



Original Article

Total knee and hip arthroplasty: the reality of assistance in Brazilian public health care[☆]



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ABSTRACT

Objective: To analyze the number of hospital permits for total knee arthroplasty (TKA) and total hip arthroplasty (THA) in Brazil between 2008 and 2015, and correlate them with regional, national, and international demographic and epidemiological aspects.

Methods: Data on demographics, economic level, and TKA and THA were obtained from the website of the Ministry of Health/DATASUS, Brazilian Institute of Geography and Statistics, and the National Health Agency to assess the assistance provided by the Public Health Care System in arthroplasties for elderly Brazilian population without private health care.

Results: The South and Southeast had the best care, with 8.07 and 6.07 TKAs/100,000 inhabitants, one TKA per 1811 and 2624 seniors, 17.3 and 10.99 THAs/100,000 inhabitants, and one THA per 923 and 1427 seniors, respectively. The worst rates were found in the North and Northeast, with 0.88 and 0.98 TKAs/100,000, one TKA per 6930 and 10,411 seniors, 0.96 and 3.25 THAs/100,000, and one THA per 6849 and 2634 seniors, respectively. The national average was 4.00 TKAs/100,000, one TKA per 3249 seniors, 8.01 THAs/100,000, and one THA per 1586 seniors. The international average was 142.8 TKAs/100,000 and 191.8 THAs/100,000.

Conclusion: The results expressed unsatisfactory results for TKA and THA in Brazil, with greater relevance in the North and Northeast.

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Artroplastia total de joelho e quadril: a preocupante realidade assistencial do Sistema Único de Saúde brasileiro

RESUMO

Objetivo: Analisar o número de autorizações de internação hospitalar para cirurgias de artroplastia total de joelho (ATJ) e quadril (ATQ) no Brasil entre 2008 e 2015 e correlacioná-lo com aspectos demográficos e epidemiológicos regionais, nacionais e internacionais.

Palavras-chave:

Artroplastia

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[☆] Study conducted at the Hospital do Coração, Departamento de Ortopedia e Traumatologia, São Paulo, SP, Brazil.

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Métodos: Os dados sobre informativos demográficos, econômicos e sobre ATJ e ATQ foram obtidos no website do Instituto Brasileiro de Geografia e Estatística (IBGE), Agência Nacional de Saúde (ANS) e Ministério da Saúde/Datasus para avaliar o assistencialismo do Sistema Único de Saúde (SUS) em artroplastias para a população idosa brasileira sem planos de saúde privados.

Resultados: As Regiões Sul e Sudeste apresentaram a melhor relação assistencial, com 8,07 e 6,07ATJ/100.000 habitantes e uma ATJ para 1.811 e 2.624 idosos e 17,3 e 10,99ATQ/100.000 habitantes e uma ATQ para 923 e 1.427 idosos, respectivamente. Os piores índices foram do Norte e Nordeste, com 0,88 e 0,98 ATJ/100.000 e uma ATJ para 6.930 e 10.411 idosos e 0,96 e 3,25 ATQ/100.000 e uma ATQ para 6.849 e 2.634 idosos, respectivamente. A média nacional foi de 4,00 ATJ/100.000 e uma ATJ para 3.249 idosos e 8,01 ATQ/100.000 e uma ATQ para 1.586 idosos. A média internacional foi de 142,8 ATJ/100.000 e 191,8 ATQ/100.000.

Conclusão: Os resultados indicaram resultados assistenciais insatisfatórios para ATJ e ATQ no Brasil, principalmente nas regiões Norte e Nordeste.

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Introduction

Osteoarthritis (OA) is the most prevalent musculoskeletal disease, affecting 4% of the Brazilian population; it is associated with morbidities such as falls, depression, and obesity.¹⁻³ The mortality risk is 50% higher in patients with gait limitation due to knee and hip OA when compared with the general population.⁴

By 2050, the mean life expectancy in Brazil will be 81 years, and 30% of the Brazilian population will be represented by the elderly.⁵⁻⁹ In Brazil, a concerning fact regarding individuals over the age of 60 is that only 12% of the population in this age group had private health insurance in 2015.¹⁰

The increase in the number of total knee (TKA) and hip (THA) arthroplasties has a relevant social and economic impact, and countries such as Australia, the United States, England, Canada, and South Korea are therefore conducting epidemiological and financial studies on these surgeries.¹¹⁻¹⁴ In Brazil, information on such procedures is scarce. National data on such surgeries performed under the Brazilian Unified Health System (Sistema Nacional de Saúde [SUS]) are available through the Brazilian Ministry of Health website. However, these indicators do not represent the entire Brazilian population.¹⁵

The objective of this study was to analyze the data of the primary TKA and THA provided by the Brazilian Ministry of Health/DATASUS between 2008 and 2015 and to observe the extent to which the SUS assists the Brazilian population for these surgeries at a state, regional, and national level, and to compare these results with international indicators.

Material and methods

The data for the study were obtained through PubMed and Google; as it did not involve any intervention or direct contact with patients, the study was not submitted to the ethics committee for approval.

The search terms used in both portals followed the PubMed Medical Subject Headings (MeSH) algorithm. The words used for the search were arthroplasty, replacement, knee, hip, cost, and epidemiology. The term AND was used between words as a Boolean operator.

A Google search was performed to obtain epidemiological, economic, and statistical data in Brazil through the search on the websites of the Brazilian Ministry of Health/DATASUS the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística [IBGE]), the National Agency of Supplementary Health (Agência Nacional de Saúde Suplementar [ANS]), and the World Health Organization (WHO). International statistical reports on arthroplasties were also obtained using the same MeSH terms.

Data on the authorization for hospital admission (AHA), mean length of hospitalization, and mortality rate in TKA and THA were collection from the website of the Brazilian Ministry of Health/DATASUS between 2008 and 2015.

The national and regional demographic indices in the study period were obtained from the IBGE website.¹⁶ Only the portion of the population that consisted of elderly individuals relying exclusively on the SUS for healthcare was used for the population calculations, excluding individuals over 60 years old who had private healthcare plans registered at ANS at the national, regional, and state levels.¹⁰ The classification of the elderly used in this study followed that presented in Art. 1 of Law 10,741, from October 1, 2003, known as the Statute of the Elderly, which establishes that this denomination applies for individuals over 60 years of age. The percentage of elderly individuals who underwent TKA and THA procedures at the national, regional, and state level was calculated by dividing the number of surgeries performed in that period by the relevant population in the study group.

The states were ranked according to the healthcare assistance they provided to their population regarding TKA and THA procedures, in which a higher proportion of surgeries in the elderly led to a better classification on the ranking.

Data on the number of TKA and THA procedures in European countries, the United States, and Australia were obtained

from the epidemiological study published by Kurtz et al.¹¹ in 2011, which collected data on these surgeries from 2000 to 2010. These results were compared with the data from Brazil, aiming to contrast the arthroplasty coverage between economically developed countries and Brazil. For these calculations, the ratio of surgeries per 100,000 elderly individuals was used.

The results obtained at the national and regional levels for TKA and THA were distributed in tables, according to the characteristics studied, between 2008 and 2015. A general table was elaborated with data referring to the results obtained in each state.

Statistical analysis

Data on TKA and THA in economically developed countries, as well as information about Brazil and its regions, were statistically described as mean, median, mode, and percentiles for a descriptive comparison of the obtained results.

The annual growth rates in the number of TKAs and THAs, both internationally and in Brazil, were obtained by dividing the number of procedures of one year by those from the previous year. The mean value was calculated by adding all growth rates and dividing by the number of years under evaluation.

The number of AHAs, the mean time of hospitalization, and the mortality rates were collected directly from the Brazilian Ministry of Health website.¹⁵

Results

Number of TKAs and THAs performed in Brazil and its regions

Between 2008 and 2015, the Southeast region stood out, averaging 57% and 51.6% of the TKAs and THAs surgeries in the country. The South Region accounted for 29.1% and 28%, followed by the Northeast, with 7.8% and 12.9%; the Midwest accounted for 3.3% and 6.1%, and the North, for 2.6% and 1.2%, respectively (Tables 1 and 2).

The state of São Paulo, which has 49% of the elderly population of the Southeast, accounted for 47.4% and 53.8% of the TKAs and THAs, respectively. Espírito Santo, with 3.7% of the regional population, accounted for 6.9% of the TKAs in the Southeast region, and obtained the best ratio of knee prostheses per elderly individuals in Brazil. Through the same evaluation method, Distrito Federal presented the best THA coverage, accounting for 29.2% of regional surgeries and 14.4% of the elderly population (Table 1).

In Brazil, TKA presented an annual growth oscillation, with a decreasing number of procedures between 2011/2012 and 2014/2015 (−1.1% and −2.3%, respectively). However, the mean annual growth between 2008 and 2015 was 8.7%. The only region that presented continuous growth in this surgery was the Southeast (Tables 2 and 3).

THA presented periods of decrease in all regions studied. The negative highlight was for the Northeast, which presented a negative annual growth of −0.4% for the studied period. In turn, the Midwest region showed the highest mean growth

(10%), followed by the North region (9.5%). At the national level, the rate of THA decreased by −1.4% in 2011/2012. However, the mean growth in the entire study period was 3.3% (Tables 2 and 3).

Elderly population who relied exclusively on SUS in Brazil and its regions

A discrepancy in the demographic distribution among the five regions of Brazil was observed. The Northeast is the second most populous region, accounting for 24.9% of the total number of elderly people who rely exclusively on SUS, second only to the Southeast, which accounted for 47.2% of the total population in this age group. The South, Midwest, and North regions accounted for 16.5%, 6.1%, and 5.0%, respectively (Table 4).

The North and Northeast regions presented the lowest proportion of elderly people, i.e., they had greater asymmetries between the base and apex of the age pyramid. In turn, the South and Southeast regions presented the highest proportion of individuals aged over 60 years. All regions presented growth of the elderly age range above that of the population (Table 4).

TKA and THA per 100,000 inhabitants – International, Brazil, and its regions

A growth in the number of THA and TKA procedures has been observed in Brazil. Nonetheless, the surgical coverage in the public healthcare system presented absolutely unsatisfactory results when compared with those of economically developed countries (Tables 2 and 5).

SUS showed a care deficit of approximately 36 times (3.9/100,000 vs. 142.8/100,000) when compared with the assistance provided in developed countries in 2010. Regarding THA, the result was 24 times lower than the mean of the European countries, United States, and Australia (7.8/100,000 vs. 191.8/100,000; Table 5).

In Brazil, the mean number of THAs was twice as high (2.04) as the number of TKAs performed by SUS. In the Northeast and Midwest regions, the disproportion between the procedures was more evident, with a superiority of THA over TKA of 231% and 265%, respectively. In the South and Southeast regions, these rates were 115% and 81%, respectively. In the North region, the number of THAs was only 9% higher than that of TKAs, and some years showed an inversion in this predominance (Table 6).

Proportion of TKA and THA in relation to the elderly population in Brazil and regions

Among all Brazilian regions, the Northeast presented the greatest care deficit for TKA, with a mean of one prosthesis made per 10,411 elderly individuals. The North region presented the worst THA coverage, with a mean of one surgery per 6849 elderly individuals (Table 7).

The South region presented the best ratio of knee and hip surgeries for the elderly population who relied exclusively on SUS: one THA and one TKA were performed per 1811 and 923 elderly individuals, respectively (Table 7).

Table 1 – Number of AHAs for TKA and THA between 2008 and 2015 in Brazilian states and the proportion of arthroplasties per elderly individuals, mean length of hospitalization, mortality rate, and ranking.¹⁵

Indexes states	AHA/TKA	AHA/THA	Regional percentage TKA; THA	Regional percentage of elderly	Proportion elderly/TKA – yearly	Proportion elderly/THA – yearly	Period of hospitalization TKA; THA (days)	Mortality Rate TKA; THA	National ranking TKA; THA
North									
Rondônia	98	150	7.8%; 13.0%	10.6%	7789	5193	3.4; 27.4	0.0; 4.0	21st; 22nd
Acre	170	120	13.5%; 10.4%	4.5%	1953	2766	4.9; 5.2	0.0; 0.0	6th; 14th
Amazonas	350	220	27.8%; 19.1%	18.9%	3939	6270	7.5; 12.5	0.0; 0.91	11th; 23rd
Roraima	61	51	4.8%; 4.4%	2.3%	2780	3228	4.0; 5.1	0.0; 0.0	10th; 18th
Para	468	402	37.2%; 34.9%	48.7%	7592	8842	5.8; 8.8	0.43; 1.0	19th; 25th
Amapá	0	33	0%; 2.8%	3.3%	0	7494	0.0; 9.3	0.0; 1.0	27th; 24th
Tocantins	109	175	8.6%; 15.2%	11.4%	7647	4774	4.3; 11.0	0.92; 1.71	20th; 20th
Northeast									
Maranhão	139	318	3.7%; 2.6%	10.6%	27,617	12,071	5.3; 10.5	0.72; 10.5	26th; 27th
Piauí	315	619	8.4%; 5.0%	6.1%	6981	3552	6.2; 8.7	0.0; 8.7	17th; 19th
Ceara	221	2306	5.9%; 18.8%	16.1%	26,309	2521	6.8; 8.9	0.0; 8.9	25th; 13th
Rio Grande Norte	415	1623	11.1%; 13.3%	6.3%	5470	1397	4.9; 7.5	0.0; 7.5	15th; 9th
Paraíba	252	908	6.7%; 7.4%	7.9%	11,318	3141	5.2; 11.8	0.40; 11.8	24th; 17th
Pernambuco	872	2780	23.3%; 22.7%	16.9%	7004	2197	4.4; 9.8	0.34; 9.8	18th; 11th
Alagoas	362	208	9.6%; 1.7%	5.1%	5102	8879	5.8; 6.1	0.0; 6.1	13th; 26th
Sergipe	248	254	6.6%; 2.0%	4.0%	4932	4816	4.2; 4.4	0.40; 4.4	12th; 21st
Bahia	910	3188	24.3%; 26.1%	27.2%	10,784	3078	3.7; 9.1	0.11; 9.1	23rd; 16th
Southeast									
Minas Gerais	6581	11,920	24.4%; 24.0%	26.3%	2120	1170	3.7; 5.9	0.14; 1.83	8th; 6th
Espirito Santo	1884	1173	6.9%; 2.4%	3.7%	1060	1707	3.3; 5.1	0.21; 0.60	1st; 10th
Rio de Janeiro	5709	9420	21.1%; 19.2%	20.9%	2502	1176	6.3; 9.8	0.16; 1.60	9th; 7th
São Paulo	12,793	26,300	47.4%; 53.8%	49.0%	2030	987	4.5; 6.7	0.24; 2.62	7th; 5th
South									
Paraná	4760	8649	34.5%; 32.5%	35.3%	1544	850	4.0; 5.2	0.25; 1.75	3rd; 3rd
Santa Catarina	3277	4846	23.7%; 18.2%	20.1%	1278	864	4.7; 5.9	0.21; 1.09	2nd; 4th
Rio Grande Sul	5739	13,078	41.6%; 49.2%	44.5%	1614	709	4.8; 6.7	0.09; 1.06	4th; 2nd
Midwest									
Mato Grosso	159	703	10.2; 12.0%	17.6%	10,459	2831	5.0; 6.1	0.90; 1.14	22th; 15th
Mato Grosso Sul	223	509	14.3 (8.7%)	20.3%	6463	2365	5.1; 8.4	0.63; 3.14	16th; 12th
Goiás	503	2908	32.3%; 49.9%	47.8%	5380	1343	4.9; 6.0	0.40; 2.85	14th; 8th
Distrito Federal	671	1706	43.1%; 29.2%	14.4%	1719	676	8.4; 13.5	0.15; 0.94	5th; 1st

Table 2 – Number of authorizations for hospital admission for total knee (TKA) and hip (THA) arthroplasties in Brazil and regions.¹⁵

RegionYear	North TKA; THA	Northeast TKA; THA	Southeast TKA; THA	South TKA; THA	Midwest TKA; THA	Brazil TKA; THA
2008	49; 126	268; 1500	2269; 4939	1307; 3279	135; 538	4028; 10,382
2009	191; 100	342; 1511	2864; 5507	1303; 3252	194; 622	4894; 10,992
2010	146; 114	476; 1600	3147; 5817	1421; 3187	160; 742	5350; 11,460
2011	144; 113	519; 1632	3339; 6118	1728; 3176	167; 655	5898; 11,694
2012	143; 113	490; 1472	3368; 6254	1651; 3041	176; 641	5828; 11,521
2013	188; 164	625; 1529	3813; 6817	2090; 3357	254; 819	6970; 12,686
2014	177; 208	564; 1519	4082; 6735	2195; 3510	277; 845	7245; 12,817
2015	218; 213	450; 1443	4085; 6626	2080; 3771	243; 964	7076; 13,017
Mean	157; 143	466; 1525	3370; 6101	1721; 3321	200.7; 728.2	5911; 11,821
Total	1256; 1151	3734; 12,206	26,967; 48,813	13,775; 26,573	1606; 5826	47,289; 94,569

The Southeast presented a THA rate similar to that observed in the Midwest. However, TKA presented disparate results among these regions, since the Southeast performed twice the number of surgeries as the Midwest (Table 7).

The states with the worst results were Maranhão, which was ranked last for THA care (one surgery per 12,071 elderly individuals) and second to last for TKA (one surgery per 27,617 elderly individuals), and Amapá, which was ranked

last for TKA (no surgeries in a population of 30,914 elderly individuals) and 24th for THA (one surgery per 7494 elderly individuals).

The state of Espírito Santo was ranked first for TKA, with one surgery per 1060 elderly individuals; Distrito Federal was the first for THA, with one surgery per 676 elderly individuals. In the South, Paraná was ranked third for both arthroplasties; Santa Catarina was ranked second and fourth place for

Table 3 – Growth of TKA and THA procedures in Brazil and its regions between 2008 and 2015.

Region/Period	North TKA/THA	Northeast TKA/THA	Southeast TKA/THA	South TKA/THA	Midwest TKA/THA	Brazil TKA/THA
2008/2009	289%; -20.6%	27.6%; 0.7%	26.2%; 11.5%	-0.3%; -0.8%	43.7%; 15.6%	21.4%; 5.8%
2009/2010	-23.5%; 14%	39.1%; 5.8%	9.8%; 5.6%	9.0%; -1.9%	-17.5%; 19.2%	9.3%; 4.2%
2010/2011	-1.3%; -0.8%	9.0%; 2.0%	6.1%; 5.1%	21.6%; -0.3%	4.3%; -11.7%	10.2%; 2.0%
2011/2012	-0.6%; 0%	-5.5%; -9.8%	0.8%; 2.2%	-4.4%; -4.6%	5.3%; -2.1%	-1.1%; -1.4%
2012/2013	31.4%; 45.1%	27.5%; 3.8%	13.2%; 9.0%	26.5%; 10.3%	44.3%; 27.7%	19.5%; 10.1%
2013/2014	-5.8%; 26.8%	-9.7%; -0.6%	7.0%; -1.2%	5.0%; 4.5%	9.0%; 3.1%	3.9%; 1.0%
2014/2015	23.1%; 2.4%	-20.2%; -5.0%	0%; -1.6%	-5.2%; 7.4%	-12.2%; 14.0%	-2.3%; 1.5%
Mean	44.8%; 9.5%	9.6%; -0.4%	9.0%; 4.3%	7.4%; 2.0%	10.9%; 10%	8.7%; 3.3%

Table 4 – Total number and percentage of elderly in Brazil and its regions who rely exclusively on the Brazilian Unified Health System (SUS).^{10,16}

Region/Year	North (Total ± %)	Northeast (Total ± %)	Southeast (Total ± %)	SUL (Total ± %)	Midwest (Total ± %)	Brazil (Total ± %)
2008	792,063 ± 5.6%	4,127,256 ± 9.0%	7,509,158 ± 14.0%	2,622,132 ± 12.6%	939,127 ± 9.7%	15,989,738 ± 11.0%
2009	824,484 ± 5.7%	4,247,855 ± 9.2%	7,811,180 ± 14.4%	2,731,930 ± 13.0%	985,703 ± 10.0%	16,601,153 ± 11.3%
2010	860,179 ± 5.9%	4,373,937 ± 9.4%	8,131,829 ± 14.8%	2,848,241 ± 13.5%	1,035,443 ± 10.3%	17,249,631 ± 11.6%
2011	899,102 ± 6.1%	4,505,972 ± 9.6%	8,471,984 ± 15.2%	2,971,283 ± 13.9%	1,088,442 ± 10.7%	17,936,783 ± 12.0%
2012	941,292 ± 6.3%	4,644,148 ± 9.8%	8,831,956 ± 15.9%	3,101,156 ± 14.3%	1,144,769 ± 11.1%	18,663,323 ± 12.4%
2013	986,504 ± 6.5%	4,788,886 ± 10.0%	9,211,035 ± 16.4%	3,237,311 ± 14.9%	1,204,304 ± 11.4%	19,428,039 ± 12.9%
2014	1,034,299 ± 6.7%	4,940,945 ± 10.2%	9,608,665 ± 17.0%	3,379,149 ± 15.5%	1,266,933 ± 11.9%	20,229,983 ± 13.2%
2015	1,084,402 ± 6.9%	5,100,897 ± 10.4%	10,023,944 ± 17.6%	3,520,041 ± 16.0%	1,332,533 ± 12.3%	21,067,978 ± 13.6%
Mean	928,290 ± 6.2%	4,591,237 ± 9.7%	8,699,968 ± 15.6%	3,051,405 ± 14.2%	1,124,656 ± 10.9%	18,395,828 ± 12.2%

Table 5 – Total knee (TKA) and hip (THA) arthroplasties per 100,000 elderly individuals, mean annual growth of surgeries in several countries, and mean population estimate with percentage of elderly subjects.^{10,11,14-16}

Indexes/Countries	TKA/100,000 (year)	TKA annual growth	THA/100,000 (year)	THA annual growth	Population (2010)
Germany	213.1 (2010)	4.8% (2005-2010)	295 (2010)	2.3% (2005-2010)	81,780,000 ± 21%
Australia	200.6 (2010)	5.8% (2002-2010)	249.1 (2010)	2.4% (2002-2010)	22,030,000 ± 14%
Brazil (SUS)	3.9 (2010)	8.7% (2008-2015)	7.8 (2010)	3.3% (2008-2015)	147,600,836 ± 10% ^a
Denmark	174.7 (2010)	13.7% (2000-2010)	225.4 (2010)	4.9% (2000-2010)	5,548,000 ± 17%
Spain	104.4 (2010)	8.1% (2000-2010)	97 (2010)	3.2% (2000-2010)	47,020,000 ± 17%
United States	213.3 (2010)	9.2% (2000-2010)	257 (2010)	8.0% (2000-2010)	309,000,000 ± 13%
Finland	187 (2010)	7.6% (2000-2010)	199.1 (2010)	4.2% (2000-2010)	5,363,000 ± 18%
France	124 (2010)	4.7% (2000-2010)	224.7 (2010)	1.0% (2000-2010)	65,020,000 ± 17%
Netherlands	127.6 (2009)	10.7% (2000-2009)	213.3 (2009)	2.7% (2000-2009)	16,620,000 ± 16%
Italy	97.7 (2009)	9.7% (2000-2009)	146.9 (2009)	2.3% (2000-2009)	59,280,000 ± 21%
Luxembourg	155.4 (2010)	3.7% (2000-2010)	207.6 (2010)	0.8% (2000-2010)	92,441 ± 14%
Portugal:	61.7 (2009)	19.1% (2000-2009)	87.8 (2009)	2.5% (2000-2009)	10,570,000 ± 19%
Sweden	125.3 (2009)	6.1% (2000-2010)	210.4 (2010)	2.4% (2000-2009)	9,378,000 ± 18%
Switzerland	211.9 (2010)	8.1% (2002-2010)	265.5 (2010)	1.7% (2002-2010)	7,825,000 ± 17%
Mean	142.8	8.5%	191.8	2.9%	56,223,376 ± 6.5%

^a The classification considers individuals over 60 years of age, according to the law in force in the country for the classification of the elderly. The other countries used the cut-off 65 years to define the elderly.

Table 6 – Proportion of knee (TKA) and hip (THA) arthroplasties performed by 100,000 people who rely exclusively on SUS in Brazil and regions.^{10,15,16}

Region/Year	North TKA; THA	Northeast TKA; THA	Southeast TKA; THA	South TKA; ATQ	Midwest TKA; THA	Brazil TKA; THA
2008	0.35; 0.90	0.58; 3.29	4.23; 9.21	6.31; 15.83	1.40; 5.58	2.78; 7.92
2009	1.34; 0.70	0.74; 3.28	5.29; 10.10	6.23; 15.56	1.97; 6.34	3.63; 7.76
2010	1.00; 0.78	1.02; 3.45	5.76; 10.65	6.74; 15.12	1.60; 7.44	3.94; 7.80
2011	0.97; 0.76	1.11; 3.49	6.06; 11.11	8.13; 14.94	1.64; 6.46	3.95; 7.84
2012	0.95; 0.75	1.04; 3.12	6.06; 11.26	7.70; 14.19	1.70; 6.22	3.87; 7.65
2013	1.23; 1.08	1.31; 3.22	6.81; 12.0	9.67; 15.54	2.42; 7.83	4.59; 8.35
2014	1.15; 1.35	1.18; 3.18	7.23; 11.94	10.08; 16.12	2.60; 7.95	4.73; 8.37
2015	1.41; 1.38	0.93; 3.00	7.19; 11.66	9.48; 17.20	2.25; 8.94	4.58; 8.43
Mean	0.88; 0.96	0.98; 3.25	6.07; 10.99	8.04; 17.3	1.94; 7.09	4.00; 8.01

Table 7 – Number of elderly in Brazil and regions for each total knee arthroplasty (TKA) and hip (THA) performed.^{10,15,16}

RegionYear	North TKA; THA	Northeast TKA; THA	Southeast TKA; THA	South TKA; ATQ	Midwest TKA; THA	Brazil TKA; THA
2008	16,164; 6286	15,400; 2751	3309; 1520	2006; 799	6956; 1745	3969; 1540
2009	4503; 8601	12,789; 2894	2727; 1418	2096; 840	5080; 1584	3392; 1510
2010	5891; 7545	9188; 2733	2583; 1397	2090; 932	6471; 1395	3252; 1565
2011	6243; 7956	8682; 2761	2537; 1384	1719; 935	6517; 1661	3041; 1533
2012	6582; 8330	9477; 3154	2622; 1412	1878; 1019	6504; 1785	3202; 1619
2013	5247; 6015	7662; 3132	2415; 1351	1474; 964	4.741; 1.470	3333; 1686
2014	5843; 4972	8760; 3252	2353; 1428	1539; 962	4573; 1499	2902; 1594
2015	4974; 5091	11,335; 3534	2453; 1512	1692; 933	5483; 1382	2907; 1643
Mean	6930; 6849	10,411; 2634	2624; 1427	1811; 923	5790; 1565	3249; 1586

TKA and THA, respectively; and Rio Grande do Sul was ranked fourth for TKA and second for THA (Table 1).

Hospitalization for TKA and THA in Brazil and regions

The hospitalization duration for TKA showed regional disparities, since the North, Northeast, and Midwest regions presented a hospitalization time of approximately one day greater than the Southeast and South regions.

The length of hospital stay for THA also presented heterogeneous results in Brazil. Contrary to the tendency in the studied period, the North and Northeast regions presented an increase in the hospitalization time – five and three days more than the South region for THA. The Southeast region presented a discrete oscillation of this index, ranging from 6.9 to 7.5 days. In the Midwest region, the mean hospitalization time increased by 2.2 days between 2008 and 2012, followed by a mean decrease of 2.7 days between 2012 and 2015. The South was the only region that showed a progressive decrease in the length of hospital stay for THA (Table 8).

The comparison of the length of stay rates between the TKA and THA procedures indicated that hospitalization was 51.0% longer in the former when compared with the latter. The same regional analysis indicated a higher mean length of stay when compared with TKA in 91.3% of the cases in the North region, 66.6% in the Northeast, 52.1% in the Southeast, 33.3% in the South, and 27.2% in the Midwest (Table 8).

Regarding the states, Distrito Federal and Amazonas presented higher length of stay: 8.4 and 7.5 days for TKA and 13.5 and 12.5 days for THA, respectively. Rondônia presented the discrepant result of 27.4 days of hospitalization in THA.

The positive highlights for length of stay in TKA were Espírito Santo, with 3.3 days, and Bahia and Minas Gerais with 3.7 days. For THA, Sergipe presented 4.4 days and Espírito Santo, 5.1 days (Table 1).

Mortality rate in TKA and THA in Brazil and regions

The mortality rate for arthroplasties in Brazil indicates that the risk of death in THA is nine times higher than in TKA. In the Southeast, hip surgeries presented a 13-fold higher rate of mortality than knee surgeries. The region that presented the smallest difference between the mortality rates for the two procedures was the North, where the mortality rate of THA was three times that of TKA (Table 9).

The state of Paraíba presented a worrisome 11.8% mortality rate for TKA. The highest mortality rates for TKA were observed in Tocantins (0.92%) and Mato Grosso (0.9%; Table 1).

Discussion

In Brazil, the data related to public assistance for procedures of primary THA and TKA showed worrisome results, which highlights the immediate and future need for planning and management for surgical treatment for gonarthrosis and coxarthrosis.

Worldwide, TKA and THA are in rapid expansion, particularly the former, which present a more marked increase in the number of procedures than the latter.¹² This trend stems from the aging of the global population, as well as from an increase in the sequelae from trauma and obesity.¹⁷ Sports injuries also contribute to the need for these surgeries, which are responsible for the growth in arthroplasties in ever younger patients.¹⁸

Socioeconomic studies on arthroplasties are increasingly frequent. In 2005, in the United States, approximately 500,000 knee replacements accounted for \$11 billion in expenses¹⁹; while in Australia, one billion Australian dollars were spent on the same procedure in 2015.²⁰ According to the data available in DATASUS, 189,457 hip and knee surgeries of partial arthroplasties, primary total arthroplasties, revisions, unconventional implants, and post-arthroplastic hip dislocation surgeries were performed in Brazil between 2008 and 2015, generating a cost of R\$ 705,793,263.15.¹⁵

In the studied period, Brazil presented annual vegetative growth of 1.24%,¹⁶ and the number of TKA and THA procedures increased by 7.7% and 2.3%, respectively, close to the average of the countries studied (Table 5). Inversion of growth was observed in the biennia of 2011/2012 (–1.8% TKA and –1.4% THA) and 2014/2015 (–2.3% TKA). In these periods, the gross domestic product (GDP) decreased by –2% and –4.2%, respectively, in relation to the previous year.^{21,22} This same economic trend was observed in the 2010/2011 and 2013/2014 biennia, with GDP reductions of –3.8% and –3.3%, respectively; nonetheless, in those years the number of TKA procedures grew by 10.2% and 3.9%, and of THA, by 2.0% and 1.0%.^{15,21,22}

The SUS coverage rate for TKA and THA per 100,000 inhabitants was alarming when compared with those of European countries, the United States, and Australia. SUS performed 36 times less TKA and 24 times less THA than the mean of the developed countries. The countries used in the comparisons had a more aged population percentile, especially

Table 8 – Mean length of hospital stay for knee (TKA) and hip (THA) arthroplasties in Brazil and regions.¹⁵

RegionYear	North TKA; THA	Northeast TKA; THA	Southeast TKA; THA	South TKA; ATQ	Midwest TKA; THA	Brazil TKA; THA
2008	6.3; 8.0	6.7; 8.7	5.1; 6.9	5.3; 6.7	8.5; 7.7	5.4; 7.2
2009	6.8; 8.7	6.2; 8.5	4.7; 7.5	4.9; 6.3	6.4; 8.5	5.0; 7.3
2010	5.4; 8.8	6.1; 8.9	4.5; 6.9	4.7; 6.1	7.2; 8.6	4.8; 7.1
2011	5.9; 11.5	5.0; 8.9	4.5; 7.2	4.4; 6.0	7.4; 9.5	4.6; 7.3
2012	5.9; 11.6	5.2; 9.1	4.7; 7.2	4.6; 5.9	7.7; 9.9	4.8; 7.3
2013	5.2; 12.3	4.7; 9.5	4.7; 7.0	4.3; 5.9	5.8; 8.7	4.6; 7.2
2014	5.4; 15.4	4.7; 9.2	4.3; 6.9	4.3; 5.8	5.4; 7.6	4.4; 7.1
2015	5.6; 13.2	4.6; 9.7	4.6; 6.9	4.1; 5.5	5.0; 7.2	4.5; 7.0
Mean	5.8; 11.1	5.4; 9.0	4.6; 7.0	4.5; 6.0	6.6; 8.4	4.7; 7.1

Table 9 – Mortality rate in total knee (TKA) and hip (THA) arthroplasties in Brazil and regions.¹⁵

RegionYear	North TKA; THA	Northeast TKA; THA	Southeast TKA; THA	South TKA; ATQ	Midwest TKA; THA	Brazil TKA; THA
2008	2.0; 0.0	0.3; 1.6	0.2; 2.6	0.1; 1.2	0.0; 2.6	0.5; 2.0
2009	0.0; 1.0	0.3; 2.8	0.3; 2.2	0.1; 1.5	0.5; 2.2	0.3; 2.1
2010	0.7; 0.0	0.2; 1.6	0.1; 2.2	0.1; 1.3	0.6; 2.9	0.1; 1.9
2011	0.0; 1.7	0.2; 2.3	0.1; 2.6	0.1; 1.3	0.6; 2.4	0.1; 2.2
2012	0.0; 0.9	0.0; 2.8	0.1; 2.5	0.3; 1.2	1.1; 1.4	0.2; 2.1
2013	0.0; 1.8	0.0; 2.9	0.1; 2.0	0.1; 1.4	0.4; 1.0	0.1; 1.8
2014	0.0; 2.9	0.5; 1.6	0.3; 1.8	0.2; 1.4	0.0; 2.5	0.3; 1.7
2015	0.4; 0.9	0.0; 2.1	0.1; 1.6	0.1; 1.0	0.0; 1.9	0.1; 1.5
Mean	0.38; 1.15	0.18; 2.21	0.16; 2.18	0.13; 1.28	0.4; 2.11	0.21; 1.91

Germany and Italy, in which this index was 11% higher.²³ Nonetheless, Australia and Luxembourg presented only 4% more elderly individuals than Brazil and performed 45 times more TKA and 29 times more THA procedures. These results indicate a relevant care deficit, which leads to a repressed demand of patients awaiting treatment and an overburden to the National Social Security System.

Data obtained through the Access to Information Law indicated that, in the study period, 56,111 individuals received Social Security benefits due to coxarthrosis and gonarthrosis. The cost of these benefits provided by the INSS in May 2016 was R\$46,695,407.44.²⁴

Nunley et al.²⁵ and Lombardi et al.²⁶ have indicated that the surgical treatment of gonarthrosis and coxarthrosis with arthroplasties substantially decreases the disability indexes, and allows 90% and 98% of patients that undergo TKA and THA to return to their work activities. In 2009, it was estimated that the United States obtained direct and indirect financial benefits of \$12 billion from TKA surgery, as these surgeries allowed savings of \$19,000 per citizen operated throughout their life, due to a 15% reduction of economic inactivity and an increase of productivity in 85% of patients.²⁷

In 2010, the mean age of the Brazilian population was 29 years; the projections for 2050 indicate that this mean age will be 44 years, 30% of whom will be elderly.²⁸ This estimate reinforces the need for a national management plan for the treatment of joint degenerative diseases due to the high growth prospects of these morbidities.

Regarding length of stay in TKA and THA, the mean results observed in Brazil were comparable to those of European countries,^{29,30} but higher than those in the United States.³¹ This data presented discrepancies per regions of Brazil, since the North and Northeast presented, on average, one more day of hospitalization for TKA and three more days for THA than the South region. A national plan with management and

conduct protocols for patients undergoing this surgery is essential for the improvement of care and reduction of costs.

The mortality rate for TKA in Brazil was similar to that described in the world literature³¹; however, for THA it was twice that of the United States.³¹ It is noteworthy that the Brazilian results expressed only public hospitals, places that usually have intern physicians, a fact that contributes to higher complication rates.³² The improvement of preoperative risk stratification, as well as protocols for thromboprophylaxis and antibiotic therapy, may contribute to the reduction of these indices.

In Brazil, the number of THA procedures was almost twice that of TKA. One possible explanation is that THA is performed in cases of fracture and joint degeneration, while TKA is almost entirely determined by gonarthrosis, which facilitates the onset of a repressed demand. This gives THA a spontaneous random demand, since deviated fractures require almost compulsory hospitalization for the surgical treatment, something that is not observed in TKA.

A great disparity in care was observed among the five national demographic regions. The South Region, with 16.5% of the elderly population and third in GDP per capita,³³ accounted for 29.1% and 28% of the TKAs and THAs in Brazil, presenting the best arthroplasties per elderly ratio in the country. The Southeast, with 47.2% of the elderly population and the highest GDP per capita,³³ accounted for 57% and 51.6% of TKAs and THAs, respectively, having the second best arthroplasty per elderly ratio. The Midwest region, with 6.1% of the elderly population and the second best GDP per capita,³³ accounted for 3.3% of the TKAs and 6.1% of the THAs. It was observed that the South region, despite having only the third best GDP per capita, provided the best coverage for arthroplasties.

The negative highlights were the Northeast and North regions. The Northeast, which has the lowest GDP per capita³³

and approximately one-quarter of the country's total elderly population, performed only 7.8% and 12.9% of the TKAs and THAs, respectively, showing the worst TKA/elderly ratio and the second worst THA/elderly ratio. In turn, the North, with 5% of the elderly and the fourth GDP per capita,³³ performed 2.6% and 1.2% of the TKAs and THAs, respectively, showing the worst THA/elderly ratio and the second worst TKA/elderly ratio.

It is necessary to create national policies for the professional development and to elaborate protocols for conducting conservative and surgical treatment of coxarthrosis and gonarthrosis in Brazil, as well as to improve data capture for arthroplasties, so that financial resources can be better distributed to improve the healthcare services provided to the Brazilian population.

Study limitations

The information for this study was collected from data available on the websites of public bodies, such as IBGE, ANS, WHO, and the Brazilian Ministry of Health, which were largely based on estimates and may interfere with the accuracy of the results.

Conclusion

The assistance provided by SUS to the Brazilian population for TKA and THA showed unsatisfactory results when compared with the same international indicators, with greater disparity in the North, Northeast, and Midwest regions.

Conflicts of interest

The authors declare no conflicts of interest.

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