



IMPACT OF THE COVID–19 PANDEMIC ON SURGICAL PROCEDURES IN BRAZIL: A DESCRIPTIVE STUDY

IMPACTO DA PANDEMIA DE COVID–19 NOS PROCEDIMENTOS CIRÚRGICOS NO BRASIL: UM ESTUDO DESCRITIVO

Bárbara Okabaiasse Luizeti¹, Victor Augusto Santos Perli¹, Gabriel Gonçalves da Costa², Igor da Conceição Eckert³, Aluisio Marino Roma⁴, Karina Miura da Costa⁵

Autor correspondente: Bárbara Okabaiasse Luizeti – E-mail: baluizeti@gmail.com

ABSTRACT

COVID–19 pandemic has deeply affected medical practice, and conducts o minimize the overload of healthcare services were necessary. The objective of this study is to evaluate the impact of the pandemic in the practice of surgical procedures in Brazil. This is a descriptive study with data about hospitalizations for surgical procedures in Brazil from 2016 to 2020, collected from the Department of Informatics of Brazil’s Unified Health System (DATASUS). Primary analysis describes the variations in the number of elective, urgent and other types of surgical procedures performed during this period, by comparing the mean number of hospitalizations from 2016 to 2019 with the absolute number from 2020. Secondary analysis describe the variations in hospitalizations for surgical procedures during this period in each of Brazil’s geographical regions, and variations in different surgical procedure subgroups. There was a decrease of 14.88% [95% CI: 14,82–14,93] in hospitalizations for surgical procedures in 2020, when comparing to the mean between 2016–2019. Decrease rates were 34.82% [95% CI: 34,73–34,90] for elective procedures and 1.11% [95% CI: 1.07–1.13] for urgent procedures. Surgical procedure subgroups with highest decrease rates were endocrine gland surgery, breast surgery, oral–maxillofacial surgery and surgery of upper airways, face, head and neck. The overload of healthcare facilities demanded reductions in non–urgent activities to prevent services’ collapse. Further studies are needed to evaluate the social and clinical impact of such reductions and support the development of precise criteria defining which procedures should be prioritized.

Keywords: COVID–19. Elective surgical procedures. Hospitalization. SARS–CoV–2. Surgery.

RESUMO

A pandemia de COVID–19 afetou profundamente a prática médica, e condutas para reduzir a sobrecarga dos serviços de saúde foram necessárias. O objetivo deste estudo é avaliar o impacto da pandemia na prática de procedimentos cirúrgicos no Brasil. Trata–se de um estudo descritivo, com dados sobre hospitalizações por procedimentos cirúrgicos no Brasil entre 2016 e 2020, coletados do Departamento de Informática do Sistema Único de Saúde do Brasil (DATASUS). A análise primária descreve as variações na quantidade de procedimentos eletivos, de urgência e outros tipos realizados nesse período, comparando o número médio de hospitalizações entre 2016 e 2019 com o número absoluto em 2020. Análises secundárias descrevem variações nas hospitalizações por procedimentos cirúrgicos nesse período em cada uma das regiões do Brasil, e variações

¹ Acadêmicos do curso de Graduação em Medicina da Universidade Cesumar – UNICESUMAR, Maringá (PR), Brasil.

² Mestrando em Química Biológica pela Universidade Federal do Rio de Janeiro (URFJ), Rio de Janeiro (RJ), Brasil.

³ Bacharel em Nutrição pela Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA), Porto Alegre (RS), Brasil.

⁴ Docente do curso de Graduação em Medicina da Universidade Cesumar – UNICESUMAR, Maringá (PR), Brasil.

⁵ Doutora em Clínica Cirúrgica pela FMRP–USP/SP. Docente do curso de Graduação em Medicina da Universidade Cesumar – UNICESUMAR, Maringá (PR), Brasil.

nos diferentes subgrupos de procedimentos cirúrgicos. Houve uma queda de 14,88% [IC 95% – 14,82–14,93] nas hospitalizações por procedimentos cirúrgicos em 2020, comparando com a média entre 2016 e 2019. As taxas de redução foram 34,82% [IC 95% – 34,73–34,90] para procedimentos eletivos e 1,11% [IC 95% – 1,07–1,13] para procedimentos de urgência. Subgrupos de procedimentos cirúrgicos com maiores reduções foram: cirurgia de glândulas endócrinas, cirurgia da mama, cirurgia bucomaxilofacial e cirurgia de vias aéreas superiores, face, cabeça e pescoço. A sobrecarga dos serviços de saúde demandou reduções na realização de procedimentos não urgentes para prevenir o colapso dos serviços. São necessários estudos adicionais para avaliar o impacto social e clínico dessas reduções, e auxiliar na elaboração de critérios precisos para definir quais procedimentos devem ser priorizados.

Palavras-chave: Cirurgia. COVID-19. Hospitalização. Procedimentos cirúrgicos eletivos. SARS-CoV-2.

INTRODUCTION

Coronavirus Disease 2019 (COVID-19) was first reported in late December 2019 in Wuhan, Hubei Province of China (ZHU *et al.*, 2020; WORLD HEALTH ORGANIZATION, 2020a) The disease spread quickly, and was stated as an international public health emergency by the end of January 2020. In March of the same year, the World Health Organization (WHO) declared COVID-19 as a pandemic (WILDER-SMITH; CHIEW; LEE, 2020; WORLD HEALTH ORGANIZATION, 2020b).

Since the beginning of the outbreak, there was concern about the impact on healthcare systems. Due to the risk of nosocomial transmission, possible lack of personal protective equipment (PPE), overflow of healthcare facilities, and limited medical resources, there was a disruption in delivering surgical care to millions of patients (LEE *et al.*, 2021; EMANUEL *et al.*, 2020; KURIHARA *et al.*, 2020; AL-JABIR *et al.*, 2020a; SØREIDE *et al.*, 2020).

The relation between surgery and the outbreak is complex: the risk of exposure and nosocomial infection is higher in the context of a surgical procedure; postoperative care may need hospitalization and intensive care, thus reducing the availability of these

supports to COVID-19 patients. Other situations affecting surgical practice were also seen, such as the shortage of medications and blood components (KURIHARA *et al.*, 2020; AL-JABIR *et al.*, 2020a).

In this context, many countries canceled elective procedures to redirect surgical resources and workforce to COVID-19 patients, (SØREIDE *et al.*, 2020; COVIDSurg..., 2020; LACOBUCCI, 2020) and considering that healthcare professionals could be at high risk of exposure to the virus during surgical procedures, (JESSOP *et al.*, 2020) specific institutional protocols were developed for operating rooms depending on the type of surgery (KIBBE, 2020; LIVINGSTON, 2020).

The aim of this study was to analyze the impact of the COVID-10 pandemic on the practice of surgical procedures in Brazil.

2 METHODS

This is a descriptive study, analyzing data about hospitalizations for surgical procedures performed in Brazil from 2016 to 2020. Data were collected from the Brazilian Department of Informatics of the Unified Health System (DATASUS), which includes only data from the Brazilian public health system, collected in The Public Health Information Tab – TABNET.

Primary analysis describes the variations in the performing of the different types of surgical procedures, classified in TABNET as “elective procedure”, “urgent procedure”, “accident in the workplace or at the duty of a company”, “accident on the way to work”, “other types of traffic accidents” and “other types of injury or poisoning by chemical or physical agents”. The last four were computed in a single group called “other procedures”. Variations in elective, urgent and other types of procedures were analyzed by comparing the mean number of hospitalizations from 2016 to 2019 with the absolute number from 2020. Also, a time series chart with the number of hospitalizations from 2016 to 2020 was made.

Secondary analysis describes the variations in hospitalizations for surgical procedures in each of Brazil’s geographical regions, also by comparing the mean number of hospitalizations from 2016 to

2019 with the absolute number from 2020. A time series chart with the number of hospitalizations for surgical procedures during the months of 2020 was also made.

Other secondary analysis describes the variations in different surgical procedures subgroups, also comparing the mean of hospitalizations from 2016 to 2019 with the numbers from 2020.

Analyses were performed in software R for statistical computing, version 4.0.3 (R Core Team, Vienna, Austria). The study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE Statement) (VON ELM *et al.*, 2020).

3 RESULTS

The number of hospitalizations for surgical procedures from 2016 to 2020 is shown in Table 1 and Figure 1, with temporal distribution of total, elective and urgent surgical procedures. There was an increase in surgeries from 2016 to 2019, and a reduction in 2020. When comparing the average number of hospitalizations from 2016–2019 with 2020, there was decrease of 14.88% [95% CI: 14.82–14.93] in total surgical procedures. Elective procedures had a greater decrease in comparison to urgent procedures, with 34.82% [95% CI: 34.73 – 34.90] less elective procedures and 1.11% [95% CI: 1.07–1.13] less urgent procedures in 2020.

Table 1. Number of hospitalizations for surgical procedures in Brazil between 2016 and 2020, according to the type of procedure

Procedure	2016	2017	2018	2019	2020
Elective surgeries	1,726,279	1,790,425	1,984,641	2,089,807	1,237,056
Urgency surgeries	2,644,140	2,716,817	2,774,911	2,844,255	2,714,709
Other procedures	73,988	66,823	64,503	62,901	57,351
Total surgeries	4,444,407	4,574,065	4,824,055	4,996,963	4,009,116

Source: Authors (2021)

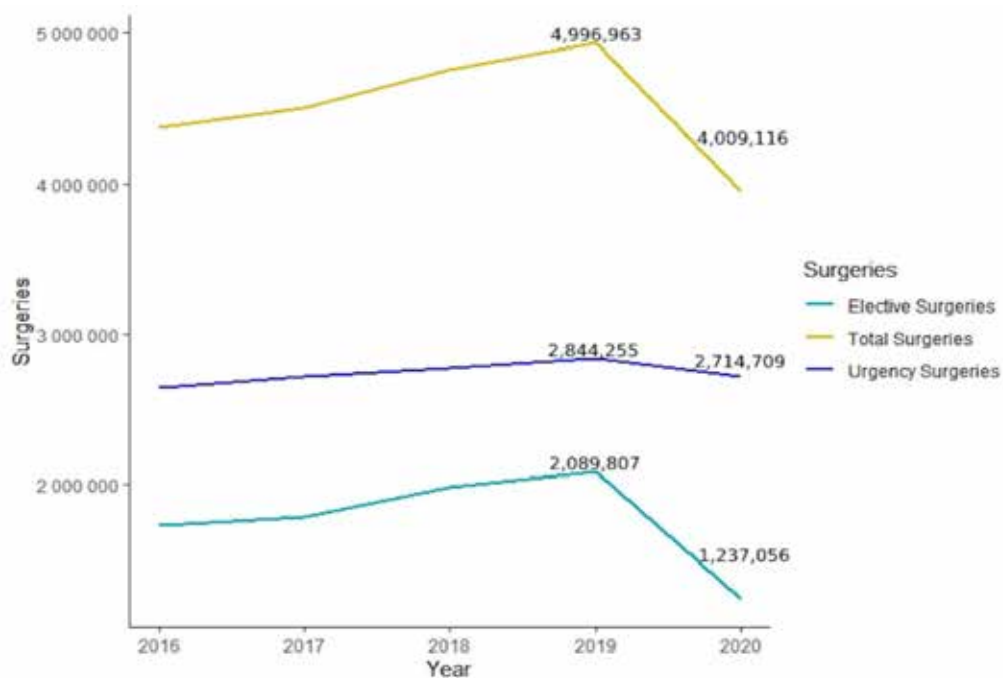


Figure 1. Temporal evolution of the number of elective, urgent and total surgical procedures in Brazil between 2016 and 2020
Source: Authors (2021)

Table 2 shows the number of hospitalizations between 2016 and 2020, according to geographical regions. Comparing the average number from 2016 to 2019 with 2020, there were decreases of 15.81% in the Southeast, 14.96% in the Northeast, 14.68% in the North, 14.37% in the South, and 11.04% in the Midwest (average reduction of 14,17%).

Table 2. Number of hospitalizations for surgical procedures in each of the five Brazilian regions, 2016–2020

Procedure	2016	2017	2018	2019	2020
North	325,975	342,398	360,933	366,708	297,765
Northeast	1,160,769	1,189,679	1,286,596	1,321,188	1,054,120
Midwest	343,797	348,354	357,152	377,746	317,39
Southeast	1,801,439	1,855,185	1,944,753	2,020,534	1,604,257
South	812,427	838,449	874,621	910,787	735,584
Total	4,444,407	4,574,065	4,824,055	4,996,963	4,009,116

Source: Authors (2021)

Table 3 show the number of hospitalizations according to the surgical procedures subgroups. Endocrine gland surgery, breast surgery, oral/maxillofacial surgeries, surgery of the upper airways/face/head/neck, and minor surgeries/surgeries of skin/subcutaneous tissue/mucosa were the five subgroups with the highest decrease rates. The lowest decreases were found in reconstructive, osteomuscular, thoracic, oncology and other surgery subgroups. Obstetric surgery was the only subgroup with an increased rate (0.48%).

Table 3. Number of hospitalizations according to the subgroups of surgical procedures between 2016 and 2020 in Brazil

Surgical procedures subgroups	Hospitalizations from 2016–2019 (average)	Hospitalizations in 2020	Ratio (%)
Endocrine gland surgery	12,253	6,368	–48.03%
Breast surgery	34,824.75	20,66	–40.68%
Oral and maxillofacial surgery	13,273.75	8,322	–37.3%
Surgery of the upper airways, face, head and neck	132,504.5	84,719	–36.06%
Minor surgeries and surgeries of skin, subcutaneous tissue and mucosa	118,676	79,322	–33.16%
Surgery of the genitourinary system	501,674.5	338,983	–32.43%
Vision apparatus surgery	108,136.5	73,779	–31.77%
Surgery of the digestive system, attached organs and abdominal wall	768,490.5	536,729	–30.16%
Circulatory system surgery	292,014	234,947	–19.54%
Central and peripheral nervous system surgery	88,425.75	72,765	–17.71%
Reconstructive surgery	57,821.25	47,587	–17.7%
Surgery of the osteomuscular system	768,984.25	701,006	–8.84%
Thoracic surgery	58,799.5	55,258	–6.02%
Oncological surgery	146,922.5	138,701	–5.6%
Other surgeries	557,951.5	556,027	–0.35%
Obstetric surgery	1,048,853.75	1,053,943	+0.48%
Total	4,709,872.5	4,009,116	–14.88%

Source: Authors (2021)

Figure 2 shows the number of hospitalizations per month in 2020. Regarding the 4,009,116 surgical procedures performed, there was a reduction from the beginning to the middle of the year: January (403,829 procedures), February (396,118 procedures [-1.90%]), March (380,610 procedures [-3.91%]), April (285,924 procedures [-24.87%]), May (285,071 procedures [-0.29%]) and June (276,959 procedures [-2.84%]). There was an average decrease rate of 6.77% in this period, with the highest decrease observed from March to April. From July to November, there was an increase in the number of surgeries: July (299,058 procedures), August (310,016 procedures [+3.66%]), September (329,551 procedures [+6.30%]), October (360,078 procedures [+9.26%]) and November (361,027 procedures [+0.26%]), with an average increase rate of 5.49% in this period. In December (320,875 procedures), there is a new decrease rate (11.12%) compared to November.

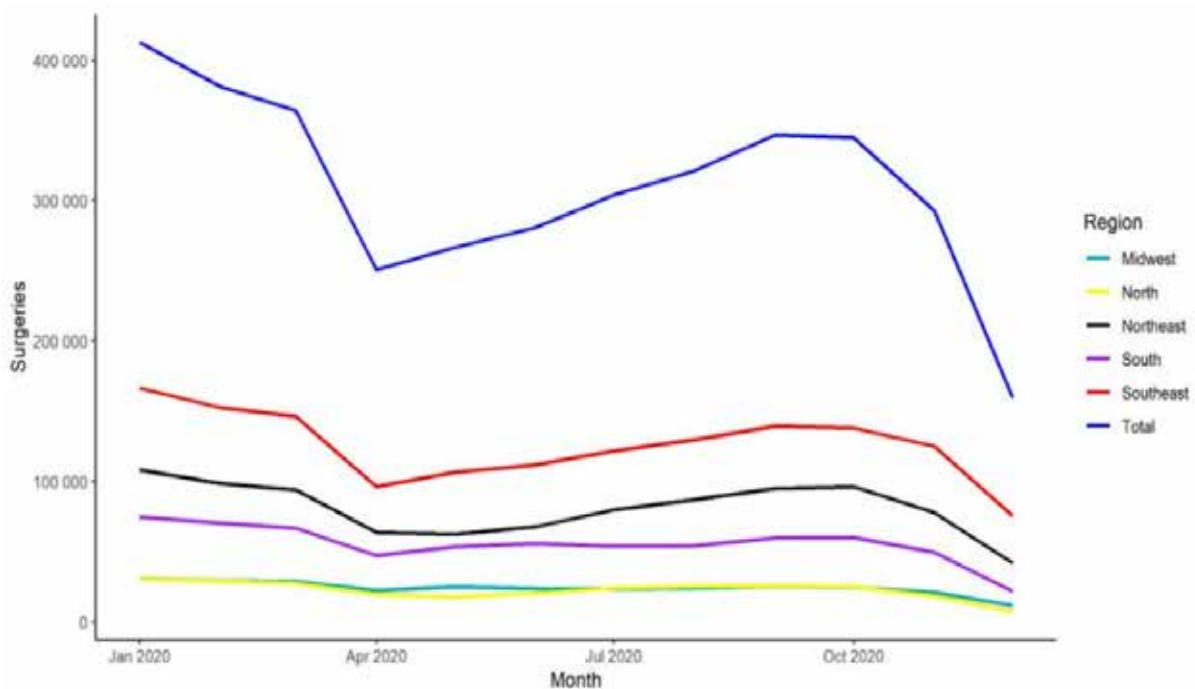


Figure 2. Number hospitalizations for surgical procedures in 2020, per month
Source: Authors (2021)

Figure 2 also shows the number of hospitalizations per month in 2020 according to the geographical regions. When comparing the hospitalization rates in January and December, there were decreased rates of 36.58% in North, 22.06% in South, 19.95% in Southeast, 19.25% in Midwest, and 16.49% Northeast. As well as in the overall analysis, the highest reductions occurred in April and December. In April, there were decreased rates of 27.08% in Southeast, 24.88% in Midwest, 24.74% in South, 23.74% in Northeast and 21.2% in North. In December, decrease rates were

26.73% in North, 12.73% in Northeast, 10.31% in South, 9.15% in Southeast and 1.82% in Midwest.

4 DISCUSSION

The decision to perform a surgical procedure during the pandemic requires a thorough evaluation to establish priorities and precisely define in which cases benefits overcome risks and surgery is genuinely needed (SØREIDE *et al.*, 2020; MOLETTA *et al.*, 2020). That was a great challenge for surgeons in 2020,

since avoiding unnecessary activities in healthcare facilities, and thus canceling or postponing all non-urgent procedures, was widely stated as an important measure to prevent overload and enable reorganization of the healthcare systems worldwide (SØREIDE *et al.*, 2020; COVIDSurg..., 2020; LACOBUCCI, 2020). The Brazilian public health system adhered to these recommendations, as seen by a greater decrease in elective surgeries in 2020 (34.82%) in comparison to urgent procedures (1.1%).

When analyzing monthly surgical procedures in 2020, there was a remarkably low number of surgeries between April and June, the months following the country's first reported cases, resuming growth from July onwards. Indeed, regulatory measures must be more restrictive at the beginning of an outbreak, when healthcare systems are unprepared to deal with a possible overload, so time is needed until more health resources can be acquired (SØREIDE *et al.*, 2020; COVIDSurg Collaborative, 2020). There was a new reduction rate in December when compared to the previous months. Although a seasonal decrease in hospitalizations for surgical procedures in November and December also took part from 2017 to 2019, (BRASIL, 2021a) this reduction in 2020 could also be attributed to the increase in COVID-19 cases that took part in Brazil in November (JOHNS HOPKINS UNIVERSITY & MEDICINE, 2021).

Even though Brazil has considerable differences in public administration and heterogeneous cultural and economic conditions across different regions, data shows similar reduction rates in hospitalizations when comparing the rates in 2020 with the previous years, with an average reduction of 18.96%. However, in the 2020 monthly comparison, there was a higher decrease rate in the North in December when compared to the other regions. These reductions might have been the result of the regional healthcare system collapse in December (BRASIL, 2021b).

Surgical care that is not time-critical can be delayed to a later date when the pandemic subsides. However, certain procedures must be performed even during a pandemic, such as cancer treatment and

urgent surgeries (SØREIDE *et al.*, 2020). This could explain why oncology and thoracic surgeries suffered minor reductions, while endocrine gland surgery was the subgroup with the highest decrease rates (48.03%), probably due to the possibility of safe deferral of these procedures (MOLETTA *et al.*, 2020; LOMBARDI *et al.*, 2020; PALLADINO *et al.*, 2020).

Regarding plastic surgery, guidelines support the deferral of breast reconstruction and revision procedures, (AL-JABIR *et al.*, 2020b) which might explain the high decrease rates in breast surgery (40.68%). Other studies have found that plastic surgery procedures most impacted by the pandemic were superficial skin lesions and subcutaneous mass procedures (KARA *et al.*, 2021), which corroborates our findings of substantial decrease rates in minor surgeries and surgeries of skin, subcutaneous tissue and mucosa (33.16%).

Other subgroups with important decrease rates were oral and maxillofacial (37.3%), and upper airways, head and neck (36.06%) surgeries. These procedures were of particular concern due to the high risk of generating aerosols and consequent COVID-19 infection. Guidelines recommended that these surgeries should only be performed in life-threatening conditions with great precautions (AL-JABIR *et al.*, 2020b; ZIMMERMANN; NKENKE, 2020).

There were also a decrease among surgeries of the digestive system and abdominal wall (30.16%), which may also reflect recommendations and alternative management of digestive emergency conditions performed during the pandemic. Guidelines support that only life-threatening gastrointestinal conditions should undergo surgery, and there were recommendations for clinical treatment of conditions such as uncomplicated appendicitis and cholecystitis, (MOLETTA *et al.*, 2020; AL-JABIR *et al.*, 2020b) situations in which conservative management appears to be effective and reduce the length of hospital stay (JAVANMARD-EMANGHISSI *et al.*, 2020).

Cancer surgery was one of the challenges faced in the context of the pandemic. Since both cancer and surgical patients are at high risk of

COVID–19 infection and complications of the disease (JAVANMARD–EMANGHISSI *et al.*, 2020; COVIDSurg COLLABORATIVE, 2020; AMERICAN COLLEGE OF SURGEONS, 2020), there was a concern involving the exposure of these patients to the hospital environment, and most guidelines supported that surgeries should be delayed whenever possible. On the other hand, there were concerns about the risks of postponing oncological procedures and the exposure of patients undergoing conservative cancer treatment. The recommendation was that decisions should be made based on the clinical condition and the pandemic's impact on the local healthcare system (AL–JABIR *et al.*, 2020; AMERICAN COLLEGE OF SURGEONS, 2020; HUDA *et al.*, 2020). This study found only a 5.6% reduction in general oncological surgeries, suggesting that Brazil had a trend in choosing for operation in most cancer cases.

Hospitalization rates for obstetric surgery were slightly higher in 2020 than the average from 2016 to 2019 (0.48% increase). Brazil is one of the countries with the highest cesareans rates, which consisted of 56.3% of all deliveries in 2019 (BRASIL, 2021c). Since most guidelines support that maternal COVID–19 infection should not influence the type of delivery (PAVLIDIS *et al.*, 2021), it should be safe to assume that the pandemic did not significantly impact this group of procedures.

COVID–19 has had a devastating impact on patients, the economy and healthcare systems. There is hope that cases will begin to decline soon and, as the COVID–19 vaccine is distributed, hospitals must develop protocols to resume elective surgeries safely. This will be the next challenge for the surgical community. Moving forward requires not only creativity but also structural changes to patient workflows (KAYE *et al.*, 2020; BONANO; HUDDLESTON, 2021; MEREDITH; HIGH; FREISCHLAG, 2020).

Regarding the long–term effects on surgical practice, the reported changes in surgical procedures may support the development of more precise criteria defining which non–urgent procedures should be prioritized. Except for life–threatening conditions, there

is no consensus defining which surgical procedures need immediate interventions and which ones could be postponed, and reported recommendations were based on personal expertise and experience (SØREIDE *et al.*, 2020; MOLETTA *et al.*, 2020; MARTIN, 2020). Such criteria may support the management in other situations of overload of healthcare and should be based on robust scientific evidence. Further studies are needed to evaluate the impacts of the surgeries' postponing in the outcomes of the clinical conditions regarding each of the reported procedures subgroups.

This study has limitations: the data refer only to the Brazilian public health system because data from the private health system are not available, and, as secondary data, the veracity of the information provided depends on proper registration.

Although regression analyses that could help explain the differences in the number of surgeries between subgroups and regions were not performed, some justifications for the temporal trends of reduction in surgical procedures are speculated, such as the correlation with decrees and laws of state and municipal governments that imposed the postponement of elective surgeries.

5 CONCLUSION

COVID–19 pandemic has resulted in changes in Brazilian surgical practice. The need for minimizing the overload in healthcare facilities demanded reductions in healthcare activities and avoidance of non–urgent procedures, as seen by the notable decline in elective surgeries. Lower numbers of procedures were seen in April, July and December of 2020, periods of an increasing number of cases in the country.

Further studies are needed to evaluate the social and clinical impact of the reductions in surgical procedures so that more reliable evidence may be achieved to support the development of more precise criteria defining which non–urgent surgical procedures should be prioritized when activities are resumed.

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