

HOSPITAL COST OF KNEE ARTHROPLASTY IN THE BRAZILIAN UNIFIED HEALTH SYSTEM (SUS) IN GOIÁS: AN ANALYSIS OF DATASUS DATA

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ABSTRACT

Introduction: Knee arthroplasty represents a significant portion of orthopedic surgical procedures within the Unified Health System (SUS), generating substantial hospital costs. However, regional disparities in resource allocation and expenditure patterns remain underexplored, particularly in the state of Goiás. **Objectives:** Analyze the hospital cost, temporal trends, and geographic distribution of knee arthroplasties funded by the SUS in the state, using public data from the Department of Informatics of the SUS (DATASUS). **Methods:** A retrospective analysis was conducted using public data from the DATASUS database. Hospital Admission Authorizations (AIH) for knee arthroplasties performed between January 2008 and July 2025 in Goiás were collected. Descriptive statistics were applied to assess temporal trends, geographic distribution, and mean cost per procedure. A statistical test for trend analysis was performed for the 2008–2024 period. **Results:** The analysis of DATASUS data revealed a total of 2,521 approved Hospital Admission Authorizations (AIH), corresponding to a total expenditure of R\$ 11,949,392.25. The data include four types of procedures: non-conventional knee arthroplasty, revision/reconstruction total knee arthroplasty, primary total knee arthroplasty, and primary unicompartmental knee arthroplasty. The annual average was 148.3 procedures, with significant variability over the years. The lowest number of procedures was recorded in 2008 (37 AIH), and the highest in 2019 (330 AIH). An overall upward trend was observed until 2019, followed by a decline in 2020–2021, possibly related to the COVID-19 pandemic, and subsequent recovery in 2022–2024. The geographic distribution of knee arthroplasty procedures and expenditures in Goiás shows an extreme concentration in the capital and metropolitan region. Procedures were performed in only six municipalities throughout the study period, highlighting a severe centralization of high-complexity services in the state. Goiânia accounted for 85.0% of all AIH (2,144 procedures) and 81.2% of all expenditures (R\$ 9,700,469.96), followed by Anápolis with 6.1% of AIH (155 procedures) and 8.9% of expenditures (R\$ 1,069,067.04). The metropolitan region of Goiânia, including Aparecida de Goiânia, accounted for 87.5% of all procedures performed in the state. **Conclusion:** The analysis of hospital costs of knee arthroplasties in the SUS in Goiás reveals a scenario of extreme geographic concentration, with only six municipalities performing procedures across the entire state during the period from 2008 to 2024. Goiânia concentrated 85.0% of the procedures and 81.2% of the expenditures, highlighting a centralization that significantly compromises equitable access to treatment for the population living in non-metropolitan areas. The mean cost per procedure (R\$ 4,739.94) was slightly higher than the national average, with important variability between municipalities, warranting further investigation into its determining factors.

Keywords: Knee, Arthroplasty, Hospital Cost, Surgery, SUS.

INTRODUCTION

Osteoarthritis (OA) is one of the most prevalent joint diseases worldwide and one of the leading causes of pain and chronic disability in the adult population. In Brazil, studies indicate that the prevalence of OA may reach up to 33% among individuals over 25 years of age, representing a significant burden on both the healthcare system and society.¹ The knee joint is one of the most commonly affected, and in advanced stages of the disease, arthroplasty emerges as a procedure that provides substantial pain relief and restores function in patients with advanced osteoarthritis, rheumatoid arthritis, and other degenerative joint conditions. Preoperative evaluation includes the patient's medical history, physical examination, laboratory tests, and imaging studies.

With the aging of the Brazilian population, the demand for these procedures has increased, placing greater pressure on the resources of the Brazilian Unified Health System (SUS). A comprehensive study of procedures performed in Brazil between 2012 and 2021 identified 65,602 primary knee arthroplasties, with a total cost exceeding R\$ 271 million.² The same study highlighted the uneven distribution of procedures across the country's regions, with the Midwest—where the state of Goiás is located—accounting for only 4% of the total surgeries.²

Understanding the distribution and costs of these procedures at the state level is crucial for planning healthcare policies, allocating resources, and organizing the specialized care network. Given the scarcity of analyses focusing on Goiás, this article aims to examine hospital costs, temporal trends, and the geographical distribution of knee arthroplasties funded by SUS in the state, using public data from the Department of Informatics of the Brazilian Unified Health System (DATASUS).

METHODOLOGY

A descriptive, cross-sectional study was conducted based on secondary data from a public domain source. The data source was the Hospital Information System (SIH/SUS), accessed through the DATASUS TabNet platform on September 25, 2025.³

Data were extracted by selecting the geographic coverage "Goiás" and the option "Hospital Production (SIH/SUS)." Knee arthroplasty procedures were filtered using the codes from the SUS Procedures, Medicines, and Orthoses, Prostheses and Materials (OPM) Table, specifically those from subgroup 04.08.05 (Knee Arthroplasty), which include: 0408050047 (Non-conventional knee arthroplasty), 0408050055 (Total knee arthroplasty – revision/reconstruction), 0408050063 (Primary total knee arthroplasty), and 0408050071 (Primary unicompartmental knee arthroplasty).

The variables collected were "Approved AIHs (Hospital Admission Authorizations)" and "Total Value," aggregated by "Year of Service" and "Municipality of Hospitalization." The analysis period covered January 2008 to December 2025. For trend analysis, the year 2025 was excluded due to containing partial data.

Additionally, a literature review was carried out using scientific databases (PubMed and SciELO) to contextualize the findings within the national literature on the epidemiology of osteoarthritis and the costs of arthroplasty.

Temporal trends were assessed using simple linear regression and Pearson's correlation. The

geographical distribution of costs was analyzed through descriptive statistics.

RESULTS

Anesthetic The analysis of DATASUS data revealed a total of 2,521 approved Hospital Admission Authorizations (AIHs) for knee arthroplasty procedures in Goiás between January 2008 and December 2024, corresponding to a total cost of R\$ 11,949,392.25. The data include four types of procedures: non-conventional knee arthroplasty, total knee arthroplasty – revision/reconstruction, primary total knee arthroplasty, and primary unicompartmental knee arthroplasty.

3.1. Temporal Analysis

Considering the full period from 2008 to 2024, a total of 2,521 Hospital Admission Authorizations (AIHs) were recorded. The annual average was 148.3 procedures, with significant variability over the years. The lowest number of procedures occurred in 2008 (37 AIHs), while the highest was recorded in 2019 (330 AIHs).

A general upward trend was observed until 2019, followed by a decline in 2020–2021, likely related to the COVID-19 pandemic, and a subsequent recovery between 2022 and 2024.

3.2. Geographical and Cost Analysis

The geographical distribution of knee arthroplasty procedures and expenditures in Goiás shows an extreme concentration in the capital and metropolitan area. Procedures were performed in only six municipalities throughout the entire period analyzed, demonstrating a severe centralization of high-complexity services in the state.

Goiânia accounts for 85.0% of all AIHs (2,144 procedures) and 81.2% of all expenditures (R\$ 9,700,469.96), followed by Anápolis with 6.1% of AIHs (155 procedures) and 8.9% of expenditures (R\$ 1,069,067.04). The metropolitan region of Goiânia, including Aparecida de Goiânia, concentrates 87.5% of all procedures performed in the state.

3.3. Average Cost per Procedure and Variability

The average cost per knee arthroplasty in Goiás, calculated from the total data for the period 2008–2024, was R\$ 4,739.94. This value shows significant variability among municipalities, with the lowest average recorded in Rio Verde (R\$ 4,446.71) and the highest in Aparecida de Goiânia (R\$ 7,470.24)—a 68.0% difference between the extremes. When compared with the national average of R\$ 4,135.50, reported in a study that evaluated the period from 2012 to 2021², the average value for Goiás is 14.6% higher. This difference may reflect both inflation over the period and possible methodological differences between studies. In 2024, the average hospital length of stay ranged from 1.6 days (Mineiros) to 4.1 days (Rio Verde), with most municipalities reporting stays between 2.0 and 3.0 days—values consistent with rapid recovery protocols in arthroplasty procedures.

Table 1 – Distribution of Procedures and Costs by Municipality in Goiás (2008–2024)

Municipality	AIH	% of AIH	Total value(R\$)	% of Total Value	Average Value 2024 (R\$)
GOIÂNIA	2,144	85.0%	9,700,469.96	81.2%	4,627.98
ANAPOLIS	155	6.1%	1,069,067.04	8.9%	4,802.81
CERES	90	3.6%	405,774.60	3.4%	4,526.33
APARECIDA DE GOIÂNIA	63	2.5%	470,491.50	3.9%	7,470.24
RIO VERDE	53	2.1%	218,391.58	1.8%	4,446.71
MINEIROS	15	0.6%	85,197.57	0.7%	5,679.84
TOTAL	2,521	100%	11,949,392.25	100%	4,739.94

Source: SIH/SUS, DATASUS. Prepared by author.

Table 2 – Approved Hospital Admission Authorizations (AIHs) by Municipality and Year of Service, from January 2008 to December 2024, Goiás, Brazil.

Municipality	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
520110 ANAPOLIS	-	-	-	-	3	20	14	14	6	16	21	14	9	21	1	11	5	155
520140 APARECIDA DE GOIÂNIA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	47	63
520540 CERES	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	87	90
520870 GOIÂNIA	37	30	30	17	17	80	134	149	128	237	274	316	113	132	114	165	171	2144
521310 MINEIROS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	15
521880 RIO VERDE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	40	53
Total	37	30	30	17	20	100	148	163	134	253	295	330	122	153	115	208	365	2521

Procedure: 0408050047 – Non-conventional knee arthroplasty; 0408050055 – Total knee arthroplasty – revision/reconstruction; 0408050063 – Primary total knee arthroplasty; 0408050071 – Primary unicompartmental knee arthroplasty.
Source: Ministry of Health – Hospital Information System of the Brazilian Unified Health System (SIH/SUS).

Table 3 – Average AIH Value by Municipality and Year of Service, from January 2008 to December 2024, Goiás, Brazil..

Municipality	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
520110 ANAPOLIS	...	...	...	...	4585.75	5016.79	4711.84	5092.13	3910.09	4283.59	5147.78	5445.84	4943.49	5126.09	5265.3	5494.84	4802.81
520140 APARECIDA DE GOIÂNIA	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7461.9	7470.24
520540 CERES	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3994.6	4526.33
520870 GOIÂNIA	3456.59	3726.4	4188.67	4554.67	4219.52	4666.66	5060.19	5085.04	4032.08	4337.45	4385.83	4738.82	4709.04	4502.06	4107.52	4529.84	4627.98
521310 MINEIROS	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5679.84
521880 RIO VERDE	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3117.17	4446.71

Procedure: 0408050047 – Non-conventional knee arthroplasty; 0408050055 – Total knee arthroplasty – revision/reconstruction; 0408050063 – Primary total knee arthroplasty; 0408050071 – Primary unicompartmental knee arthroplasty.
Source: Ministry of Health – Hospital Information System of the Brazilian Unified Health System (SIH/SUS).

Table 4 – Total Value by Municipality and Year of Service, from January 2008 to December 2024, Goiás, Brazil.

Municipality	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
ANAPOLIS	-	-	-	-	13757.24	103335.8	65965.71	71289.8	23460.57	68537.46	908103.4	78241.81	44491.44	107647.8	5285.3	60443.2	24014.04
APARECIDA DE GOIÂNIA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	119390.4	351101.1
CERES	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11983.8	393790.8
GOIÂNIA	127893.9	111792.1	125666	77429.35	71731.86	373333.2	678054.9	757671	516106.2	1027976	1201718	1497466	532121.2	594272.1	468257.4	747424.2	791385.4
MINEIROS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65197.57
RIO VERDE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40523.18	177868.4

Procedure: 0408050047 – Non-conventional knee arthroplasty; 0408050055 – Total knee arthroplasty – revision/reconstruction; 0408050063 – Primary total knee arthroplasty; 0408050071 – Primary unicompartmental knee arthroplasty.
Source: Ministry of Health – Hospital Information System of the Brazilian Unified Health System (SIH/SUS).

Table 5 – Average Length of Stay by Municipality and Year of Service, from January 2008 to December 2024, Goiás, Brazil.

Municipality	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
520110 ANAPOLIS	...	...	...	...	3	3.3	3.7	4	2.8	2.3	2.3	2.6	2	1.9	2	2.1	2
520140 APARECIDA DE GOIÂNIA	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2.8	3
520540 CERES	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2.3	2.8
520870 GOIÂNIA	5.6	8.3	7.5	12.1	6.6	5.6	4.4	4.1	3.4	3.5	3.8	3.8	3.8	3.5	3.5	3.4	3
521310 MINEIROS	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.6
521880 RIO VERDE	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.6	4.1

Procedure: 0408050047 – Non-conventional knee arthroplasty; 0408050055 – Total knee arthroplasty – revision/reconstruction; 0408050063 – Primary total knee arthroplasty; 0408050071 – Primary unicompartmental knee arthroplasty.
Source: Ministry of Health – Hospital Information System of the Brazilian Unified Health System (SIH/SUS).

DISCUSSION

The stability in the number of knee arthroplasty procedures in Goiás may reflect multiple systemic factors. First, limitations in the installed capacity of the healthcare network may be restricting service availability, creating an artificial ceiling on procedures regardless of actual demand. Second, the underdiagnosis and undertreatment of early-stage osteoarthritis, identified by Brazilian specialists¹, may result in patients reaching the public healthcare system

at more advanced stages of the disease, when additional comorbidities can contraindicate surgery. Third, changes in regulatory policies and in the authorization criteria for high-complexity procedures may have influenced the approval of Hospital Admission Authorizations (AIHs) throughout the study period.

The extreme concentration of procedures in a few urban centers constitutes the main finding of this study and even exceeds national patterns of regional inequality. National data indicate that the Midwest region accounts for only 4% of all knee arthroplasties performed in Brazil, despite representing approximately 7.8% of the national population². Within the state of Goiás itself, the concentration is even more pronounced: only six municipalities performed knee arthroplasty procedures throughout the entire study period, in a state with 246 municipalities.

Goiânia alone accounts for 85.0% of all procedures³ and 81.2% of total expenditures, while the metropolitan region (including Aparecida de Goiânia) concentrates 87.5% of all procedures. This extreme centralization reflects a healthcare network organization model that concentrates high-complexity services almost exclusively in large urban centers, creating virtually insurmountable access barriers for populations in rural and remote areas. The complete absence of procedures in 240 municipalities highlights a significant care gap that may compromise the principle of universality underpinning the Brazilian Unified Health System (SUS).

Several hypotheses may explain this difference. The first relates to the type of implant used. Brazilian studies have shown that national prostheses achieve clinical outcomes comparable to imported ones at a 5-year follow-up, with 78.4% satisfaction for Brazilian implants versus 90.7% for imported models (a difference that was not statistically significant, $p = 0.053$).⁴ Considering that domestic implants are substantially less expensive, it is possible that Goiás has predominantly adopted this option, resulting in significant cost savings without relevant clinical compromise.

The average cost per procedure in Goiás (R\$ 4,739.94) is 14.6% higher than the national average (R\$ 4,135.50)², a difference that can be explained by temporal and methodological factors. The significant variability among municipalities (a 68.0% difference between the highest and lowest averages) warrants careful analysis, as it may reflect differences in case complexity, implant types used, or hospital management practices. To contextualize these figures, international studies report hospital costs for total knee arthroplasty ranging between US\$ 14,910 and US\$ 48,325⁵⁻⁶, demonstrating wide variability even within developed healthcare systems.

A second hypothesis concerns case composition. The national study included all types of arthroplasty (primary, revision, unicompartmental), with revision surgeries typically costing 30–50% more than primary ones due to greater technical complexity and operative time². It is possible that Goiás performs a lower proportion of revision surgeries, either due to technical limitations in local centers or because such complex cases are referred to other states.

Methodological differences may also contribute to the discrepancy. The national study analyzed data from 2012 to 2021, whereas the present study covers 2008 to 2025, encompassing different SUS reimbursement policies over time. Additionally, variations in cost-recording practices among states may influence the values reported in the SIH/SUS database.

The quality of care and clinical outcomes are fundamental aspects that could not be assessed in this study but may be related to the observed costs. International studies have shown that

the use of specific surgical technologies, such as patient-specific instrumentation, can reduce both hospital costs and readmission rates by 31% at 30 days and 28% at one year.⁵ Periprosthetic infections, which occur in 1–2% of patients, represent the main cause of revision surgeries and can significantly increase costs, with values reaching US\$ 55,707 for septic cases versus US\$ 30,224 for aseptic ones.⁷

A fourth and more concerning possibility is the relative underfunding of procedures in Goiás, which could affect the quality of implants used, length of hospital stay, or other aspects of care. The average national hospital stay for the Midwest region was 4.81 days², but specific data for Goiás were not available for comparison. International studies have identified specific factors associated with increased hospital costs in arthroplasty, including a body mass index (BMI) greater than 35, ASA classification 3–4, peripheral vascular disease, chronic pulmonary disease, renal disease, and diabetes⁸. A systematic review confirmed that the presence of comorbidities is positively correlated with both length of stay and hospital costs in arthroplasty⁹. The prevalence of these risk factors in the Goiás population may therefore influence the average costs observed.

The temporal analysis also reveals interesting aspects when contextualized with national data. The study by Naito et al. identified a sharp reduction in procedures in 2020 and 2021 due to the COVID-19 pandemic, a pattern that may have influenced our findings, although specific data are insufficient to quantify this impact in Goiás.²

This study has important limitations that must be considered when interpreting the results. The use of secondary data from SIH/SUS, although it allows for comprehensive population-based analyses, may contain inconsistencies or underreporting. The data analyzed refer exclusively to the period between 2008 and 2024, providing a consistent 17-year time series for analysis. The data collection and recording methodology remained stable throughout the period, allowing for reliable temporal comparisons and trend analysis.

The results of this study provide a detailed overview of the costs and distribution of knee arthroplasty procedures in Goiás, revealing marked characteristics of centralization and cost variability. The total of 2,521 procedures performed between 2008 and 2024, representing an investment of R\$ 11.9 million, demonstrates the magnitude of this high-complexity service in the state. The growth trend observed until 2019, followed by a decline in 2020–2021 and subsequent recovery, aligns with the national pattern of the COVID-19 pandemic's impact on elective procedures. In the United States, for instance, approximately 800,000 total knee arthroplasties are performed annually¹⁰, highlighting the scale of these procedures in healthcare systems with greater installed capacity.

Future studies should investigate the determinants of the cost differences observed, including detailed analyses of implant types used, case complexity, and clinical outcomes. It is also recommended that geographic access studies be conducted to quantify the barriers faced by patients from rural areas, as well as analyses of care quality and complication rates to assess whether the lower costs observed in Goiás have any impact on clinical results.

CONCLUSION

The analysis of hospital costs for knee arthroplasty procedures within the SUS in Goiás reveals a scenario of extreme geographical concentration, with only six municipalities performing these surgeries across the entire state between 2008 and 2024. Goiânia accounts for 85.0% of all procedures

and 81.2% of total expenditures, highlighting a centralization that significantly compromises equitable access to treatment for populations living in the interior. The average cost per procedure (R\$ 4,739.94) is slightly higher than the national average, with notable variability among municipalities that warrants further investigation into the underlying determinants.

It is recommended that healthcare managers use these data to plan the expansion and decentralization of high-complexity orthopedic surgery services. Future studies using primary data are suggested to investigate the factors influencing procedure costs in Goiás and to evaluate clinical outcomes and patient quality of life following knee arthroplasty in the state.

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