe	Aracaju	0.665	2,278,308	21,918.443 km <sup>2</sup>
Bahia	Salvador	0.660	14,812,617	564,732.450 km <sup>2</sup>

\*HDI: Human Development Index - Last update in 2010 \*\*Last update in 2018 Source: Brazilian Institute of Geography and Statistics<sup>16</sup>

N	Code	Procedure				
1	0305010042	Continuous hemodialysis	Unexpired			
2	0305010050	Hemodialysis I (up to 1 session/week - exceptionality)				
3	0305010069	Hemodialysis I (up to 3 sessions/week)				
4	0305010077	Hemodialysis I in HIV carrier** (exceptionality - up to 1 session/week)				
5	0305010085	Hemodialysis I in HIV carrier** (up to 3 sessions/week)				
6	0305010093	Hemodiálise (up to 1 session/week - exceptionality)				
7	0305010107	Hemodialysis (up to 3 sessions/week)	Unexpired			
8	0305010115	Hemodialysis in patient positive HIV** and/or Hepatitis B and/or Hepatitis C serology (up to 3 sessions/week)	Unexpired			
9	0305010123	Hemodialysis in patient positive HIV** and/or Hepatitis B and/or Hepatitis C serology (exceptionality - up to 1 session/week)	Unexpired			
10	0305010131	Hemodialysis for acute/intensified chronic renal patients without dialysis treatment initiated	Unexpired			
11	0305010204	Pediatric hemodialysis (up to 4 sessions/week)	Unexpired			
12	0308020014	Continuous hemodiafiltration	Unexpired			

Figure 1. Relation of procedures collected in the study. Jequié (BA), Brazil, 2014-2017. Source: Ministry of Health Outpatient Information System of UHS (OIS/UHS) \* Procedure repealed by Ordinance 1,016, of 21 September 2012<sup>17</sup> \*\*Human Immunodeficiency Virus (HIV)

Data were stratified by the nine states that compose the Northeast region, service character, and the quantity and value of approved procedures, presented by means of absolute and relative frequencies built by means of Excel software. Due to the method used for data collection, this study did not require the evaluation of the Research Ethics Committee, in

accordance with the Resolution 466/2012 of the National Health Council.

#### **RESULTS**

Table 2 shows that, in the period of study, there were 11,837,165 HD procedures. The highest prevalences were the state of Bahia, with 2,910,948 (24.6%), and procedures in elective character, with 11,585,841 (97.9%).

Table 2. Number of HD preformed in Northeast Brazil and servisse character. Jequié (BA), Brazil, 2014-2017.

Variables	2014	2015	2016	2017	TOTAL	%
FU						
Maranhão	71,575	292,878	316,639	337,691	1,018,783	8.6
Piauí	61,102	256,275	277,924	295,275	890,576	7.5
Ceará	148,859	612,909	641,376	664,445	2,067,589	17.5
Rio Grande do Norte	61,935	248,864	251,743	262,676	825,218	7.0
Paraíba	45,348	183,768	188,641	197,465	615,222	5.2
Pernambuco	178,743	719,510	732,337	759,798	2,390,388	20.2
Alagoas	54,855	219,877	226,092	225,967	726,791	6.1
Sergipe	26,095	114,415	121,018	130,122	391,650	3.3
Bahia	220,240	871,935	898,512	920,261	2,910,948	24.6
Total	868,752	3,520,431	3,654,282	3,793,700	11,837,165	100
Service character						
Elective	851,169	3,446,901	3,574,827	3,712,944	11,585,841	97.9
Urgency	17,095	72,433	78,947	79,824	248,299	2.1
Occupational accident, or while working for the company	406	805	430	588	2,229	0.0
Accident while going to work	54	192	39	213	498	0.0
Other types of traffic accident	12	3	39	92	146	0.0
Other types	16	97	-	39	152	0.0
Total	868,752	3,520,431	3,654,282	3,793,700	11,837,165	100

Source: Ministry of Health - Outpatient Information System of UHS (OIS/UHS)

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As shown in table 3, the financial impact exceeded R\$ 2.2 billion in the Northeast region. The highest prevalence of burden was in the state of Bahia, with R\$ 542,942,205.92 (24.6%) and the

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procedure 0305010107 (Hemodialysis - up to 3 sessions/week) was responsible for R\$ 2,070,671,630.47 (93.6%).

Table 3. Values applied in the HD procedure according to FU and procedure. Jequié (BA), Brazil, 2014-2017.

Variables	2014	2015	2016	2017	Total (R\$)	%
Approved value						
Maranhão	12,994,866.42	53,811,355.25	58,563,886.34	67,277,453.08	192,647,561.09	8.7
Piauí	10,959,822.26	46,430,299.81	50,761,473.84	58,110,740.87	166,262,336.78	7.5
Ceará	26,757,436.22	111,159,184.75	117,427,928.03	131,259,711.98	386,604,260.98	17.5
Rio Grande do Norte	11,132,979.05	45,010,709.92	45,751,954.11	51,596,014.14	153,491,657.22	6.9
Paraíba	8,161,829.23	33,230,279.25	34,499,565.30	39,175,555.84	115,067,229.62	5.2
Pernambuco	32,254,885.70	130,489,762.53	133,820,152.41	149,590,333.18	446,155,133.82	20.2
Alagoas	9,865,510.73	39,897,945.86	41,372,617.10	44,613,001.51	135,749,075.20	6.1
Sergipe	4,680,684.99	20,584,695.67	21,818,699.89	25,553,132.76	72,637,213.31	3.3
Bahia	39,584,532.29	158,183,570.77	163,896,918.49	181,277,184.37	542,942,205.92	24.6
Total	156,392,546.89	638,797,803.81	667,913,195.51	748,453,127.73	2,211,556,673.94	100
VALUE BY PROCEDUI	RE					
0305010093	2,584,477.08	9,281,989.38	9,334,445.17	11,514,118.00	32,715,029.63	1.5
0305010107	151,564,470.61	604,731,651.69	618,101,059.48	696,274,448.69	2,070,671,630.47	93.6
0305010115	1,440,380.07	21,675,238.47	37,107,160.80	37,354,986.81	97,577,766.15	4.4
0305010123	34,237.89	328,842.99	468,714.06	551,787.39	1,383,582.33	0.1
0305010204	768,981.24	2,780,081.28	2,901,816.00	2,757,786.84	9,208,665.36	0.4
0305010042	-	-	-	-	-	-
0305010131	•	•		•		-
0308020014	-	-	-	-	-	-
Total	156,392,546.89	638,797,803.81	667,913,195.51	748,453,127.73	2,211,556,673.94	100

Data missing in the system. Source: Ministry of Health - Outpatient Information System of UHS (OIS/UHS)

## **DISCUSSION**

The participation of Centers Specialized in Nephrology as providers of teams of the basic network promotes better professional qualification to meet demands, the proper management of renal lesion at an early stage and better monitoring of the biological parameters of the lesion in patients with risk factors, always aiming at the prevention of complications. Moreover, the integrality between Nefrology Centers and basic health care should be taken into account for the construction of care networks for patients with CRF.<sup>14</sup>

As a matter of urgency, along with the integration of health services, managers need to participate in in the development of educational programs for the population, stressing the importance of early diagnosis, therapy and prevention of the disease.<sup>14</sup>

There were 11,837,165 HD procedures in the Brazilian Northeast, with Bahia recording the highest prevalence (24.6%). In the Northeast region, there are 134 active and regulated dialysis centers, which correspond to 18% of dialysis units in the country. A study showed that the Northeast region presented a smaller proportion of patients who started treatment. Some factors that contribute to this reality include the low educational level and socioeconomic condition.

Also in the Northeast region, there are weaknesses in financial transfers, which contribute to the submission of users to economic precaiousness and raises numerous difficulties of access to basic health services.<sup>20</sup> The state of

Bahia is also part of this discussion, since, in addition to belonging to the Northeast region, it is the state with the largest population and, therefore, brings a higher prevalence of individuals with risk factors for CRF. Such characteristics may relate to its greater prevalence in hemodialysis procedures observed in the present study.

Table 3 shows that the financial impact caused by HD in the Northeast region exceeded R\$ 2.2 billion and that the highest burden occurred in Bahia, with 24.6% of the total value. The elective HD performed within up to three sessions/week was responsible for 93.6% of total costs. In this context, the increased costs with material resources has attracted the attention and concern of health managers, who need to promote investments in resource management systems, in order to generate less burden and to maintain the quality and quantity of care.<sup>21</sup>

In this perspective, a study<sup>22</sup> that investigated the panoramic situation of HD carried out by the public health system in Brazil revealed that almost 50% of the spendings with renal therapy in the country were concentrated in São Paulo, Rio de Janeiro and Minas Gerais. Such data also reflect the unequal treatment between the regions of the country, registered in another national study.<sup>23</sup> Adding the results by region, a study<sup>24</sup> showed that, between 2000 and 2004, the South region of the country possessed higher average spending with peritoneal dialysis and the Northeast, with HD. The costs with HD suffer influences of fixed costs with physical structure, equipment, water treatment and professional services.<sup>14,24</sup>

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Dialysis institutions are part of a complex economic context, because they require regular technical and technological updating, aiming to guarantee the quality in the provision of services. Furthermore, the growing demand for services and the lack of resources from the UHS and health insurances exacerbate their financial situation. In this perspective, the development of studies focusing on financial aspects in health care enables the implementation of institutions strategies that ensure the balance between efficiency and economic viability in the provision of services.21

The assistance to the CRF bearer is not restricted to hemodialysis sessions, since other procedures are necessary, such as dispensation of medications, hospitalizations when needed and access to renal transplantation. The repercussions of renal therapies in the spendings of the national health system are significant if compared to other diseases. Moreover, a large amount of financial resources are burdened in dialysis procedures that cover a relatively small population. 24

A study<sup>14</sup> conducted in São Paulo, in the period from 2008 to 2012, showed that the patients in HD had a total cost of R\$ 526,791,528.62 (88%) and HIV patients in HD had a cost of R\$ 7,047,875.58 (1%). According to the authors, the costs in this dialysis modality were more expensive due to the greater therapeutic scope, because they cover costs relating to specialized service, laboratory exams, hospitalization and use of inputs and equipment with greater economic value.<sup>14</sup>

Analyzing the total annual expenses with a patient with negative serology for HIV, another study<sup>5</sup> evidenced an average of R\$ 36,267.54. Furthermore, for individuals serologically positive for the immunodeficiency, there were a total of R\$ 48,538.22 in the first year of session. In this way, this shows the importance of preventive strategies and active search for users with risk factors and those that are already in the initial stage of the disease, once, in this way, there is a reduction of public spending with CRF and its complications.<sup>14</sup>

In Brazil, from 2013 to 2015, there was an increase of 361.32% and 364.84%, respectively, in the costs with HD in patients with HIV and/or hepatitis B and/or C. Moreover, HD performed in three weekly sessions amounted 95.96% of procedures and 96.07% of spendings. These results are similar to the values found in the Northeast region, in which the HD in the cited modality corresponded to 97.9% (Table 2) and accounted for 93.6% of costs (table 3).

This study could not identify the reason for the increased spending with sessions with HIV and hepatitis. According to the authors, such results may be due to the increased number of people

with such conditions that survived the initial phase of the disease because of technological and therapeutic advance or even the increased incidence and diagnosis of HIV and hepatitis in the population.<sup>25</sup>

The spendings with the treatment of CRF tend to increase due to the population aging and incidence of NCCD, especially hypertension and DM.<sup>25,26</sup> In 2003, the total public spending in Brazil with renal replacement therapies were R\$ 17,414.742,205,28, which correspond to approximately 8% of resources.<sup>14</sup>

Furthermore, hospital institutions linked to the UHS are experiencing difficulties managing resources that are already scarce due to reduced spending in the three government spheres. The limited health resources reflect the need for knowledge of healthcare costs in order to ensure the effective management of resources. Moreover, professionals need to be aware that care provision generates direct and indirect costs. In this way, there will be the adoption of critical-reflective thoughts regarding the rational use of human and material resources available in the institution, which will improve the decision-making to ensure the effectiveness in the allocation of resources.<sup>27</sup>

### CONCLUSION

This study showed that the hemodialysis presented increasing behavior between 2014 and 2017. The values used for this therapy followed the growth trend and constitute a large economic burden for the Unified Health System. This study is likely to collaborate especially in the strengthening and enhancement of Basic Care, regarding the increase in the quality of assistance to users who have risk factors, including conducting an active search in the northeast community.

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Submission: 2019/02/02 Accepted: 2019/07/27 Publishing: 2019/08/09

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