




# IMPACT OF MEASURES TO FIGHT THE PANDEMIC COVID-19 ON KNEE ARTHROPLASTIES IN BRAZIL

## IMPACTO DAS MEDIDAS DE ENFRENTAMENTO À PANDEMIA COVID-19 NAS ARTROPLASTIAS DE JOELHO NO BRASIL

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### ABSTRACT

**Objective:** To assess the impacts of measures to face COVID-19 on total knee arthroplasty procedures in the country, based on data provided by the SUS Information and Informatics Department (DATASUS). **Methods:** Cross-sectional study of secondary data in the public domain, available on the website of the Department of Information and Informatics of SUS (DATASUS), containing information about hospital admissions in the SUS. **Results:** Brazil suffered a 51.82% decrease, on average, in the performance of total knee arthroplasty by the Unified Health System (SUS) in 2020, due to measures to face COVID-19. The analysis by region offers more details on this reduction in the number of procedures. In the Northeast, the decrease was on average 48.02%, whereas in the Center-West it was 65.61%. Southeast, North, and South registered an average decrease of 49.38%, 51.81%, and 55.06%, respectively. **Conclusion:** COVID-19 impacted the realization of TKA in Brazil, with greater and lesser levels of decline observed in different Brazilian regions. In the Southeast region, for example, the states of São Paulo and Minas Gerais were the most affected, mainly due to the large population concentration, as well as Paraná, which has high numbers of procedures and a sharp decrease in 2020. **Level of Evidence III, Retrospective Comparative Study.**

**Keywords:** COVID-19. SARS-CoV-2. Pandemics. Arthroplasty, Replacement, Knee. Orthopedic Procedures.

### RESUMO

**Objetivo:** Avaliar os impactos das medidas de combate à COVID-19 nos procedimentos de artroplastia total do joelho (ATJ) no país, com base nos dados fornecidos pelo Departamento de Informações e Informática do Sistema Único de Saúde (SUS). **Métodos:** Estudo transversal realizado com dados secundários de domínio público, disponíveis no site do Departamento de Informações e Informática do SUS (DATASUS), contendo informações sobre as internações hospitalares realizadas no SUS. **Resultados:** O Brasil sofreu uma queda de 51,82%, em média, na realização da artroplastia total do joelho pelo SUS em 2020, decorrente das medidas de combate à COVID-19. A análise por região oferece mais detalhes dessa redução no número de procedimentos. Na região Nordeste, a queda foi, em média, de 48,02%, enquanto no Centro-Oeste foi de 65,61%. Sudeste, Norte e Sul registraram queda, em média, de 49,38%, 51,81% e 55,06%, respectivamente. **Conclusão:** A COVID-19 impactou a realização de ATJ no Brasil, com níveis de maior e menor declínio observados nas diferentes regiões brasileiras. Na região Sudeste, por exemplo, os estados de São Paulo e Minas Gerais foram os mais afetados, devido principalmente à grande concentração populacional, assim como o Paraná, que apresenta números altos de procedimentos realizados e forte queda em 2020. **Nível de Evidência III, Estudo Retrospectivo Comparativo.**

**Descritores:** COVID-19. SARS-CoV-2. Pandemias. Artroplastia do Joelho. Procedimentos Ortopédicos.

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### INTRODUCTION

In late 2019, a series of cases of pneumonia of unknown cause emerged in the city of Wuhan, China. The analysis of the sequencing of samples from the lower respiratory tract identified the existence of a new virus of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and the disease was named, in February 2020, of COVID-19 by the World Health Organization (WHO). A month after the

announcement, 114 countries were hit, recording more than 118,000 cases and 4,000 deaths resulting in a pandemic declaration.<sup>1,2</sup> COVID-19 is a disease caused by an RNA virus, with the typical appearance of a crown under an electron microscope due to the presence of spike glycoproteins in its envelope.<sup>3</sup> Of natural and zoonotic origin, SARS-CoV-2 presents various clinical characteristics and risk factors, causing its severity to vary from asymptomatic to

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fatal, with lethality rates of about 1.4%.<sup>4,5</sup> Added to these aspects, its ability to propagate rapidly and cause symptoms more severe than those of seasonal influenza resulted in hospital overload of patients in need of respiratory support, thereby causing catastrophic effects on the health system and, consequently, on the world economy.<sup>6,7</sup> On February 25, 2020, the first COVID-19 case was identified in Brazil, causing the spread of the disease throughout the country. Based on the WHO declaring a global pandemic, the government established control and prophylaxis measures supported by sanitary, epidemiological, and legal criteria. Among the measures adopted, postponing elective surgical procedures was recommended aiming to slow the spread of the virus, preserve patients and health professionals of asymptomatic or undiagnosed carriers, save personal protective equipment, ensuring hospital occupation for the most severe cases.<sup>6,7</sup> Among elective orthopedic surgeries, total knee arthroplasty (TKA), which has been established in recent decades as a very successful treatment for advanced knee osteoarthritis mainly for relieving pain and improving the function and quality of life of those affected, stands out.<sup>8,9</sup> Whether its origin is primary, posttraumatic, or secondary to avascular necrosis, osteochondritis or septic arthritis, osteoarthritis – the main cause of musculoskeletal disability in the world – is the most common indication for TKA.<sup>10</sup> In severe and advanced cases, restoring the functional gait capacity and reducing pain are provided by TKA, whose number of procedures has been interrupted or decreased not only in Brazil, but worldwide, mainly due to the protocols established for COVID-19.<sup>11</sup>

Although scarce, the Ministry of Health makes official data on the number of TKA performed by the Unified Health System (SUS) available.<sup>12</sup> Based on this, this article aims to know the number of TKA carried out in the country in recent years, compared with the period in which the measures against COVID-19 were applied.

## METHODS

Cross-sectional study of secondary data from the public domain, available on the website of the Department of Information and Informatics of the SUS (DATASUS), containing information on hospital admissions performed by SUS. Due to using collective data, without individual identification of patients in the databases, applying the informed consent form (TCLE) and submitting to the Human Subjects Research Ethics Committee was considered unnecessary.

The analyzed data were obtained from the DATASUS (<http://www2.datasus.gov.br/DATASUS/index.php>) platform, using the Hospital Admission Information System (SIHSUS). All Hospital Admission Authorizations (HAA) for procedures related to knee arthroplasty (codes: 0408050063 – primary total knee arthroplasty and 0408050055 – total knee arthroplasty – revision/reconstruction) from January 2010 to December 2020.<sup>12</sup>

Data from the Brazilian Institute of Geography and Statistics (IBGE) were also consulted to understand the relevance of this issue in relation to the population indices of the country.<sup>13</sup>

Descriptive statistics of the data are presented in absolute number, means, percentages, and in the form of graphs.

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## RESULTS

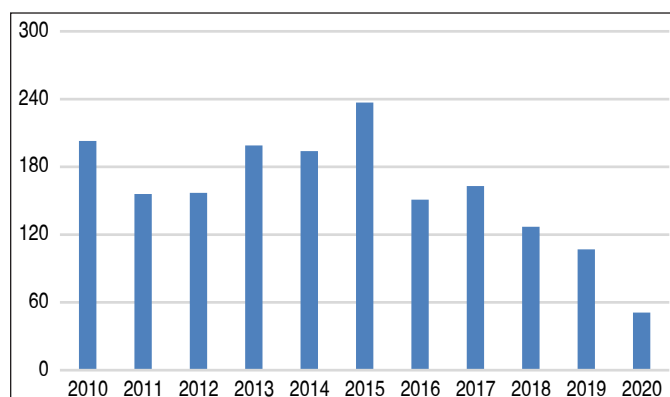
In the period between 2010 and 2020, 81,825 HAAs were issued for TKA in Brazil. Between 2010-2018, the number of TKA performed in the country fluctuated, increasing progressively, with a more evident increase in 2019 compared with previous years, followed by a sharp decrease in 2020. Comparatively, the reduction in procedures performed between 2019-2020 was, on average, 51.82% (Table 1).

**Table 1.** Total knee arthroplasties performed per year in Brazil by the Unified Health System.

Year	North	Northeast	Southeast	South	Center-West	Total
2010	203	529	3,718	1,605	171	6,226
2011	156	573	3,799	1,935	175	6,638
2012	157	546	3,827	1,878	186	6,594
2013	199	690	4,240	2,338	271	7,738
2014	194	629	4,592	2,421	240	8,076
2015	237	510	4,604	2,330	265	7,946
2016	151	459	4,798	2,209	266	7,883
2017	163	605	4,915	2,198	412	8,293
2018	127	820	4,341	2,668	430	8,386
2019	107	756	5,317	2,821	477	9,478
2020	51	393	2,691	1,268	164	4,567
Total	1,745	6,510	46,842	23,671	3,057	81,825

Source: DATASUS, 2021.

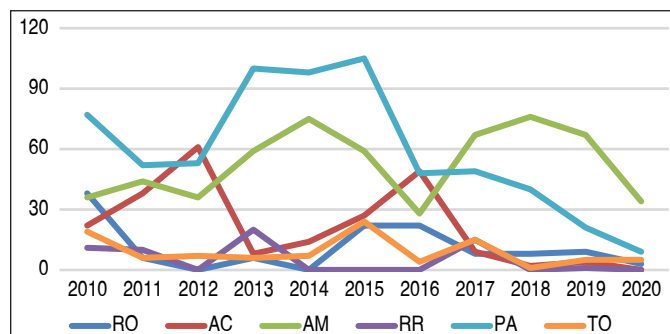
Regarding the performance in different Brazilian regions, the North region saw an increase in procedures between 2013-2015 (peaked in 2015), compared with 2010-2012. A reduction occurs in 2016 compared with 2015, with annual fluctuations until 2019, the year before the pandemic. The decrease between 2019 and 2020 contributed to the total TKA decrease in the region being, on average, 51.81% (Figure 1).



**Figure 1.** Total knee arthroplasties performed per year in the North region by the Unified Health System.

Source: DATASUS, 2021.

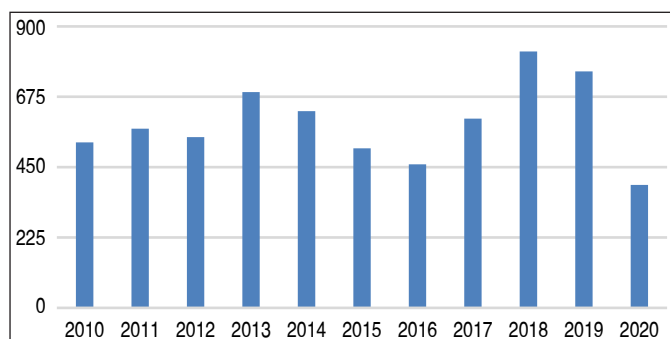
Between 2019-2020, the decrease was more pronounced in the Amazonas, which, from 2017, started showing a more expressive performance. The analysis of each state reveals fluctuation periods between 2010-2020, with increases and decreases in the number of TKA performed (Figure 2).



**Figure 2.** Total knee arthroplasties performed per year in the states of the North region by the Unified Health System.

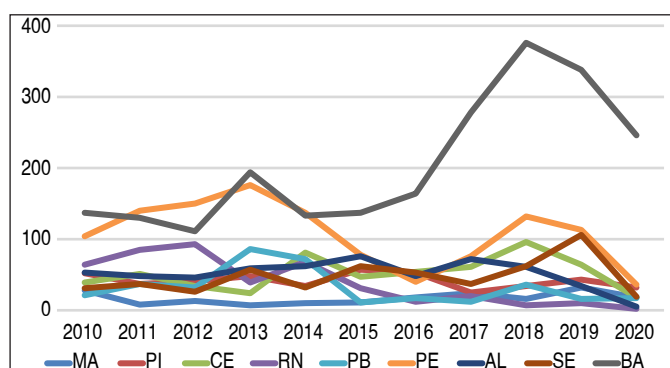
Source: DATASUS, 2021.

In the Northeast region, TKA numbers were accentuated between 2018-2019, declining in 2020. The regional performance between 2010-2020 faced fluctuations, but the drop between 2019-2020 was responsible for the decrease of, on average, 48.02% in the number of procedures (Figure 3). Comparing the states shows the impact suffered by Bahia, which, after an increase in 2018, faced a great reduction in 2020, as well as Sergipe and Pernambuco (Figure 4).



**Figure 3.** Total knee arthroplasties performed per year in the Northeast region by the Unified Health System.

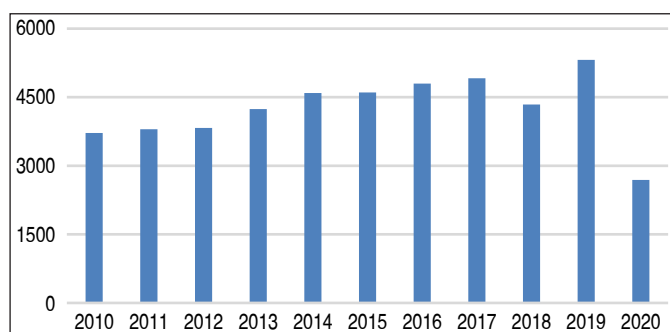
Source: DATASUS, 2021.



**Figure 4.** Total primary knee arthroplasties per year in the states of the Northeast region by the Unified Health System.

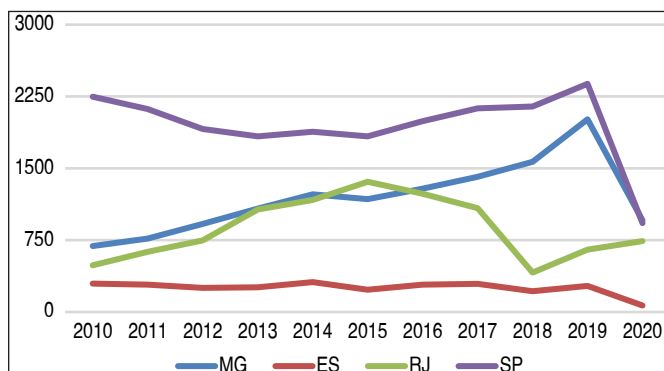
Source: DATASUS, 2021.

Recording the highest number of TKA in the country, the Southeast region had a progressive fluctuating performance between 2010-2019, before facing a mean decline of 49.38% in total procedures between 2019-2020 (Figure 5). São Paulo and Minas Gerais showed the steepest decreases in the period, unlike Rio de Janeiro, the only Brazilian state to slightly increase procedures during the pandemic (Figure 6).



**Figure 5.** Total primary knee arthroplasties per year in the Southeast region by the Unified Health System.

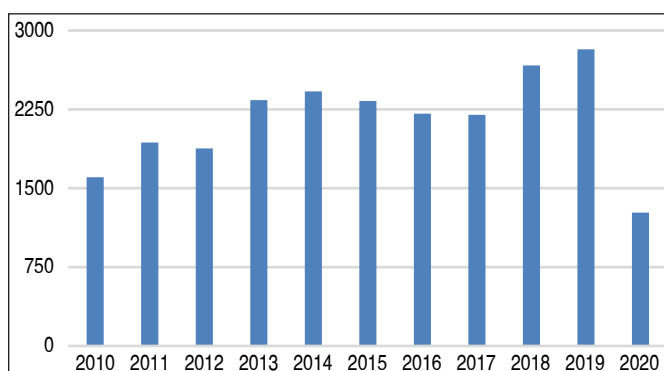
Source: DATASUS, 2021.



**Figure 6.** Total knee arthroplasties performed per year in the states of the Southeast region by the Unified Health System.

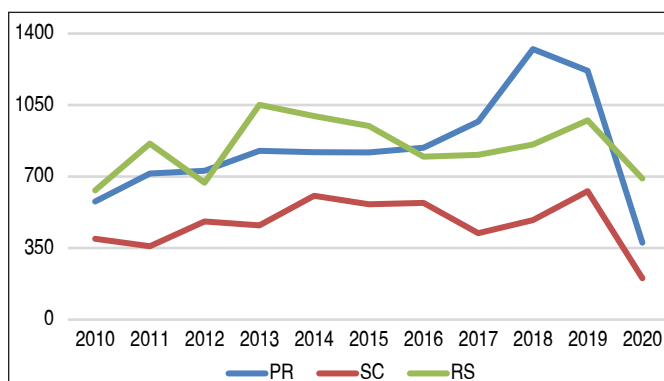
Source: DATASUS, 2021.

Like the Southeast, TKA performed in the South region decreased almost 50% in 2020 (Figure 7), mainly impacting the state of Paraná, compared with Santa Catarina and Rio Grande do Sul (Figure 8). The reduction between 2019-2020 across the Southern region corresponded, on average, to 55.06%.



**Figure 7.** Total knee arthroplasties performed per year in the South region by the Unified Health System.

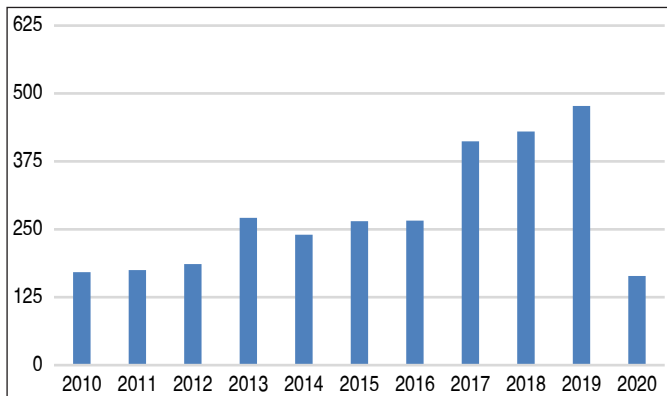
Source: DATASUS, 2021.



**Figure 8.** Total knee arthroplasties performed per year in the states of the South region by the Unified Health System.

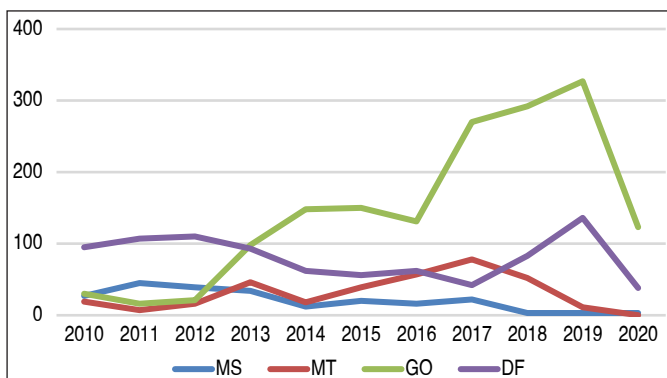
Source: DATASUS, 2021.

A TKA numbers considerably increase between 2017-2019 in the Center-west region, which, in 2020, faced a reduction of 65.61%, on average, in these procedures compared with the previous year (Figure 9). Goiás and the Federal District were the most affected states during the period (Figure 10).



**Figure 9.** Total knee arthroplasties performed per year in the Center-west region by the Unified Health System.

Source: DATASUS, 2021.



**Figure 10.** Total knee arthroplasties performed per year in the states of the Center-west region by the Unified Health System.

Source: DATASUS, 2021.

## DISCUSSION

Brazil, as a whole, suffered the impacts caused by COVID-19 and the measures to cope with the pandemic, particularly in the performance of TKA by the SUS, recording a steep decrease (51.82%, on average) in 2020. Since 2010, the number of TKA performed by SUS has increased, with a more significant peak in 2019, the year before the notification of the first COVID-19 case.

The results of the study by Ferreira et al.<sup>11</sup> offer an overview of the discrepancy that Brazil faces and will still face regarding the performance of TKA. Their results demonstrate the analysis of the number of admission authorizations for TKA surgeries between 2008 and 2015 showing that the South and Southeast regions presented the best care ratio with 8.07 and 6.07 TKA/100,000 inhabitants and one TKA for 1,811 and 2,624 older adults, respectively. The worst rates were recorded in the North and Northeast, with 0.88 and 0.98 TKA/100,000 inhabitants and one TKA for 6,930 and 10,411 older adults, respectively.

In the United States, as demonstrated in the retrospective analysis by Barnes et al.,<sup>14</sup> who sought to determine the impact of COVID-19 on the number of arthroplasties performed by the American Medicare system, its variables, and the resulting financial implications. They identified a sharp decrease (94%) in the performance of the procedure in mid-March 2020, with reductions of 87% in the total daily revenue of the system for arthroplasty and 85% of the revenue for the surgeon.

The study by Wilson et al.<sup>15</sup> sought to quantify the number of cases of total hip and knee arthroplasties (THA and TKA) delayed in the

United States, estimating the time needed to care for these patients after elective surgeries restart. Using population data, they projected a scenario with cases ranging from 77,646, at best, and 372,706, at worst of these delayed procedures, as well as a projected recovery time, on average, of 9 to 35 months.

A study developed by the Research Committee of the American Association of Hip and Knee Surgeons (AAHKS)<sup>7</sup> to assess the impacts on physical, mental, and economic health of patients with TKA and THA postponed due to the pandemic, with 360 patients with procedures canceled between March and July 2020, showed that the greatest concern of patients was related to uncertainty about when surgery would be rescheduled. Although 85% of the participants understood and agreed with the measures adopted to face the pandemic, approximately 90% intended to reschedule the procedure as soon as possible. Issues related to age and geographic region affected patients' anxiety levels, since younger people showed greater concern with financial aspects and safety at work.

In the study by Athey et al.,<sup>16</sup> 99 orthopedic surgeons affiliated with AAHKS answered a questionnaire to identify the global impact of COVID-19 on patient care. With the exception of Japan, in 31 of the 32 countries represented, the interviewees said that their practice was affected to some degree, with 70% needing to cancel elective procedures, more than a third needing to close their offices completely, and those who remained open were estimated to be sustainable, on average, for another seven weeks, causing, according to the authors, changes in most international arthroplasty practices. A retrospective study conducted in 2021 by Motta Filho et al.<sup>17</sup> found a 48.5% reduction in surgical productivity and 72.4% in outpatient care in 2020 compared with the same period in 2019, in a trauma unit of an institute specialized in high complexity elective orthopedic procedures.

In general, studies capable of directing professionals of the area and patients on the future of performing these procedures are lacking. Data on the impact on TKA in the supplementary and private health service, corresponding to a sizable portion of the procedures performed, is unknown.

The quantitative impact on TKA is important from the point of view of public health since the increase in life expectancy of the world population is directly related to a higher incidence of degenerative diseases. With this, the coming decades will evidently bring a significant growth in the number of procedures. In the United States alone, the projection indicates a 69% increase in the incidence of this surgery in 2050.<sup>18</sup> Understanding the phenomenon will help in planning strategies and managing services provided by the SUS, making it possible to dimension, from the comparison between regions, the demand of the coming months/years, and the generation of additional costs.

On the other hand, note that, regardless of the issues caused and the future challenges, postponing the procedures was relevant for reducing the risk of deaths from COVID-19. In a retrospective study, Holmes et al.<sup>19</sup> evaluated data from 320 individuals admitted to the orthopedics department of a UK hospital between March 23, 2020, and June 18, 2020. A total of 240 patients were SARS-CoV2 negative, 21 patients SARS-CoV2 positive, and 59 patients were not tested. During hospitalization, the in-hospital viral transmission rate was 12.5% of those initially tested on admission with negative results. During the evaluated period, 25 deaths were recorded, 56% occurred in positive SARS-CoV2 individuals, whereas 36% of deaths were SARS-CoV2 negative. Possibly, this relevant number of patients was infected by asymptomatic health professionals or hospitalized patients awaiting swab results.

## CONCLUSIONS

In 2020, COVID-19 strongly impacted the performance of TKA In Brazil, which, in general, recorded an average decrease of 51.82%. The irregular distribution of the population in the different Brazilian regions resulted in greater and lesser decline, with the states of São Paulo and Minas Gerais, for example, among the most affected sites, due to the large population concentration, including that of

older adults – commonly considered the largest risk group of cases of knee osteoarthritis – as well as Paraná, main representative of the Southern region, which has high numbers of procedures and a sharp decline in 2020. The data from this study may assist the competent authorities in identifying and correcting discrepancies in the service provided to SUS users in different Brazilian regions and states.

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**AUTHORS' CONTRIBUTIONS:** Each author contributed individually and significantly to the development of this article. AMP: data collection, literature review, statistical analysis, and writing of the article; FFS: data collection, literature review, and writing of the article; SGO: data collection, bibliographic review, and preparation of the final project; GDBA: critical review of the article and preparation of the final project; CPMJ: data analysis and the entire intellectual concept of the article.

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