Arterial hypertension as a tracer for the evaluation of access to health care

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Abstract *This study evaluated the use of and access to different services involved in the care of patients with arterial hypertension in the Public Health System in the municipality of São Paulo, Brazil. This is an ecological study that addressed the magnitude, trend and relationships of outpatient procedures linked to the arterial hypertension care Data were retrieved from the SIA/SUS and the Estabsus from the Municipal Health Secretariat, and were processed with PostgreSQL relational database linking the different information by the indicators chosen and analyzed by territories. The statistical analysis were performed by the R program with the trend significance analysis of the historical series of indicators defined and the relationships between them. Essential changes in the care model were found in the period under study in São Paulo, with a declining general trend of primary medical visits and increased specialized cardiology procedures. Production was heterogeneous in the different regional coordination offices in the city. The study shows the potential use of SUS databases and it allows the identification of gaps in the access, coverage and use of high complexity services in health care for chronic conditions in the Brazilian Unified Health System (SUS).*

Key words *Health assessment, Hypertension, Health services research*

Introduction

In Brazil, health services produce daily large amounts of data that feed different information systems. However, even with technological advances in the area of information systems, the data produced are undervalued and consequently underutilized in managerial practices, especially in the evaluation processes[1,2]. The appropriation and adequate analysis of these data can produce vital information to assist in the decision-making process of managers, also contributing to the improvement of the supply and access to different types of health services that underpin the health care networks (RAS)[3].

When it comes to the quality of health services, it is not always possible to make right, timely decisions based on primary data sources due to the complex nature of the health sector. Therefore, the use of secondary data, especially those from national and local databases, in evaluation and monitoring practices, has huge potential to support decision-making processes, allowing the provision of information in timely and low-cost fashion[4].

In this perspective, the use of available secondary data facilitates the evaluations of the supply, production and access to health services responsible for attending to a specific illness or health problem that can be used sometimes as a tracer condition[5]. Thus, it is possible to produce simple information, but of great relevance for the understanding of the service delivery system of the different points of care underlying a RAS. It is worth mentioning that the choice of the tracer condition is guided by specific criteria, such as a high-prevalence health problem with a defined diagnosis, with known patterns for patient handling and influence of interventions in the course of the well-established disease[6,7].

Systemic arterial hypertension (SAH) is conceived as a tracer condition and may contribute to the evaluation of the production of care in different chronic noncommunicable diseases (NCDs). NCDs are a significant health problem today, especially in low- and middle-income countries. In Brazil, they have become one of the main priorities for the health system, since they represent the highest burden of morbimortality, accounting for about 72% of all deaths[8-10]. Among NCDs, SAH is the most prevalent cause in Brazil, with rates of 21.4% among people over 18 years of age, according to data from a recent national health survey, equivalent to about 31 million patients[9].

It should be noted that SAH is a controllable condition, that is, blood pressure levels are maintained within reasonable limits and complications are avoided through continued care, preferably performed by multidisciplinary health staff[11]. However, studies indicate that population blood pressure control rates are low, ranging from 19% to 39%[8,12]. In Germany and the United States, about 18.5% of patients have adequate blood pressure control, while the European average is 8%. In Africa and Latin America, this rate ranges from 1% to 15%[13,14].

The effective follow-up of people living with SAH should be carried out preferably by Primary Health Care (PHC). Integrality of care also requires some specialized support, in particular, the cardiologist, diagnostic and therapeutic support for the management of this health problem, like an electrocardiogram (ECG), ergometric test, echocardiogram, Holter and Ambulatory Blood Pressure Monitoring (ABPM)[11,12]. It is understood that the production and use of these procedures allow the realization of the integrality of care to people with SAH through the accomplishment of the line of care outlined for their treatment.

Therefore, it is essential to articulate the services of different technological complexities for the proper monitoring of SAH at the outpatient level. Thus, the Unified Health System (SUS) has advocated the implementation of the organizational arrangement of care networks and care lines to ensure comprehensive care at all points of care for chronic conditions[12,15]. The care lines should focus on the needs of users, the use of interpersonal technologies and the existence of a network of services that support the necessary actions, access to available care resources, and action on social determinants and the regulatory process[15,16].

Thus, this study aimed to evaluate the use and access to different services involved in the health care of hypertensive patients, in the public network of the city of São Paulo, and to establish the relationship between access and production of these services in the different levels of complexity of the health care network, in order to support management in the decision-making process. The city of São Paulo was chosen due to the several services available that provide hypertension care procedures.

Methods

This is an ecological study of a time series that addressed the magnitude and trend of the production of complementary medical visits and tests linked to the hypertension care line and performed at the outpatient level of the SUS in the city of São Paulo. This study is an integral part of the Inquiry Project on the Functioning of Primary Health Care and Access to Specialized Care in the Brazilian Metropolitan Regions, and received financial support from the Ministry of Science, Technology and Innovation and the Ministry of Health through the National Council for Scientific and Technological Development (CNPq).

The data sources were the Outpatient Information System of the Unified Health System (SIA/SUS) and the EstabSUS, which is an application of the São Paulo Municipal Health Secretariat (SMS/SP). This system complements data from the National Registry of Health Establishments (CNES) and facilitates comprehensive access to information on health establishments and services, by type of service and facility and management levels, whether public or private.

The care line procedures selected for this study were primary medical visit divided into primary emergency and non-emergency visits, ECG performed in PHC facilities, specialized cardiology visit, echocardiogram and ABPM (Figure 1). It should be noted that the analyses were performed from the assumption that the productions of these procedures are indicators of the population's access to the services provided by the SMS/SP.

The production data corresponding to the care line cited above were extracted from the databases as quantities performed between 2009 and 2014. Since SAH is a more frequent problem in the adult population, we opted to exclude primary pediatric visits. These data were collected by a regional health coordination office, as per the distribution adopted by the São Paulo SMS, which corresponds to five distinct regions of São Paulo, Midwest, Southeast, North, East and South and used for comparative analysis of the time series related to the chosen indicators.

Data were processed by the PostgreSQL relational database, articulating the various information as per the chosen indicators and territories analyzed. The PHC facilities (UBS) and the Ambulatory Medical Care Facilities (AMA) were the preferred gateways to the SAH care line. We used the number of procedures performed in these facilities to calculate relationships with the procedures performed in secondary care.
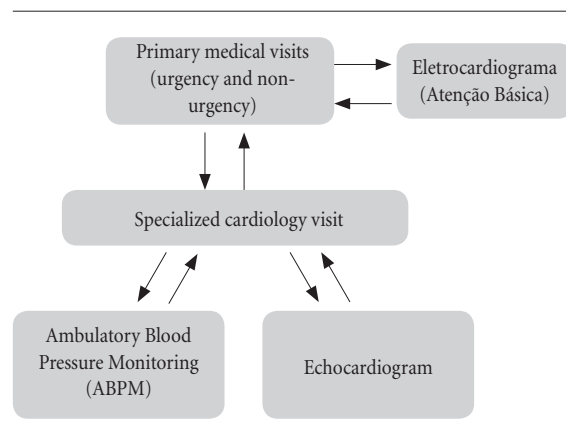

Figure 1. Selected procedures from the Hypertension / Hypertensive Cardiopathy care line.

It is worth highlighting that, in São Paulo, as per the SMS/SP, the AMAs were implemented in 2005 to work in the field of Primary Care in all regions of the city of São Paulo[17]. Their main characteristic is attending low and medium complexity walk-in emergency demand, with extended working hours as per the local needs. The SMS/SP opted to extend them through management contracts in partnership with civil society entities qualified as Social Health Organizations (OSS).

Given this context, we considered the period between 2000 and 2014 for the analysis of the time series of primary medical visits. The extension of the interval between 2000 and 2008 sought to highlight the overview in the period before the implantation of the AMAs, followed by profound changes occurring due to the production of primary medical visits, after the full functioning of such units in the municipality.

Regarding the indicators whose production occurred in the UBS, we calculated the ratios for the population without a private health plan or insurance and aged above 15 years. Thus, the ratios for primary medical visits (total, non-emergency and emergency) and ECG in PHC were calculated by this user population.

Given the unique nature of the municipality of São Paulo concerning coverage of supplementary health in the population, a study was performed through a household survey conducted by the *Instituto Via Pública*[18], which estimated the population using private medical care plans and insurance at 55.6%. Despite the possible overestimated supply of services in a system, considering the perspective of a universal SUS, we chose to

exclude the population covered by the supplementary health from the denominator to better express the local reality. In fact, the use of one population estimate or another as denominator does not interfere with the intended interpretation, which is the time trend of proportions. All population-based ratios were shown as simple ratios estimating per-user visits or tests.

It is also worth highlighting that a household survey conducted in 2015 found that 13.5% of UBS users in the state capital have private health plans[19].

We also calculated ratios for procedures such as performing an electrocardiogram in the UBS/primary medical visits of different types (total, emergency and non-emergency), medical visit with specialist in cardiology/primary medical visit of different types, specialized visit in cardiology/ECG performed in PHC, performing ECG/specialized cardiology visit, performing ABPM/specialized cardiology visit. These ratios are approximations of the relationships established between Primary and Specialized Care in the hypertension care line and were calculated using a 100 base.

Finally, we calculated the coverage of specialized cardiology procedures (specialized cardiology visit, echocardiogram and ABPM) in the city of São Paulo and by regional coordination office, taking as the numerator the number of procedures performed, and the reference population used in the other ratios as the denominator.

Statistics were processed with the R program, with an analysis of the significance of the historical series' trends of the defined indicators and the relationships between them. We considered significant tendencies with a p-value < 0.05. The historical series were analyzed by the adjusted linear trend slope method. The values of the indicators expressed the procedures' count and did not characterize an inference, but the record of what was done, thus dispensing with the calculation of the confidence intervals of these measures or their ratios.

Resolutions 466/2012 and 510/2016 justify the lack of clearance by the Human Research Ethics Committee since the study was based on data accessed in official, open access databases.

Results

The analysis of the ratio of primary medical visits/population by its components (emergency and non-emergency) showed that, up to 2009,

the primary non-emergency visits prevailed, and an increasing trend until 2002, followed by relative stability until 2008, when they declined until 2011, returning to stability at a lower level than the former. On the contrary, the ratio of primary emergency visits by the user population evidenced levels considerably lower than those of the primary non-emergency visit until 2005. It then showed a significant variation in its production, with massive growth from 2006 and a slightly declining trend in the years after 2009, increasing between 2013 and 2014 (Graphic 1).

Primary non-emergency visits accounted for 92.7% of all primary visits in 2000. Due to the increased production of primary emergency visits, as of 2006, this proportion declined significantly, ranging from 49.2% to 53.2% from 2009 onwards. The growing emergency visits between 2000 and 2014 was 1,100%, representing an increase of 84.6%, due to total primary visits, from 1.3 to 2.4 visits/population between 2000 and 2014.

Table 1 shows values and trends in the production of primary and specialized visit procedures of cardiology, echocardiogram and ABPM, in the period between 2009 and 2014. It shows that the ratios involving the primary visits reaffirm the data already presented in Graph 1, and the decline trends mentioned therein were statistically significant in the 2009-2014 period. While there was a general trend to curb primary medical visits, the specialized cardiology procedures evidenced an increasing trend.

The performance of electrocardiograms in UBS and AMA was stable vis-à-vis the population, but the production of such tests was about four times lower than the production of specialized cardiology visits, contrary to the expected production of ECG procedures performed more widely in PHC before the visit to the specialist.

The analysis of the production of cardiology visits did not show a definite trend, contrary to the statistically significant increases in the echocardiogram and ABPM ratios, indicating that there was a higher production of these two procedures in the analyzed period. The increased ratio of cardiology visits compared to primary emergency medical visits can be explained by the significant decline of these primary visits. The ratio between specialized visits in cardiology and ECG in PHC remained stable since the production of these two procedures did not increase (Table 1).

The above analyses are reinforced by the higher production of specialized cardiology procedures. The production of echocardiograms in-

creased from 118,953 exams in 2009 to 206,530 in 2014, an increase of 73.6%. Regarding ABPM, this increase was 93.1%, up from 10,196 exams in 2009 to 19,659 in 2014. In both cases, the trend was statistically significant (data not shown in the table).

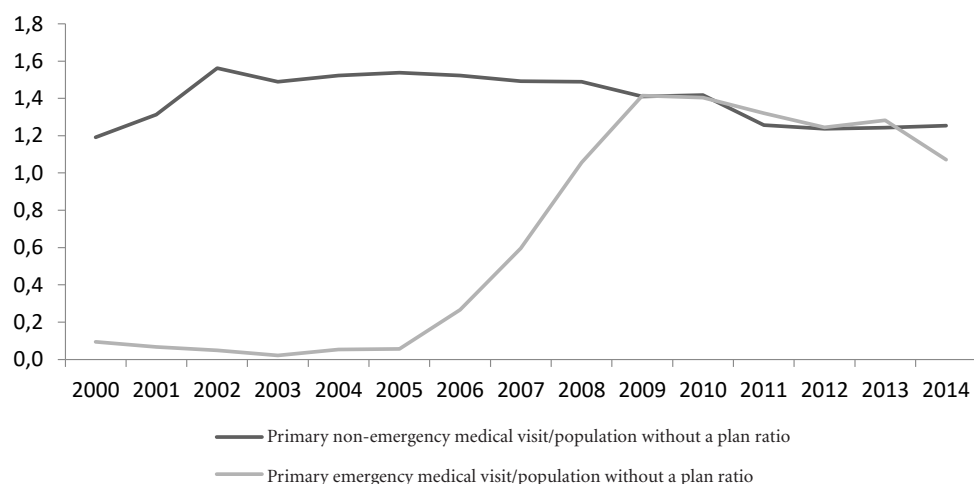Table 2 shows the statistically significant variations between 2009 and 2014, by region-

Figure 2. Ratio of primary emergency and non-emergency medical visit, except pediatrics, by population without health plan aged 15 or over, 2000 to 2014, São Paulo, SP.Fonte: SIA/SUS e SMS/IVP.

Table 1. Related indicators regarding hypertension care line procedures, São Paulo, 2009-2014.

Indicators (ratios)	Year						p-value	trend
	2009	2010	2011	2012	2013	2014		
Primary medical visits/population	2.78	2.78	2.55	2.46	2.51	2.33	0.006	-
Primary non-emergency medical visits/population	1.41	1.42	1.27	1.24	1.25	1.26	0.041	-
Primary emergency medical visits / population	1.36	1.35	1.29	1.22	1.27	1.07	0.017	-
ECG in primary care/population	0.04	0.04	0.05	0.04	0.04	0.04	0.492	
ECG in primary care/primary medical visit*	1.34	1.57	1.79	1.68	1.75	1.79	0.045	+
Specialized cardiology visit/primary medical visit*	5.33	5.66	6.57	6.82	6.38	6.43	0.098	
Specialized cardiology visit/Primary non-emergency medical visit*	10.47	11.05	13.24	13.53	12.86	11.90	0.254	
Specialized cardiology visit/ Primary emergency primary medical visit *	10.84	11.59	13.05	13.76	12.65	13.97	0.032	+
Echocardiogram/Specialized cardiology visit *	16.46	20.05	20.79	21.21	23.85	26.85	0.001	+
MAPA/ Specialized cardiology visit *	1.41	1.83	1.80	1.95	2.26	2.56	0.00	+
Specialized cardiology visit/ ECG in PHC*	397.61	359.95	367.34	405.97	364.87	389.98	0.470	

Source: SIA/SUS e EstabSUS/SP

* Population base = 100. + significant growth trend. - significant decline trend.

al coordination office, in the production of the procedures displayed in the previous table. It should be noted that the five regions have different sociodemographic conditions, and the East, South, and North regions have the worst sanitation conditions, the most significant proportions of the population living in favelas, and the lowest proportion of inhabitants with a monthly income greater than ten minimum wages. Regarding the coverage of primary care services, the East and South regions have the largest UBS supply proportionally. Concerning the AMAs, the East and Southeast regions show 30% and 20% higher supply than the municipal average, while the supply was 30% lower in the Midwest.

This analysis allowed to verify that the variations in the production of the procedures were heterogeneous in the different regional coordination offices of the city. The lower total number of primary medical visits and its components were observed in all regional coordination offices and were statistically significant in the East and Southeast regions, showing similar patterns in both regions, and a more significant drop in primary emergency medical visits. In the Southeast, this decline is mainly influenced by the decreased production of primary emergency medical visits, which was well above the other regions and 51.1% above the municipal average. This situation suggests that this drop could be due to possible excess supply in the previous period, which did not occur in the Eastern region that shows values close to the municipal average in all com-

ponents. However, the South region showed a decline in the primary emergency visits.

Regarding the specialized cardiology procedures, the analysis by regional coordination office identified that the significant increase in the production of echocardiograms and ABPMs in the municipality was reproduced in almost all regions. Echocardiograms showed a significant increase in four regions. A 73.6% increase in the production of this procedure was found in the city, ranging from 45.2% in the Midwest to 132.9% in the North. Regarding ABPMs, the production grew 92.8% in the city and was significant in three regions (East, Southeast, and South), with a significant increase in the Eastern region, clarifying that only 11 exams were produced at the onset of the series (Table 2).

Again, based on Table 2, in the Northern Region, the relative stability of primary visits and higher production of procedures such as ECG and specialized cardiology visits are noteworthy. This increases significantly in the ratio with the primary visits and could indicate a process of greater possibilities of follow-up in the line of care.

The Southern Regional Office shows a box with a significant drop in only primary emergency visits. The significant hike in the ratio of cardiology visits to primary visits is due to the reduced production of consultations in the AMAs. The Midwest region did not show any variation in the production, except for echocardiograms. Table 3 shows the coverage of specialized pro-

Table 2. Significant variations in the production of procedures related to the arterial hypertension care line in the city of São Paulo, by regional coordination offices, in the period from 2009 to 2014.

Indicators	Variation (%) in the City of São Paulo*	Variation (%) by Regional Health Coordination Offices*				
		Midwest	East	North	Southeas	South
Ratio - primary medical visits/population	-16.2	---	-19.4	---	-25.9	---
Ratio - Primary non-emergency medical visit / population	-11.0	---	-15.5	---	-15.8	---
Ratio – Primary emergency medical visit / population	-21.5	---	- 23.2	---	-32.7	-19.7
Ratio - ECG/population	---	---	---	85.5	---	---
Ratio - ECG/primary medical visits	33.9	---	---	124.3	73.7	---
Ratio - specialized cardiology visit/primary medical visit	---	---	---	85.0	---	33.3
Number of specialized cardiology visits	---	---	---	59.5	---	---
Number de echocardiograms	73.6	45.2	125.5	132.9	---	70.4
Number of ABPMs	92.8		21.063.0		45.2	341.3

* Only those values with statistically significant variations are shown.

cedures (specialized visit, echocardiogram and ABPM), by user population, in the municipality and the different regional coordination offices. We identified that the Midwest and Southeast regions have coverage well above the municipal mean in the three procedures analyzed, thus suggesting that there may be greater production of these procedures in these two regions. The other three regions (North, South and East) had smaller coverage than the municipal one.

Discussion

The analysis of the use and access to the different health services involved in health care for the hypertensive has excellent potential to reduce possible identified inequalities that affect the quality of care provided[20]. It is also important to point out that it has been recommended to provide care for SAH patients in Primary Care, which is the preferred gateway for the health system and the communication center of the RAS, due to their high degree of decentralization and capillarity[21]. The integrality of care must also be ensured by the support of specialized services to aid in the differential diagnosis and comprehensive management of the cases, thus enabling quality and less burdensome care[22].

This study allowed us to identify that there were substantial changes in the care model in the city of São Paulo from 2000 to 2014. It may be that the notable increase in the production of emergency primary medical visits occurred between 2006 and 2009 is directly related to the implantation of AMAs, which are mostly physically linked to the existing UBS, which, when func-

tioning as emergency care facilities, with an open door and without medical records, promoted a higher production of emergency primary medical visits.

It is worth remembering that, according to the parameters of the Ministry of Health for outpatient visits in the SUS, the recommended relationship is that primary non-emergency visits represent approximately 84% of total primary visits[23]. Also, the SAH care line recommends that care for people living with the disease should be preferably carried out in routine services. Thus, the abrupt increase in the production of primary emergency visits and a concomitant decline in the proportion of the primary non-emergency visits occurring in the municipality from 2006 on, indicate that there has been a reversal of priority in attending to chronic conditions in Primary Care, and hypertensive patients started to have more access to services geared to acute care. This phenomenon has been described in other settings of different complexities, but with a similar trend[24,25].

Maintaining access to primary medical visits, especially routine ones, together with other prevention and promotion procedures available in Primary Care have great potential to improve the quality of care for SAH patients. Canada is the country with the best results in the follow-up of this disease, and the success of these results is attributed to the implementation of a PHC-based health system[11]. Similarly, in Cuba, the second country with the best SAH-related indicators, the population's blood pressure control rate is 40% and rises to 65% among users regularly followed by PHC[11,26].

The carriers of this disease should be referred to other points of the health care network, when necessary, to ensure integrality. However, there is still little evidence of the best time to refer to the specialist[11]. However, what was observed in this study is that although no increase in the production of primary medical visits and specialized cardiology medical visits was reported, an 73.6% and 92.8% hike was found in the production of echocardiogram and ABPM tests, respectively. This context reveals a movement unrelated to the intentionality of Primary Care and even specialized care related to comprehensive care for SAH patients.

Ideally, increased use of health procedures is expected due to the demand associated with a higher need for such procedures by users. However, supply-related aspects, characterized by the greater availability of specialized tests in the rou-

Table 3. Coverage of the production of specialized hypertension care line procedures, Municipality of São Paulo and its regional health coordination offices, by population without a health plan, 2014.

Health Regions	Coverage per 100 inhabitants		
	Echocardiogram	ABPM	Cardiology visit
Municipality	4.0	0.4	15.0
Midwest	10.4	0.8	54.6
East	2.2	0.2	3.7
North	2.5	0.4	7.6
Southeast	5.8	0.7	27.6
South	3.2	0.2	6.5

tine of health services or by some adopted management model can also explain the different use of specific health services. In this case, demand was prompted according to the organization of the supply of certain health services[27,28]. From this perspective, the marked elevation in the number of primary emergency visits observed in the city of São Paulo tends to be explained by the effect of the production of health service instead of the health needs of the population. Here, we support the thesis that the demand was induced by the opening of the AMAs in São Paulo in 2005, which extended the services with an "open door" feature to meet the walk-in demand.

It is worth mentioning that the Brazilian health system is very dependent on the private sector and that AMAs are managed by OSS. In this case, the rationale of productivity and profit may diverge from the health needs of the population and interfere with the supply and following use and incorporation of technologies in the health care process[29,30]. Health regulation is a valuable tool to ensure access and flows through the needs of the population and has been built in the city of São Paulo during this period[31].

Considering that access to primary medical visits is evenly distributed in every municipality, it is unlikely that the high concentration of specialized procedures identified in the Midwest and Southeast regions can be explained by the different health needs of its residents. Thus, it is not difficult to raise the hypothesis that a strong demand induced by the greater availability of these health procedures is found in the mentioned regions. This disparity may show a movement disconnected from PHC reinforcing the idea that the organization of health care still suffers from the fragmentation of services and actions generating incoherence between the supply of services and care needs[32].

This hypothesis is validated by the explanatory model of the use of services where the availability and the physical presence of the services[22] were among the most important determinants of access. Healthcare supply inequality can generate important consequences both for individuals and society, and must be continuously identified by health systems to facilitate the decision to address it[33]. Adequate allocation of care resources has great potential to ensure access and consequently reduce the disparities in the supply of health services[34].

The differences in the supply/use of the procedures analyzed in the regions may have occurred much more as a result of the implementation of services with emergency care characteristics in Primary Care than by considering the regional sociodemographic conditions.

This work shows the use of a secondary database of the SUS, with production data that allows to identify and to understand relationships between the different activities and procedures performed when used in the analysis of the care line of a tracer condition.

The use of a tracer condition facilitates the process of analysis of the procedures registered in production databases of the Department of Information Technology of the SUS (DATASUS), which are available to all SUS stakeholders, facilitating the process of dialogue, agreement and necessary adjustments to the universalization of the health system.

The analysis of the magnitude and trend of the procedures allows identifying changes in the care model, mainly concerning the type of gateway and logical sequence between the primary care and specialized care procedures. The relationship built between the procedures allows identifying imbalances between their realizations, given the procedures recommended for primary care and specialized care.

In working procedures related to the user population, distortions are found in the production of procedures recommended for differential diagnosis and follow-up of the cases, and higher production of complementary tests procedures than activities that are responsible for requesting them has been identified.

When these production data are analyzed by geographic territories, we found inequalities in access and possibly in the provision of services that facilitate or hinder the feasibility of the principles of universality, integrality and equity of the SUS.

Collaborations

OY Tanaka worked on the project's design, data analysis, drafting/review of the manuscript and approval of the version to be published. M Drumond Júnior worked on the project's design, data collection and analysis, drafting/review of the manuscript and approval of the version to be published. TL Gontijo, MCP Louvison and TEC Rosa worked on data analysis, drafting/review of the manuscript and approval of the version to be published.

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