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MORBIDITY-MORTALITY EPIDEMIOLOGY AND PUBLIC COSTS OF KIDNEY FAILURE

EPIDEMIOLOGIA DA MORBIMORTALIDADE E CUSTOS PÚBLICOS POR INSUFICIÊNCIA RENAL EPIDEMIOLOGÍA DE MORBIMORTALIDAD Y COSTES PÚBLICOS POR INSUFICIENCIA RENAL

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ABSTRACT

Objective: to describe the epidemiology of morbidity-mortality and public costs of kidney failure between 2012-2017. **Method:** this is a quantitative, ecological and descriptive study, with data from the Hospital Information System. All five Brazilian regions were selected as study population, with the collection of gender, age and race/color variables, values of hospital services, hospitalizations, deaths and mortality rate. Data were analyzed by means of descriptive statistics (absolute and relative frequencies) and presented in the form of tables constructed through Excel software. **Results:** there were 507.830 hospitalizations due to kidney failure. The highest values were in the Southeast (45.48%), males (56.47%), aged 60 through 64 years (11.10%) and self-reported whites (36.81%). Furthermore, there were 64,977 deaths and mortality rate of 12.8%, with the highest rates in the northern region (13.91%). There was a financial impact exceeding R\$ 1.4 billion. **Conclusion:** kidney failure affects, in greater prevalence, elderly and white men when the outcome is death, resulting in changes in the family dynamics and budget, increased costs to health systems and reduced quality of life. **Descritores:** Epidemiology; Public Health; Nephrology; Kidney Diseases; Healthcare Costs; Information Systems.

RESUMO

Objetivo: descrever a epidemiologia da morbimortalidade e custos públicos pela insuficiência renal entre 2012-2017. **Método:** trata-se de estudo quantitativo, ecológico e descritivo, com dados do Sistema de Informações Hospitalares. Selecionou-se as cinco regiões brasileiras como população de estudo e coletou-se as variáveis sexo, faixa etária, raça/cor, valores dos serviços hospitalares, internações, óbitos e taxa de mortalidade. Analisou-se os dados por meio de estatística descritiva simples (frequências absolutas e relativas) e apresentou-se em forma de tabelas construídas por meio do software Excel. **Resultados:** registrou-se 507.830 internações por insuficiência renal. Evidenciou-se maior prevalência no Sudeste (45,48%), no sexo masculino (56,47%), entre 60 a 64 anos (11,10%) e autodeclarados brancos (36,81%). Notificou-se, também 64.977 óbitos e mortalidade de 12,8%, com maior taxa na região norte (13,91%). Houve impacto financeiro superior a 1,4 bilhões de reais. **Conclusão:** conclui-se, que a insuficiência renal aflige em maior prevalência homens idosos e brancos quando o desfecho final é o óbito, implicando em mudanças na dinâmica e orçamento familiar, incremento de custos aos sistemas de saúde e redução da qualidade de vida. **Descritores:** Epidemiologia; Saúde Pública; Nefrologia; Nefropatias; Custos de Cuidados de Saúde; Sistemas de Informação.

RESUMEN

Objetivo: describir la epidemiología de la morbimortalidad y costes públicos por insuficiencia renal entre 2012-2017. **Método:** se trata de un estudio cuantitativo, ecológico y descriptivo, con datos del Sistema de Información Hospitalaria. Fueron seleccionadas las cinco regiones brasileñas como población de estudio y recogidas las variables sexo, edad, raza/color, valores de los servicios hospitalarios, hospitalizaciones, muertes y tasa de mortalidad. Los datos fueron analizados mediante estadística descriptiva (frecuencias absolutas y relativas) y se presentan en forma de tablas construidas mediante software Excel. **Resultados:** se registraron 507,830 hospitalizaciones por insuficiencia renal. Mayor prevalencia en el sureste (45.48%), el sexo masculino (56.47%), entre 60 y 64 años (11,10%) y auto-declarados blancos (36.81%). También se notificaron 64,977 muertes y tasas de mortalidad del 12,8%, con tasas más altas en la región norte (13.91%). Hubo un impacto superior a los 1.400 millones de reales. **Conclusión:** Se concluye que la insuficiencia renal aflige, en la mayor prevalencia, hombres ancianos y blanco cuando el resultado final es la muerte, resultando en cambios en la dinámica y el presupuesto familiar, aumento de costes para los sistemas de salud y la reducción de la calidad de vida. **Descritores:** Epidemiología; Salud Pública; Nefrología; Enfermedades Renales; Costos de la Atención en Salud; Sistemas de Información.

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INTRODUCTION

Kidney Failure (KF) occurs when renal functions decrease, and can be classified as Acute Kidney Failure (AKF) or evolve to Chronic Kidney Failure (CKF)¹. AKF consists of a reversible syndrome evidenced by the sudden loss for hours or days of glomerular filtration capacity.² CKF is characterized by the last stage of Chronic Kidney Disease (CKD) after a slow, progressive and irreversible loss of renal functions (glomerular, tubular, and endocrine).³

In both cases, there is a serum increase of nitrogenous waste such as urea, creatinine, metabolic acids, among others, which change the chemical composition of the blood and interfere with the metabolic and hydroelectrolytic homeostasis.^{3,4} The main etiological sources of KF are diabetic nephropathy, Systemic Arterial Hypertension (SAH) and glomerulonephritis. Its development also occurs from pyelonephritis, hereditary lesions, use of nephrotoxic drugs, vascular disorders and exposure to occupational agents as heavy metals, among others.⁵

The initial therapy, also called conservative treatment, aims to avoid the progression of complications, using medicines, dietary therapies and control of SAH. When these measures are no longer effective, the treatment changes to Renal Replacement Therapy (RRT), among which stand out Hemodialysis (HD), Peritoneal Dialysis (PD) and Renal Transplantation (RT).⁵ The first two therapies are used in the AKF⁶ and CKF,⁷ while RT is only performed in patients with the chronic form of the disease.⁷

The estimates of the KF incidence in Brazil reaches approximately 8% per year, being three times more frequent in patients with heart failure, which potentiates progressive renal lesions since they share the same etiology, SAH, most comprehensive chronic condition in Brazilian statistical data on kidney diseases.⁸ Regarding the information presented and, allied to the burden generated for public coffers, KF is considered an important public health problem.

In Brazil, the primary care has been facing financial crises and the high demand ends up overloading the professionals in such a way, who often do not reach efficiency in their actions. Therefore, this study presents itself as relevant to society and the scientific environment, once it provides knowledge and analysis of the Brazilian health situation of KF. Moreover, it allows assessing the effectiveness of public policy and the primary care in the

health promotion, protection and recovery context.

OBJECTIVE

- To describe the Brazilian morbidity-mortality epidemiology and public costs of Kidney Failure between 2012-2017.

METHOD

This is a quantitative, ecological and descriptive study, conducted based on morbidity-mortality data of KF registered in Brazil. The country has 207,660,929 inhabitants distributed in 5,570 municipalities, forming a territorial area of 8,515,767,049 m², organized politically and administratively into five regions: north, northeast, southeast, south and midwest.⁹

Data collection occurred electronically through the Hospital Information System (HIS), of the Unified Health System Department of Informatics (DATASUS - *Departamento de Informática do Sistema Único de Saúde*). The following variables were considered: gender (male and female), age (≥ 1 year to < 80 years), race/color (white, black, *pardo*, Asian and indigenous), according to the categories standardized for the Brazilian population,¹⁰ values of hospital services, deaths and mortality rate reported in the period from 01 January 2012 to 31 December 2017.

Mortality rate was obtained through the ratio between the deaths and hospital admissions during the study period, subsequently, multiplying the result by 100. The study selected the cases classified in Chapter XIV - Diseases of the genitourinary tract (N00-N99), of the 10th International Classification of Diseases and Related Health Problems, covering the category from N17.0 to N19.

Data collection and tabulation occurred in 2018. Data were computed and analyzed through descriptive statistics in Microsoft Office Excel (Microsoft©, 2010) and presented in the form of tables. Due to the character of this study, there was no need for submission to the Research Ethics Committee, according to resolution 466/2012 of the National Health Council.

RESULTS

Table 1 shows hospitalizations, deaths and mortality rate recorded in the studied period. In 2016, there was a greater number of hospitalizations (n=104.676) and deaths (n=13.785), corresponding to 20.61% and 21.21%, respectively. The southeastern region presented the highest percentage in both

variables and, in relation to the mortality rate, the northern region stands out with 13.91%. Finally, in this time interval, KF

presents an average mortality of 12.8% of deaths.

Table 1. Morbidity-mortality from KF in Brazil stratified by year of admission and regions. Jequié (BA), Brazil, 2012-2017.

Variables	2012	2013	2014	2015	2016	2017	Total	%
Hospitalization								
North	658	5,353	5,580	5,959	6,030	5.495	29.075	5.73
Northeast	1.681	21.190	21.075	21.637	22.708	21.245	109.536	21.57
Southeast	3.260	42.656	45.067	46.736	47.474	45.757	230.950	45.48
South	1.651	18.921	19.550	20.206	20.757	19.825	100.910	19.87
Midwest	765	7.188	7.029	7.402	7.707	7.268	37.359	7.36
Total	8.015	95.308	98.301	101.940	104.676	99.590	507.830	100
Deaths								
North	96	680	775	810	852	831	4.044	6.22
Northeast	243	2.633	2.791	3.155	3.213	2.790	14.825	22.82
Southeast	478	5.652	5.922	6.326	6.449	6.005	30.832	47.45
South	170	1.946	2.033	2.247	2.375	2.184	10.955	16.86
Midwest	85	787	881	847	896	825	4,321	6.65
Total	1.072	11.698	12.402	13.385	13.785	12.635	64.977	100
Mortality rate								
North	14.59	12.7	13.89	13.59	14.13	15.12	13.91	13.91
Northeast	14.46	12.43	13.24	14.58	14.15	13.13	13.53	13.53
Southeast	14.66	13.25	13.14	13.54	13.58	13.12	13.35	13.35
South	10.3	10.28	10.4	11.12	11.44	11.02	10.86	10.86
Midwest	11.11	10.95	12.53	11.44	11.63	11.35	11.57	11.57
Total	13.37	12.27	12.62	13.13	13.17	12.69	12.8	12.8

Source: Ministry of Health - Hospital Information System of the UHS (HIS/UHS)

Table 2 shows the increase in the prevalence of hospital admissions as age advances. There was greater involvement in people aged 60 through 64 years, representing a percentage of 11.10% (n=56.380).

Furthermore, the second highest prevalence of hospitalizations due to KF occurred in people aged ≥ 80 years, which is equivalent to 10.68% (n=54.219).

Table 2. Hospitalization due to KF in Brazil stratified by age group and year of admission. Jequié (BA), Brazil, 2012-2017.

Age group (years)	2012	2013	2014	2015	2016	2017	Total	%
< 1	37	412	390	427	367	392	2.025	0.40
1 - 4	60	578	623	683	663	574	3.181	0.63
5 - 9	59	741	668	771	792	608	3.639	0.72
10 - 14	129	1.137	1.105	1.082	1.118	952	5.523	1.09
15 - 19	176	1.716	1.690	1.590	1.601	1.413	8.186	1.61
20 - 24	212	2.235	2.281	2.368	2.426	2.,207	11.729	2.31
25 - 29	281	3.252	3.259	3.340	3.246	3.022	16.400	3.23
30 - 34	331	4.158	4.008	4.001	4.149	3.769	20.416	4.02
35 - 39	410	4.692	4.678	4.815	4.964	4.638	24.197	4.76
40 - 44	491	5,660	5,753	5,721	5,677	5,475	28,777	5.67
45 - 49	588	7.404	7.081	7.463	7.437	6.919	36.892	7.26
50 - 54	729	8.585	8.830	9.039	9.403	9.020	45.606	8.98
55 - 59	849	9.997	10.261	10.681	10.736	10.440	52.964	10.43
60 - 64	829	10.481	10.832	11.238	11.815	11.185	56.380	11.10
65 - 69	806	9.389	10.192	10.890	11.538	10.936	53.751	10.58
70 - 74	697	8.182	8.671	8.924	9.464	9.097	45.035	8.87
75 - 79	557	6.846	7.611	7.944	8.152	7.800	38.910	7.66
≥ 80	774	9.843	10.368	10.963	11.128	11.143	54.219	10.68
Total	8.015	95.308	98.301	101.940	104.676	99.590	507.830	100

Source: Ministry of Health - Hospital Information System of the UHS (HIS/UHS)

Table 3 shows that the self-reported white population stands out in the hospitalization service in the entire period, corresponding to

36.80% (n=186.926). The *pardo* race/color also stands out with 30.62% (n=155.520).

Table 3. Hospitalizations due to KF in Brazil stratified by race/color and year of admission. Jequié (BA), Brazil, 2012-2017.

Color/race	2012	2013	2014	2015	2016	2017	Total	%
White	2.717	35.298	36.751	37.605	38.306	36.249	186.926	36.81
Black	384	4.995	5.429	5.532	5.766	6.150	28.256	5.56
Pardo	2.127	26.108	29.417	31.331	33.623	32.914	155.520	30.62
Asian	23	464	544	985	1.519	1.600	5.135	1.01
Indigenous	9	76	62	87	90	104	428	0.08
No information	2.755	28.367	26.098	26.400	25.372	22.573	131.565	25.91
Total	8.015	95.308	98.301	101.940	104.676	99.590	507.830	100

Source: Ministry of Health - Hospital Information System of the UHS (HIS/UHS)

The male population showed higher renal complication reaching a point where they required a greater number of hospitalizations,

as shown in table 4. Men presented a greater number of admissions in all five years, totaling 56.46% (n=286,759).

Table 4. Hospitalizations due to KF in Brail stratified by gender and year of admission. Jequié (BA), Brazil, 2012-2017.

Gender	2012	2013	2014	2015	2016	2017	Total	%
Male	4.452	53.472	55.094	57.570	59.337	56.834	286.759	56.47
Female	3.563	41.836	43.207	44.370	45.339	42.756	221.071	43.53
Total	8.015	95.308	98.301	101.940	104.676	99.590	507.830	100

Source: Ministry of Health - Hospital Information System of the UHS (HIS/UHS)

Table 5 shows the public costs generated by the hospital services during hospitalization. The southeastern region generated greater burden to the Unified Health System (with

49.89% of the costs (n= R\$ 713,983.271.10). Thus, KF generated a financial impact exceeding R\$ 1.4 billion to the Brazilian public coffers.

Table 5. Public costs in R\$ due to Kidney Failure in Brazil. Jequié (BA), Brazil, 2012-2017.

Region	Total	%
North	54,492,799.75	3.81
Northeast	279,373,190.50	19.52
Southeast	713,983,271.10	49.90
South	316,304,418.80	22.10
Midwest	66,815,074.94	4.67
Total	1,430,968,755.00	100

Source: Ministry of Health - Hospital Information System of the UHS (HIS/UHS).

DISCUSSION

The results of this study showed that, through DATASUS, in Brazil, there are differences in the distribution of the morbidities-mortalities and hospital costs of KF in function of the variables of location, age, gender and skin color/race.

In the analysis of hospitalizations and deaths from KF by Brazilian region, this study found higher rates in the southeastern region, with 45.48% and 47.45%, respectively, as shown in table 1. Furthermore, the North region presented the highest mortality rate (13.91%), as shown in table 1.

Estimates show that 10 million Brazilians have some kind of renal involvement, 100 thousand are undergoing dialysis and Brazil has a prevalence of CKD of 50/100,000 inhabitants. A study with CKD patients treated in dialysis units in Brazil estimated that approximately 22,337 individuals die from

renal complications in the country. This Brazilian rate was lower when compared to the that found in the United States.¹¹

In relation to the age variable, the results of this article point to a higher prevalence of KF in the age group 60 through 64 years (11.10%) and the second greatest prevalence in ≥ 80 years (10.68%), as shown in table 2. Another study found results that corroborate these findings, such as the one performed at a university hospital in the city of São Paulo that observed an average age of 65.8 years of hospitalized patients with CKD.⁸

When it comes to renal changes, there must be attention to their risk factors, such as aging, presence of heart failure, Diabetes Mellitus (DM) and in particular, SAH, since the probability of developing CKD increases when the individual has associated vulnerabilities. In addition, a study conducted in the capital of São Paulo highlights that, each year of life, the possibility of developing the disease rises

approximately 1.9%; when bearer of hypertension or DM, it increases approximately two times and, in case of heart failure, the chances increase by up to 2.6 times.⁸

Another study has highlighted the relationship between the risk of death from renal complications and increase of age, such as the survey conducted in Belo Horizonte, which observed the prevalence of 68% of deaths in individuals undergoing dialytic therapy aged over 65 years.¹² The explanation for considering aging a risk factor is the relationship between the aging process of the body and the consequent decrease in the GFR.¹³

Considering the color/race variable, a study tends to corroborate the findings of this research (Table 3), indicating a greater prevalence in the white color/race.⁸ However, another study done by the national health survey found no significant differences between race/skin color in patients with CKD.¹⁴

Although blacks have a greater prevalence of risk factors for CKD, such as SAH¹⁵ and DM,¹⁶ the white race showed a higher probability of developing the disease. A study conducted in the state of Bahia found similar results, whose mostly black population had a lower incidence of CKF, especially by glomerulonephritis.¹⁷

Even though health professionals collected the color/race information of this study through the users' self-report, and despite a phenotypic variable, it is also a cultural construction of each individual. Similarly, a study of some Brazilian researchers concluded that the perception about race/color shows variable behavior in temporal space, often due to its association with social status.¹⁸

This study showed that, of all KF cases, 56.47% occurred in the male population, according to Table 4, an expected result, since men have physiologically higher probability of developing CKD.¹⁹ A survey conducted in Salvador-BA, which aimed to analyze the medical records of patients with CKD, showed that the number of cases is more prevalent in the male population.⁷ Another study done from the DATASUS database in the child population found a prevalence of 60% of males in the cases of hospitalization in children, which is in line with the findings of the present study on the gender variable.¹

Although some studies^{2,20,21} have evidenced a higher number of women with CKD, men present a higher risk for reduction of GFR, and, consequently, evolution to the chronic

form of the disease.^{20,21} This relationship results from the greater adherence of women to health services and greater prevalence in this population enrolled in programs of the basic network, such as HiperDia. There is also a greater prevalence of SAH in women aged over 60 years and longer life expectancy at birth (76.5 years), when compared to men.²¹

In relation to the financial impact, KF generated a burden exceeding R\$ 1.4 billion to Brazilian public coffers, as shown in table 5. The annual expenses with the KF patient in HD involve exams (R\$ 539.76), hospitalization (R\$ 1,180.00), consultations (R\$ 120.00), therapy (R\$ 7,829.89), vascular access (R\$ 817.57) and dialysis sessions (R\$ 25,780.32), totaling R\$ 36,267.54 per year. These values refer only to users seronegative for Human Immunodeficiency Virus (HIV) and, for this population, the value increases to R\$ 48,538.22 per year due to therapeutic peculiarities.²²

The costs of maintaining dialysis machines still cooperates for lifting the burden generated, since they include costs for recruitment of professionals, material resources and outsourcing of work. Therefore, the monitoring of expenses resulting from renal therapy through HD includes not only the hemodynamic procedure, but also the context of conservation and effectiveness of treatment. Nevertheless, the assistance method performed through HD consists of the main form of intervention directed at patients with renal involvement.²³

The costs of PD treatment are smaller the those of HD. The annual expenses with the first therapy consists of exams (R\$ 607.76), hospitalization (R\$ 464.86), consultations (R\$ 660.00), therapy (R\$ 4,642.30), peritoneal access (R\$ 549.75) and the treatment itself (R\$ 21,498.72), totaling R\$ 28,423.39 per year.²²

Furthermore, the PD stands among the RRT procedures due to its simple implementation of the therapeutic resource, as well as the reduced infrastructural demand to reach the targeted assistance purposes, which adds to lower costs in relation to the extracorporeal therapies, such as HD.²⁴ This technique encompasses the continuous ambulatory peritoneal dialysis (CAPD), the continuous cyclic peritoneal dialysis (CCPD) and intermittent peritoneal dialysis (IPD).²⁵ adapting to certain existing scenarios.

The discussion on the costs with RT takes into account whether the donated organ came from a Dead Donor (DD) or Living Donor (LD) and the pharmacological group employed in the post-therapy transplant therapy. In this

way, the highest costs for transplantation are observed with DD and LD associated with the immunosuppressant tacrolimus (R\$ 48,388.17, and R\$ 46,550.18, respectively). This therapeutic modality results in lower mortality rate and provides a better quality of life (QOL) for individuals. Moreover, the costs with the immunosuppressive drugs are lower in relation to those used in HD and PD.²²

However, preliminary values resulting from the RT are still significant and also reflect the burden arising from the implementation of the surgical procedure, since, after it, there are low costs in the use of actions for monitoring and preventing the rejection of organ.²⁶ The RT represents an option with high cost-benefit ratio while providing improvement in the life quality and expectancy, as a long-term result, when comparing methods of continuous dialysis.²⁷

More than 80% of the Unified Health System (UHS) finance and control the procedures for the treatment of KF. Furthermore, preventive measures related to risk factors for kidney problems, as well as the active search for these patients in the initial stage, provide reduced costs for the UHS, generating savings for the public coffers.²⁸

CONCLUSION

The findings of this study show that kidney failure occurs, in greater prevalence, in elderly and white men when the outcome is death, resulting in changes in the family dynamics and budget, increased costs to health systems and reduced QOL. Moreover, public costs tend to increase due to the aging of the population, consequently, increasing the development of chronic diseases in the Brazilian population.

Thus, it is necessary to strengthen control and prevention actions for KF, especially in the northern region, due to the higher mortality rate recorded. Therefore, Kidney Failure represents an important challenge for public health, and this study provides subsidies to direct preventive strategies at this pathology, especially regarding the control of SAH and DM.

The results of this article originate from the analysis of information of a health information system in the public domain. Therefore, a limitation of the study refers to the possible underreporting. DATASUS data were chosen because of their easy access, reduced time for data collection and analysis, low cost and because it is one of the main tools for directing the creation and implementation of public health policies.

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