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Factors associated with public dental service use by adults in the state of São Paulo, Brazil, 2016

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Abstract *The aim of this study was to investigate the factors associated with public dental care use by adults in the State of São Paulo, Brazil. A cross-sectional study was conducted with a representative sample of adults aged 35 to 44 years using data from the 2015 Epidemiological Survey of the Oral Health Status of the Population of the State of São Paulo (SBSP-2015). Multivariate logistic regression was performed using variables based on a model proposed by Andersen for predicting access to public dental services. Results: 3,421 (59.9%) adults visited private services and 2,288 (40.1%) visited public services. Prevalence of the use of public dental services was greatest among women (41.8%) and adults with a lower education level (50.2%). Being non-white (OR = 1.32, 95% CI: 1.16, 1.50), lower household income (OR = 2.37, 95% CI: 2.11, 2.65), having had toothache (OR = 1.60, 95% CI: 1.39, 1.83), and need for endodontic treatment (OR = 1.44, 95% CI: 1.12, 1.85) were associated with public dental service use. Predisposing, enabling, and need factors were associated with public dental care use.*

Key words *Adult, Access to health services, Oral health, Cross-sectional studies*

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Introduction

Health service use is the functioning core of health systems and recent studies have shown inequalities in dental service use among adults¹⁻⁹. Access to dental services is a complex issue, particularly in countries like Brazil, which follows a universal healthcare model and where access to health services is a right for all citizens^{2,3,5-9}.

In Brazil, a nationwide survey conducted in 2010 showed that the prevalence of the need for dental treatment among adults was 75.2% and that 38.3% of respondents used public dental services¹⁰, while a study with adults living in Minas Gerais undertaken in 2012 reported that 31.8% of respondents used public dental services¹¹.

To tackle inequities in access to oral healthcare, the Brazilian government introduced oral health teams (OHT) into the Family Health Strategy (FHS) and reshaped the National Oral Health Policy (NOHP) to expand and decentralize the healthcare system, increasing the provision of public specialist and non-specialist dental services^{9,12}. However, inequities persist and studies indicate that dental service use is influenced by interacting individual and contextual factors, including the need for treatment and organization of dental services^{1-4,8,13-21}.

It is therefore essential to investigate the type of dental service used by the adult population, given that health services should be structured to meet demand for dental care^{9,13,15,17,20}. Research on dental service use can provide important insights to help determine the profile of health service users, understand the reasons why people seek care, and assess oral health status, central aspects of health policy and planning. However, a better understanding of public dental service use among adults is required^{3,9,21,22}.

This study therefore investigated the factors associated with public dental service use among adults living in the State of São Paulo.

Methods

A cross-sectional population-based study was conducted with a representative sample of adults living in the State of São Paulo.

Located in the Southeast Region of Brazil and made up of 645 municipalities, the State of São Paulo is Brazil's most populous state. In 2016, the state had an estimated population of more than 44 million inhabitants (22% of the Brazilian population), per capita income of R\$1,723,

Human Development Index of 0.783 (high), life expectancy at birth in 2015 of 77.8 years, and literacy rate of 95.9%²³.

This study used data from the 2015 Epidemiological Survey of the Oral Health Status of the Population of the State of São Paulo (SBSP, acronym in Portuguese). The survey used two-stage cluster sampling with probability proportional to size, taking into account sampling weights and design effect in the respective sampling stages. The correction factor for the weighted analysis was calculated using the inverse probability of selection. The state was stratified into six Macro Regions called domains²⁴. Thirty-three municipalities (primary sampling units) were randomly selected in each domain, with the exception of Macro Region I (Metropolitan Region of the Capital), where 12 municipalities were selected in addition to the capital²⁴. Two census tracts (secondary sampling units - SSU) were then randomly selected in each selected municipality using probability proportional to the size of the tract population. In Macro Region I, 36 SSUs were selected, corresponding to 18 collection points. All households within the selected tracts were visited to locate adults in the relevant age group²⁴.

The age group considered by the present study was 35 to 44 years. The World Health Organization recommends this age for epidemiological surveys because it allows for the assessment of oral health and the general effects of treatment provided, thus providing a good measure of the overall oral health status of the adult population^{22,24}.

The reference standard used to calculate sample size was prevalence of dental caries, as used by recent national surveys and because tooth decay is the leading oral health problem^{10,24}. In addition, we used the calculation basis from data on periodontal status and use of and need for a dental prosthesis for the Southeast Region gathered by the National Oral Health Survey (SB Brasil 2010)¹⁰. The sample size formula was adjusted for the size of the reference adult population of each municipality based on data from the Population Projection System run by *Fundação SEADE*, resulting in a final sample of 6,051 adults²⁴.

Data was collected in each SSU (census tract) using the exhaustive method to obtain the minimum sample size, where all households along a planned route are visited and all persons from the relevant age group present are examined²⁴. Data collection is finalized when the minimum number of adults is obtained²⁴.

Individuals who had never visited the dentist or were unable to recall the last time they visited

the dentist and those who reported that they had used other dental services were excluded^{9,22}.

The data was collected by teams of dental surgeons and dental assistants who received training in consensus methods. Cohen's kappa coefficient was calculated in the final round and weighted for each examiner, age group, and problem, adopting a minimum acceptable value of 0.65²⁴.

The dependent variable was type of dental service used in the last visit: public or private/health plan. Independent variables were selected based on the behavioral model of health services use revisited by Andersen (1995) and used by previous studies of the use of dental services^{9,17,21,22,25}. According to this model, health service use is a function of interacting individual and contextual characteristics, the health system, and past use of services²⁵. The author divides the determinants into three groups: predisposing factors (individual and sociodemographic characteristics), enabling factors (income and health service characteristics), and need factors (perceived health status and health needs)^{9,21,22}. The predisposing variables were: age (35 to 45 years); sex (male and female); education level (≤ 9 years and ≥ 10 years of study); self-declared skin color (white and non-white, black, brown, yellow, and indigenous); and whether the respondent had had toothache (yes, no). The enabling variables were: household income (\leq R\$1,500, R\$1,501 to R\$2,500, and \geq R\$ 2,501); last dental visit (less than a year, more than a year); reason for the last dental visit (check-up, treatment/pain/extraction); and satisfaction with treatment (satisfied, indifferent/unsatisfied). The need variables were: need for endodontic treatment (yes, no); need for upper or lower dental prosthesis (yes, no); and satisfaction with oral health status/teeth (satisfied, indifferent/unsatisfied). The variables were dichotomized using the median as a parameter.

The prevalence of public and private dental service use was calculated for each independent variable and a crude analysis was performed using Pearson's chi-squared test to test the strength of association. Since a complex sample design was employed, the 95% confidence interval was calculated for the prevalence rates weighted using the census tract densification rate, number of respondents/examined individuals, and non-response rate. This information is essential for data correction, since it allows for weighting within census tracts and macro regions. Variables with a p-value of < 0.20 were then included in the adjusted logistic regression model. The odds

ratios (OR) and its 95% confidence interval were calculated. It is important to note, however, that the OR calculated using this technique may overestimate associations and therefore the possibility of overestimation cannot be ruled out¹⁴. The variables with significance level of < 0.05 were maintained in the final model. Since sex, household income, and education level are considered confounding variables¹⁴, three alternative logistic models were constructed: the first including the variables education level and sex, the second with household income and sex, and the third with education level and household income¹⁴. The first model is presented because it showed the greatest strength of association with public dental service use¹⁴. However, statistically significant associations between household income and sex and public dental service use were also shown in the other two models. Statistical analysis was performed using the program PSPP for Windows Version 0.8.

The research project was approved by the Research Ethics Committee at the Piracicaba School of Dentistry (number 111/2015) and conducted in accordance with Resolution 466 (12 December 2012) regarding research involving human subjects issued by the National Health Council. Each individual examined under the study signed an informed consent form²⁴.

Results

Three hundred and forty-two (5.65%) of the 6,051 respondents were excluded, resulting in a final total of 5,709 (94.3%) study participants, of which 2,288 (40.1%) used public services on their last dental visit and 3,421 (59.9%) used private services/health plan.

The prevalence rates of public and private dental service use for the predisposing variables are presented in Table 1. Adults in the younger age group (51.2%), women (68.0%), adults with a higher education level (50.5%), whites (62.4%), and those who had not had toothache (68.5%) visited the dentist more often. The prevalence of public service use was highest in adults who had had toothache (51.1%), followed by those with a lower education level (50.2%), and non-whites (46.4%), while the prevalence of use of private services/health plan was highest among adults with a higher education level (69.9%), followed by those who reported not having had toothache (65.1%), whites (63.7%), men (63.5%), and adults in the older age group (60.8%).

Dental service use was greatest in adults with lower household income (41.3%), those who had visited the dentist within the last year (56.1%), those where the reason for visiting the dentist was treatment/pain/extraction (75.0%), and those who were satisfied with last treatment received (86.0%). Prevalence of public dental service use was 52.1% in adults who had a household income of less than R\$1,500, 41.4% in those who had not visited the dentist in the last year, 43.1% in those who reported that the reason for visiting the dentist was treatment/pain/extraction, and 40.2% in those who were satisfied with the last treatment received. On the other hand, prevalence of the use of private dental services/health plan was greatest among adults with a higher household income (77.8%), followed by those who reported that the reason for their last dental visit was a check-up (67.8%), those who had visited the dentist within the last year (61.3%), and those who were indifferent/unsatisfied with the last treatment received (61.2%) (Table 2).

With respect to the need variables, 351 (6.1%) of the adults needed endodontic treatment, 1,835 (32.2%) needed an upper dental prosthesis, 2,654 (46.6%) needed a lower dental prosthesis, and 3,132 (55.3%) were indifferent/unsatisfied with their oral health status/teeth. Among the adults who sought public dental services, 187 (53.3%) needed endodontic treatment, 887 (48.3%) needed some type of upper dental prosthesis, 1,220 (46.0%) needed some type of lower dental pros-

thesis, and 1,355 (43.3%) reported being indifferent/unsatisfied with their oral health status/teeth (Table 3).

Table 4 shows the results of the final logistic regression model predicting the factors associated with public dental service use. The model included predisposing, enabling, and needs factors associated with public dental service use. In the multivariate model, a strong association was maintained between most of the predisposing and enabling variables and the outcome. An association was maintained between the following predisposing factors and public dental service use: being a woman, lower education level, being non-white, and having had toothache. Public dental service use was a protective factor for men (OR = 0.85; 95% CI: 0.74; 0.96) and adults with a higher education level (≥ 10 years of study) (OR = 0.52; 95% CI: 0.46; 0.60). Individuals who reported having had toothache were 1.6 times (95% CI: 1.39; 1.83) more likely to seek public services than those who did not, while adults with lower household income were 2.37 times (95% CI: 2.11; 2.65) more likely to seek public services than those with a higher income. The need for endodontic treatment was associated with public dental service use (OR = 1.44; 95% CI: 1.12; 1.85). The removal of the variable "household income" from the model changed the variance of the estimates of the crude model. This change was more pronounced for the variable "sex". In the adjusted model, men were 1.21 times more likely to seek

Table 1. Prevalence of public and private dental service use among adults in the State of São Paulo according to predisposing factors. Brazil, 2016.

| Variables | Private/Health Plan | | | Public | | | Total (%) | p-value ^b |
|-------------------------|---------------------|------|---------------------|--------|------|---------------------|--------------|----------------------|
| | n | % | 95% CI ^a | n | % | 95% CI ^a | | |
| Age | | | | | | | | 0.204 |
| 35 to 39 years | 1,728 | 59.1 | (58.4;59.8) | 1,195 | 40.9 | (40.8;50.0) | 2,923 (51.2) | |
| 40 to 45 years | 1,693 | 60.8 | (60.0;61.6) | 1,093 | 39.2 | (39.1;39.3) | 2,786 (48.8) | |
| Sex | | | | | | | | < 0.001 |
| female | 2,259 | 58.2 | (57.6;58.8) | 1,621 | 41.8 | (41.1;42.5) | 3,880 (68.0) | |
| male | 1,162 | 63.5 | (62.2;64.8) | 667 | 36.5 | (34.8;38.2) | 1,829 (32.0) | |
| Education level (years) | | | | | | | | < 0.001 |
| ≤ 9 years | 1,405 | 49.8 | (49.7;49.9) | 1,418 | 50.2 | (50.1;50.3) | 2,823 (49.5) | |
| ≥ 10 years | 2,016 | 69.9 | (69.1;70.7) | 869 | 30.1 | (28.9;31.3) | 2,885 (50.5) | |
| Skin color | | | | | | | | < 0.001 |
| White | 2,270 | 63.7 | (63.0;64.4) | 1,293 | 36.3 | (36.2;36.4) | 3,563 (62.4) | |
| Non-white | 1,151 | 53.6 | (52.4;54.8) | 995 | 46.4 | (45.1;47.7) | 2,146 (37.6) | |
| Toothache | | | | | | | | < 0.001 |
| Yes | 872 | 48.9 | (47.3;50.5) | 913 | 51.1 | (49.6;52.6) | 1,785 (31.5) | |
| No | 2,522 | 65.1 | (64.6;65.6) | 1,353 | 34.9 | (34.2;35.6) | 3,875 (68.5) | |

a) 95% CI (95% Confidence Interval). b) p-value: significance level using Pearson's chi-squared test.

Table 2. Prevalence of public and private dental service use among adults in the State of São Paulo according to enabling factors. Brazil, 2016.

| Variables | Private/Health Plan | | | Public | | | Total (%) | p-value ^b |
|-----------------------------|---------------------|------|---------------------|--------|------|---------------------|--------------|----------------------|
| | n | % | 95% CI ^a | n | % | 95% CI ^a | | |
| Household income (R\$) | | | | | | | | < 0.001 |
| ≤ 1,500 | 1,016 | 47.9 | (46.6;49.2) | 1,104 | 52.1 | (50.9;53.3) | 2,120 (41.3) | |
| ≥ 1,501 and ≤ 2,500 | 1,080 | 61.8 | (60.4;63.2) | 667 | 38.2 | (37.5;38.9) | 1,747 (34.0) | |
| ≥ 2,501 | 986 | 77.8 | (76.1;79.5) | 282 | 22.2 | (19.0;25.4) | 1,268 (24.7) | |
| Last dental visit | | | | | | | | 0.035 |
| Less than a year | 1,940 | 61.3 | (60.6;62.0) | 1,222 | 38.7 | (38.6;38.8) | 3,162 (56.1) | |
| More than a year | 1,448 | 58.6 | (58.5;58.7) | 1,024 | 41.4 | (40.2;42.6) | 2,472 (43.9) | |
| Reason for visit | | | | | | | | < 0.001 |
| Check-up | 938 | 67.8 | (66.2;69.4) | 446 | 32.2 | (30.2;34.2) | 1,384 (25.0) | |
| Treatment/pain/extraction | 2,358 | 56.9 | (56.4;57.4) | 1,789 | 43.1 | (42.5;43.7) | 4,147 (75.0) | |
| Satisfaction with treatment | | | | | | | | 0.434 |
| Satisfied | 2,916 | 59.8 | (59.3;60.3) | 1,963 | 40.2 | (39.6;40.8) | 4,879 (86.0) | |
| Indifferent/unsatisfied | 488 | 61.2 | (58.8;63.6) | 309 | 38.8 | (35.6;42.0) | 797 (14.0) | |

a) 95% CI (95% Confidence Interval). b) p-value: significance level using Pearson's chi-squared test.

Table 3. Prevalence of public and private dental service use among adults in the State of São Paulo according to need factors. Brazil, 2016.

| Variables | Private/Health Plan | | | Public | | | Total (%) | p-value ^b |
|---|---------------------|------|--------------------------------|--------|------|--------------------------------|--------------|----------------------|
| | n | % | CI _{95%} ^a | n | % | CI _{95%} ^a | | |
| Endodontic treatment | | | | | | | | < 0.001 |
| Yes | 164 | 46.7 | (46.0;47.4) | 187 | 53.3 | (46.9;59.7) | 351 (6.1) | |
| No | 3,257 | 60.8 | (60.4;61.2) | 2,101 | 39.2 | (38.6;39.8) | 5,358 (93.2) | |
| Upper prosthesis | | | | | | | | < 0.001 |
| Yes | 948 | 51.7 | (50.3;53.1) | 887 | 48.3 | (46.9;49.7) | 1,835 (32.2) | |
| No | 2,463 | 63.8 | (63.3;64.2) | 1,398 | 36.2 | (35.5;36.9) | 3,861 (67.8) | |
| Lower prosthesis | | | | | | | | < 0.001 |
| Yes | 1,434 | 54.0 | (53.0;55.0) | 1,220 | 46.0 | (44.9;47.1) | 2,654 (46.6) | |
| No | 1,977 | 65.0 | (64.3;65.7) | 1,064 | 35.0 | (34.0;36.0) | 3,041 (53.4) | |
| Satisfaction with oral health/ teeth | | | | | | | | < 0.001 |
| Satisfied | 1,624 | 64.1 | (63.1;65.1) | 909 | 35.9 | (34.6;37.2) | 2,533 (44.7) | |
| Indifferent/unsatisfied | 1,777 | 56.7 | (55.9;57.5) | 1,355 | 43.3 | (42.3;44.3) | 3,132 (55.3) | |

a) 95% CI (95% Confidence Interval). b) p-value: significance level using Pearson's chi-squared test.

public dental services than women. Statistically significant associations were maintained between public dental service use and the other variables in the model without household income, with gains in the strength of association for the variables sex and need for endodontic treatment.

Discussion

The prevalence of public dental service use among adults was a little over 40%, which is higher than the rate reported by a study conducted in Minas Gerais in 2012¹. A study involving municipalities with more than 100,000 inhabitants in the State of Maranhão using data from 2007 showed that the prevalence of the use of private services/health plan among adults was 55.6%¹⁷. A

Table 4. Predisposing, enabling, and need factors associated with public dental service use among adults in the State of São Paulo, Brazil, 2016.

| Variables | OR ^a | 95% CI ^b | p-value ^c | p-value ^d |
|-------------------------|-----------------|---------------------|----------------------|----------------------|
| Predisposing | | | | |
| Sex | | | 0.012 | 0.002 |
| Female | 1 | | | 1 |
| Male | 0.85 | (0.74;0.96) | | 1.21 (1.07;1.37) |
| Education level (years) | | | < 0.001 | < 0.001 |
| ≤ 9 years | 1 | | | 1 |
| ≥ 10 years | 0.52 | (0.46;0.60) | | 0.47 (0.42;0.53) |
| Skin color | | | < 0.001 | < 0.001 |
| White | 1 | | | 1 |
| Non-white | 1.32 | (1.16;1.50) | | 1.36 (1.21;1.53) |
| Toothache | | | < 0.001 | < 0.001 |
| No | 1 | | | 1 |
| Yes | 1.60 | (1.39;1.83) | | 1.64 (1.45;1.86) |
| Enabling | | | | |
| Household income | | | < 0.001 | - |
| ≥ R\$ 1,500 | 1 | | | - |
| ≤ R\$ 1,501 | 2.37 | (2.11;2.65) | | - |
| Need | | | | |
| Endodontic treatment | | | 0.005 | 0.003 |
| No | 1 | | | 1 |
| Yes | 1.44 | (1.12;1.85) | | 1.41 (1.12;1.78) |
| Nagelkerke's R2 | 0.13 | | | |

a) OR (odds ratio: likelihood ratio). b) 95% CI (95% Confidence Interval). c) p-value: significance level using the Wald test. d) p-value: significance level using the Wald test – model without household income.

nationwide study conducted in 2003 showed that 51.8% of adults used public services on their last dental visit²². The discrepancies in the prevalence of dental service use may be explained by differences in the age groups used to characterize the adult population^{11,17,22}.

According to Andersen, predisposing and enabling factors related to the individual and family should consider how people view their own general health and whether or not they judge their problems to be of sufficient importance and magnitude to seek professional help²⁵. With regard to predisposing and enabling factors, women, people with a lower education level, non-whites, and people with a lower household income were more likely to use public dental services⁹. The greater use of public dental services by women may be related to the fact that women have more time available to visit public health centers during opening hours²².

Education level (predisposing factor) and household income (enabling factor) were associated with the outcome in the multivariate model. Household income influences purchasing

power for dental services, while education level is related to the level of understanding or awareness regarding illnesses and dental care^{1,3-5,9,21,22}. For Andersen¹⁵ and other authors²⁵, differences in socioeconomic status (household income) indicate the presence of inequity (unfair inequality) in dental service use.

The variable toothache (predisposing factor) and need variables associated with public dental service use provide important insights into the impacts of oral health policy on collective oral health and quality of life^{12,26}. In this respect, studies show that there is a high prevalence of oral health problems and tooth loss among adults in Brazil^{10,27}. The inclusion of OHTs in the FHS in 2000 and restructuring of the NOHP in 2004 led to major advances at all levels of attention, including the creation of oral health teams and implementation of dental specialty centers and regional dental prosthesis laboratories^{12,26,28}, resulting in the decentralization of oral health actions and expansion of access to non-specialist and specialist public dental services^{12,26,28}. The increased demand for private dental services in Brazil may

have been influenced by improvements in average income and a reduction in the unemployment rate (employability). On the other hand, currently, high unemployment rates may be leading adults to seek public services, with strong evidence showing the need to strengthen the NOHP as a policy to drive social inclusion and equity.

However, it is not clear whether the increase in the provision of non-specialist and specialist dental services and decentralization of the NOHP have led to a reduction in inequalities in access to dental healthcare^{27,28}. The National Health Survey, which assessed access to and utilization of dental services among Brazilians aged over 18, showed that primary care centers account for 19.6% of all dental care and that 11.0% of adults had lost all their teeth, corresponding to 16 million lost teeth²⁹. Previous studies have shown that the prevalence of dental service use for check-ups or prevention is lower in public dental services^{9,10}. A study conducted in Minas Gerais using data from 2012 reported that only 22.6% of adults visited the dentist for prevention or check-ups⁹. In this respect, research suggests that the inclusion of OHTs in family healthcare centers has not led to a major change in traditional patterns of service delivery, indicating that this may be due to the historic lack of access to dental care for the adult population and that preventive actions tend to prioritize children and fail to reach adults^{22,26-28}.

Level of need indicates the immediate reason for use of dental services²⁷. In this respect, the need for endodontic treatment was associated with type of dental service in the adjusted analysis. This finding suggests that public service users demand more complex curative and rehabilitative treatment and have poorer oral health status²². It also indicates that there is a suppressed demand for this type of service among the study population and that socioeconomically disadvantaged populations have limited access to specialist dental services, which has also been shown by international³⁻⁵ and national^{9,15,18,27} studies. This may be related to the organization of service delivery in Brazil, which prioritizes maternal and child health, schoolchildren, and individuals with a higher level of need for care^{26,28}. The problem-solving approach to dental care contradicts the modern approach to oral health care, which is centered on oral health surveillance and monitoring and prevention, thereby minimizing the need for dental

restoration and extractions^{5,22}. However, some predisposing (toothache) and need variables are potentially modified by health professionals through prevention, empowering subjects to change their behavior and the beliefs, attitudes, and values they have regarding oral health²¹.

Due to the cross-sectional study design, it was not possible to determine the cause-and-effect relationship between variables and we sought to identify individual markers of the type of dental service used. Although the rate of refusal to participate in the study was low, the timing of data collection may have precluded individuals who were not at home/at work at the time of the interview from participating. This resulted in a larger proportion of women in the sample, meaning that the greater use of dental services by women may have been overestimated, adversely affecting external validity. Furthermore, the OR can influence the variance of estimates, suggesting that caution should be taken when interpreting the results³⁰. On the other hand, the study has a wide reach, richness of data obtained from clinical examinations, and adopted robust methodological criteria, despite the low non-response rate and exclusion of adults who reported never having visited the dentist/ having used other types of dental services, who may show different patterns of use of dental services. Finally, some of the variables rely on the memory of the respondents and therefore may have been affected by response bias. In this respect, some individuals may have exaggerated care-seeking and reported recent visits to the dentist to not appear that they neglected their oral health.

In short, the findings show inequalities in access to dental services among adults in the State of São Paulo. The prevalence rates suggest that private services/health plans were used more than public dental services. The use of the model proposed by Andersen allowed us to identify some of the predisposing, enabling, and need factors that explain public dental service use among adults. The variables associated with public dental service use (education level, having had toothache, and need for endodontic treatment) suggest that mechanisms designed to enhance access should be improved, particularly those linked to information. It is hoped that the findings of this study may prompt positive changes in oral health care for Brazilian adults, regardless of the type of service used.

Collaborations

SGO Fonseca and MC Meneghim participated in study conception and design and in drafting the article. EP Fonseca participated in data analysis and interpretation. MC Meneghim participated in the critical revision of the article. All authors approved the final version to be published.

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