


Factors associated with not consulting a physician in the 12 months prior to interview with adults and elderly in the city of Rio Grande, Rio Grande do Sul, Brazil, 2016: a cross-sectional study*

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Abstract

Objective: to investigate prevalence and factors associated with not consulting a physician in the last 12 months in Rio Grande, RS, Brazil, 2016. **Methods:** this was a population-based cross-sectional study, using Poisson regression for multivariate analysis. **Results:** a total of 1,297 individuals took part in the study; average age was 46 years old (SD=17, ranging from 18 to 96); and median per capita family income was BRL 1,000 in the last month (IQR: 600 – 1,760); prevalence of non-consultation in the last 12 months was 20.0% (95%CI 17.5;22.6); associated factors, after adjusting for potential confounders, were male sex, being single, having low schooling, excessive alcohol consumption, smoking, having fewer comorbidities, and having no health plan. **Conclusion:** one in five individuals did not consult a doctor in the last 12 months; use of this service was lower among the poorest and those with a poorer lifestyle.

Keywords: Health Equity; Medical Care; Health Services Accessibility; Health Services Research; Cross-Sectional Studies.

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Introduction

The mission of the Brazilian National Health System (SUS) is to promote free of charge and universal access to health services and programs by all Brazilian citizens who need them. The public system operates alongside the private system, referred to as Supplementary Health, access to which is dependent on the client's ability to pay. Supplementary Health is defined as all forms of private health care, whether or not it is provided by means of health insurance.^{1,2}

Use of health services is understood to mean all direct contact, through medical consultations and hospitalizations, and all indirect contact, by means of access to preventive and diagnostic tests

Much progress has been achieved in the thirty years in which SUS has been in existence. However, change in health system structure and scaling up of the number of health care facilities and staff does not ensure that these services adequately reach the entire population or meet its needs. Research indicates that factors associated with Public Health services are more affected by social inequalities than factors associated with Supplementary Health system services.^{1,3-5}

Use of health services is understood to mean all direct contact, through medical consultations and hospitalizations, and all indirect contact, by means of access to preventive and diagnostic tests.⁶ The procedure by which service users enter the SUS system is a positive expression of access to Public Health, the use of which is influenced by factors relating to the individual who seeks these services, such as their health needs profile, values and preferences.⁷

Factors indicated to explain why adults and elderly people do not consult with physicians include the following: being male, less educated and family income.^{8,9} A meta-analysis conducted in 2017 found that medical consultation frequency in the last year was 71%.¹⁰ Other national studies with adults found similar results for having had a medical consultation in the last year, ranging between 64.8% and 74.2%.^{2,11,12}

Understanding factors influencing use or non-use of health services, by means of population-based studies,

assists perception of demand for health services, recognition of the reality faced by the population and health service management capacity building.¹³ Having knowledge of the profile of the population that does not use services can contribute to proposal of policies to promote these people's access to the health system and, as a result, improve their health and that of the general population. The need therefore exists to gain knowledge about groups at risk of not having medical consultations, in the sense of identifying priority individuals to be targeted with Public Health policies and actions.

The objective of this study was to analyze prevalence and factors associated with not consulting a physician in the last 12 months among individuals living in the urban area of the municipality of Rio Grande, Rio Grande do Sul (RS) state, Brazil, in 2016.

Methods

This was a cross-sectional study forming part of the project entitled 'Health of Rio Grande's Population'. The project was carried out in 2016 with the aim of assessing aspects of the health of people living in the city of Rio Grande, RS, which is located some 320km from the state Porto Alegre, in the far south of Brazil. The municipality's population is estimated to be 209,378 inhabitants (2017), its gross domestic product (GDP) per capita is R\$ 34,997.50 (2015) and its municipal human development index (HDI-M) is 0.744.

The criteria for including inhabitants of Rio Grande in the study were: (i) being aged 18 or over; and (ii) living in the urban area of the municipality of Rio Grande. People institutionalized in nursing homes, hospital and prisons, as well as those physically or mentally unable to answer the questionnaire administered by the interviewers were excluded. The sample size was calculated considering expected frequency of 10%, a two-percent margin of error and a 95% confidence level, resulting in an 'n' of 860 individuals. After adding 10% to this number for possible losses and refusals, plus 15% for the sample design effect, the 'n' needed to conduct the study was 1,075 individuals. For the purpose of studying associated factors, we used a 95% confidence level, 80% statistical power, outcome prevalence of 10%, exposure frequency of between 20% and 60% and a prevalence ratio of 2.0. This calculation led to an 'n' of

784 individuals. We added 10% to this number to allow for possible losses and refusals, 15% for the sample design effect and 20% to control confounding factors, resulting in an 'n' of 1,137 individuals.

The sampling process took place in two stages, the first being the selection of census tracts and the second the selection of households. In order to select the census tracts we prepared a list in descending order of the monthly income of all the heads of the households (77,835). The first household to be visited was selected at random and the selection interval was established (1,080) in order to identify the census tracts to which the households belonged, totaling 72 tracts. This resulted in 23,439 households in the selected census tracts. The households were thus selected systematically and proportionally to the size of the census tract. All adults aged 18 years or over living in the selected households were interviewed. Seven hundred and eleven households were visited in order to meet the calculated sample size, as we expected to find on average two dwellers per household aged 18 years or over.

The data were collected using a questionnaire administered during interviews in the households of the selected individuals between April and July 2016. The questionnaire was administered by interviewees who had been trained beforehand (recruited and selected in February and March 2016) and took around 30 minutes to complete. At the same time as data collection, quality control was performed on 10% of the sample by means of a telephone interview comprising key questions in order to identify possible fraud when administering the questionnaire. A high agreement coefficient was found ($Kappa=80\%$). The data were input twice using EpiData version 3.1. Further information on the study methods has been published.¹⁴

The dependent variable was the prevalence of not having had a medical consultation in the 12 months prior to the interview, as reported by interviewees. The following demographic and socio-economic variables were collected:

- sex (male; female);
- age range (in years: 18-39, 40-59, 60 or over);
- marital status (single; married/separated/divorced/widowed);
- race/skin color (white; brown; black), six individuals self-reported yellow (Asian) skin color and four

self-reported being indigenous. All these individuals were excluded from the analysis;

- lives alone (no; yes);
- schooling (in years of study: 0-8, 9-11, ≥ 12); and
- family income (in terciles: lowest; intermediate; highest).

The following behavioral variables were analyzed:

- tobacco smoking (being a smoker at the time of data collection: no; yes); and
- abusive alcohol intake (five measures or more for men and four measures or more for women in the last 30 days: no; yes).¹⁵

Data relating to health conditions were also collected:

- morbidities (number of self-reported health problems [defined by medical diagnosis]: hypertension; diabetes; dyslipidemias; heart disease; stroke; arthritis or rheumatism; cancer; chronic kidney failure; chronic respiratory disease); and
- self-perception of health (excellent or very good; good; regular or poor).

The following health service variables were analyzed:

- has health insurance (no; yes);
- has been visited by a community health agent (ACS) in the 12 months prior to the interview (no; yes);
- had their last medical consultation on the SUS (no; yes);
- household falls within a Family Health primary care center (UBSF) catchment area (reported by the interviewee: no [or doesn't know]; yes); and
- household neighborhood falls within a UBSF catchment area (information provided by the City Health Department: no; yes).

Except for the last variable above, all variables were obtained based on participant self-reported information during the interview at their household.

The univariate analysis served to describe the sample (absolute frequency and relative frequency). We used Poisson regression for the crude and adjusted analysis, taking into consideration the sample design effect. The measurements shown were prevalence ratio (PR) and 95% confidence interval (95%CI), together with the Wald test p value.

The multivariate analysis followed a hierarchical model prepared in order to control possible con-

founding factors, while possible associated factors were taken to be those indicated in the literature. In the model we adopted, the demographic and socio-economic variables were put on the first level (sex, age range, race/skin color, marital status, schooling and family income). Behavioral variables were put on the second level (tobacco smoking and abusive alcohol intake). Health conditions were verified on the third level (number of health problems and self-perception of health). On the fourth level we analyzed the variables relating to health service use (has health insurance; has been visited by an ACS; had their last medical consultation on the SUS; household within UBSF catchment area [according to interviewee]; household neighborhood within UBSF catchment area [according to City Health Department]).

Each variable was controlled for the other variables classified on the same level or on the levels above it. The significance level for keeping the variables in the adjusted model was 20%; while the statistical significance level for two-tailed tests was 5%. Ordinal variables were analyzed using the linear trend test *p* value. Statistical analyses were performed using Stata version 11.2.

The research project was submitted to the Federal University of Rio Grande (FURG) Health Ethics Research Committee (CEPAS) and was approved by it in March 2016: Process No. 20/2016. All participants signed a Free and Informed Consent form (TCLE).

Results

Of the 1,429 eligible individuals identified, 1,297 were interviewed, representing a 90.2% response rate. Slightly more than half (56.6%) the sample were female, approximately one quarter (24.1%) were elderly, 83.6% were of White race/skin color, 46.3% were single, 9.6% lived alone and 41.8% had eight years of schooling (Table 1). Median family income was BRL 2,780 (interquartile range: BRL 1,760 – BRL 4,920).

The majority (55.9%) had a health problem and one third (33.7%) perceived their health as being regular or poor. Around half (52.6%) had health insurance, nearly a quarter (23.9%) had been visited by an ACS, 41.4% had had their last medical consultation on the SUS, 35.0% stated that their household was registered with a UBSF and 37.7% lived within UBSF catchment areas (Table 2).

Prevalence of not having had a medical consultation in the last 12 months was 20.0% (95%CI 17.5;22.6). This prevalence varied between 6.3% for those who had three or more health problems and 30.9% for those who consumed alcohol in excess.

The crude analysis (Tables 3 and 4) shows that the following were associated with not having had medical consultation in the 12 months prior to the interview: being male, having between zero and eight years of schooling, consuming alcohol or tobacco, having between zero and two health problems, perceiving one's health as being excellent or very good and good, not having health insurance and having had their last medical consultation on the SUS.

Except for the 'self-perception of health' and 'last medical consultation on the SUS' variables, all other associations remained statistically significant after adjusted analysis (Tables 3 and 4). Moreover in the adjusted analysis, the 'marital status' variable, which was not associated with the outcome in the first analysis, revealed that single people were 36% more likely to not have had a medical consultation in the last 12 months.

The 'age range', 'race/skin color', 'lives alone', 'family income', 'visited by ACS', 'household within UBSF catchment area' (self-reported by interviewee) and 'household neighborhood within UBSF catchment area' (identified by City Health Department) variables did not show association with the outcome in the crude analysis nor in the adjusted analysis.

Discussion

The results of this study indicated that one fifth (20%) of the sample had not had a medical consultation in the last 12 months. The groups most likely to have this characteristic were males, single people, those with less schooling, fewer health problems, those who consumed alcohol in excess and smokers.

The results of a population-based study conducted in the municipality of São Leopoldo, RS, in 2011, indicated that of the 1,098 respondents, 56.7% (95%CI 53.8;59.7) had not had a medical consultation in the last 30 days.⁸ Another study by the same author and in the same data collection site indicated that 15.4% (95%CI 13.2;17.5) had not had a medical consultation in the 12 months prior to the interview,¹³ demonstrating that the prevalence of not having a medical consultation

Table 1 – Description of the demographic and socio-economic characteristics of individuals living in the urban area of Rio Grande (n=1,297), Rio Grande do Sul, Brazil, 2016

Variable	n	%
Sex		
Male	563	43.4
Female	734	56.6
Age range (in years)		
18-39	508	39.1
40-59	477	36.8
≥60	312	24.1
Race/skin color (n=1,285)		
White	1.074	83.6
Brown	103	8.0
Black	108	8.4
Marital status		
Single	600	46.3
Married/separated/divorced/widowed	697	53.7
Living alone (n=1,296)		
No	1.172	90.4
Yes	124	9.6
Schooling (in years) (n=1,295)		
0-8	541	41.8
9-11	399	30.8
≥12	355	27.4
Family income (in terciles) (n=1,169)		
Lowest	426	36.4
Intermediate	366	31.1
Highest	377	32.3
Tobacco smoking		
No	1.064	82.0
Yes	233	18.0
Abusive alcohol intake (n=1,294)		
No	1.142	88.2
Yes	152	11.8

in the municipality of Rio Grande was significantly higher. However, when considering the national context, the reality of the municipality studied reflects progress with increased accessibility to physicians: the percentage of Brazilians who did not use medical services in the 12 months prior to the survey fell from 44.8% in 1998 to 28.7% in 2013.¹⁶

According to the results of a variety of studies,^{5,11,12,17-20} when asked if they had consulted a doctor less in the last 12 months, males reported using this service significantly less, when compared to females. Culturally, male individuals seek specialized care in particular

because of the worsening or complication of an already existing clinical condition,^{11,17,21} while females (mainly those of childbearing age) seek to have their health monitored over time and for preventive purposes.^{11,12,20,22-24} Greater use of health services by females may also be a reflection of how the Brazilian health system is organized, having mother and child health care as one of its priorities.^{21,24}

With regard to other socio-demographic characteristics, we found that single individuals had fewer medical consultations. A study conducted in the municipality of Montes Claros, MG, in 2011 found

Table 2 – Description of health-related data of individuals living in the urban area of Rio Grande (n=1,297), Rio Grande do Sul, Brazil, 2016

Variable	N	%
Morbidities (number of health problems) (1,274)		
0	561	44.1
1	326	25.6
2	212	16.6
3 or more	175	13.7
Self-perception of health		
Excellent or very good	278	21.4
Good	582	44.9
Regular or poor	437	33.7
Has health insurance		
No	615	47.4
Yes	682	52.6
Visited by an ACS^a		
No	987	76.1
Yes	310	23.9
Had last medical consultation on the SUS^b (n=1,279)		
No	749	58.6
Yes	530	41.4
Household within UBSF^c catchment area, as reported by interviewee (n=1,296)		
No	842	65.0
Yes	454	35.0
Household neighborhood within UBSF^c catchment area, as mapped by City Health Department		
No	808	62.3
Yes	489	37.7
TOTAL	1,297	100.0

a) ACS: community health agent.
 b) SUS: Brazilian National Health system.
 c) UBSF: Family Health Primary Care Center.

similar results in that it identified higher prevalence of not having had a medical consultation in the last 15 days among individuals who were not in a common law relationship or were not married.⁶ A possible explanation for this finding, identified in the literature, is the fact of married individuals being more likely to consult a doctor due to the influence of their partner.¹⁷

Another aspect found here was the fact of individuals with low levels of schooling having fewer medical consultations in the 12 months prior to the study, thus corroborating other Brazilian studies.^{5,6,12,20-22,24} Higher levels of schooling may be related to more knowledge and positive behaviors with regard to health; these behaviors include greater and more adequate use of health services.^{6,20,22,23}

Moreover, the literature reveals that individuals with lower levels of income and schooling tend

to use the public health system more for medical care,^{5,6,25} while those with higher income/schooling use the private health system.¹² Also noteworthy is the fact that family income did not show significant association with the outcome of interest of this article, indicating that difficulties in getting care may possibly be more associated with issues of information and communication⁶ than with financial aspects.

Furthermore, the number of chronic health problems revealed itself to be a determining factor for having medical consultations: the greater the number of health problems, the lower the likelihood of not having had a medical consultation in the last 12 months, reflecting, as expected, greater demand for these consultations. As widely described in the literature,^{5,6,11,19-23} the presence of a health condition that requires medical monitoring increases the

Table 3 – Crude and adjusted analysis of the demographic, socio-economic and behavioral variables of individuals living in the urban area of Rio Grande (n=1,297), Rio Grande do Sul, Brazil, 2016

Level	Variable	% non-consultation	Crude analysis		Adjusted analysis	
			PR ^a (95%CI ^b)	p value ^c	PR ^a (95%CI ^b)	p value ^c
1	Sex			<0.01		0.01
	Male	24.3	1.45 (1.14;1.85)		1.41 (1.09;1.81)	
	Female	16.8	1.00		1.00	
1	Age range (in years)			0.23		0.15
	18-39	18.5	1.00		1.00	
	40-59	22.6	1.22 (0.92;1.63)		1.31 (0.96;1.80)	
	≥60	18.6	1.01 (0.72;1.41)		1.09 (0.74;1.62)	
1	Race/skin color			0.17		0.51
	White	19.3	1.00		1.00	
	Brown	27.2	1.41 (0.97;2.05)		1.23 (0.85;1.80)	
	Black	19.4	1.01 (0.67;1.51)		1.00 (0.67;1.51)	
1	Marital status			0.09		0.02
	Single	22.2	1.22 (0.97;1.53)		1.36 (1.06;1.76)	
	Married/separated/divorced/widowed	18.2	1.00		1.00	
1	Lives alone			0.18		0.78
	No	19.5	1.00		1.00	
	Yes	25.0	1.28 (0.89;1.84)		1.06 (0.71;1.57)	
1	Schooling (in years of study)			0.01		0.02
	0-8	23.5	1.57 (1.19;2.08)		1.56 (1.14;2.13)	
	9-11	19.8	1.33 (1.00;1.76)		1.34 (1.01;1.78)	
	≥12	14.9	1.00		1.00	
1	Family income (in terciles)			0.09		0.34
	Lowest	24.7	1.39 (1.00;1.93)		1.18 (0.80;1.76)	
	Intermediate	18.9	1.06 (0.74;1.51)		0.94 (0.64;1.39)	
	Highest	17.8	1.00		1.00	
2	Tobacco smoking			<0.01		0.01
	No	18.0	1.00		1.00	
	Yes	29.6	1.65 (1.33;2.05)		1.38 (1.09;1.73)	
2	Excessive alcohol intake			<0.01		0.01
	No	18.6	1.00		1.00	
	Yes	30.9	1.67 (1.24;2.24)		1.50 (1.10;2.04)	

a) PR: prevalence ratio.

b) 95%CI: 95% confidence interval.

c) Heterogeneity p value.

probability of using this type of service. According to data collected by the 2013 National Health Survey (PNS), presence of disease was the main motivation for using health services. This motivation intensifies as the number of comorbidities increases.²⁴ Moreover, the fact of age not having been associated with greater use of medical consultations indicated that effectively it is a person's clinical condition that may lead to their seeking more medical care and not necessarily their being older.^{21,22}

Behavioral characteristics, such as abusive alcohol intake or tobacco smoking, were found to be associated with greater prevalence of not having had a medical consultation in the last 12 months. The presence of unhealthy habits (possible agglomeration of associated factors – being male, reporting lower levels of schooling, being a smoker and having abusive alcohol intake) may be related to an individual being less concerned about their health status and thus being less inclined to use health services.²⁶ In the long term,

Table 4 – Crude and adjusted analysis of health conditions and health service variables of individuals living in the urban area of Rio Grande (n=1.297), Rio Grande do Sul, Brazil, 2016

Level	Variable	% non-consultation	Crude analysis		Adjusted analysis	
			PR ^a (95%CI ^b)	p value ^c	PR ^a (95%CI ^b)	p value ^c
3	Morbidities (number of health problems)			<0.01		<0.01
	0	26.0	4.14 (2.09;8.21)		4.91 (2.52;9.54)	
	1	20.6	3.27 (1.67;6.39)		3.79 (1.95;7.38)	
	2	14.6	2.33 (1.21;4.46)		2.46 (1.27;4.76)	
	3	6.3	1.00		1.00	
3	Self-perception of health			<0.01		0.25
	Excellent or very good	20.5	1.45 (1.07;1.95)		1.24 (0.89;1.72)	
	Good	24.2	1.71 (1.32;2.21)		1.28 (0.95;1.72)	
	Regular or poor	14.2	1.00		1.00	
4	Has health insurance			<0.01		0.01
	No	27.2	1.99 (1.58;2.51)		1.55 (1.10;2.17)	
	Yes	13.3	1.00		1.00	
4	Visited by an ACS^d			0.89		0.23
	No	20.0	0.98 (0.77;1.26)		1.18 (0.90;1.56)	
	Yes	20.3	1.00		1.00	
4	Had last medical consultation on the SUS^e			<0.01		0.06
	No	14.6	1.00		1.00	
	Yes	25.3	1.74 (1.38;2.19)		1.34 (0.99;1.81)	
4	Household within UBSF^f catchment area, as reported by interviewee			0.77		0.30
	No	19.8	0.97 (0.78;1.21)		1.16 (0.88;1.52)	
	Yes	20.5	1.00		1.00	
4	Household neighborhood within UBSF^f catchment area, as mapped by City Health Department			0.10		0.40
	No	18.4	0.81 (0.63;1.08)		0.96 (0.68;1.37)	
	Yes	22.7	1.00		1.00	

a) PR: prevalence ratio.
 b) 95%CI: 95% confidence interval.
 c) Heterogeneity p value.
 d) ACS: community health agent.
 e) SUS: Brazilian National Health System.
 f) UBSF: Family Health Primary Care Center.

these behaviors can lead to the appearance of illnesses and these, in turn, may lead to increased seeking of medical care.^{5,18,19}

With regard to the questions about the health system, not having health insurance increased the probability of not having medical consultations, thus corroborating the results found by the 2012 PNS²⁴ and other national household surveys.²³ Notwithstanding, individuals who had their last medical appointment on the SUS also had higher prevalence of not consulting a doctor. A secondary analysis, in turn, highlights greater prevalence of not consulting a doctor among those who had their last medical consultation on the

SUS, based on individuals who reported that their household did not fall within a UBSF catchment area. It is possible that these results reflect increased supply of services by the supplementary health segment, as well as difficulties in accessing public health services and/or negative assessment of the service provided.¹⁷ It should also be noted that the literature indicates different motives for seeking health services: whereas the private sector is used more for having tests and examinations of a preventive nature, the public sector tends to be sought more when an illness has already taken hold.² These findings are in line with those of our study.

Difficulties in accessing and using public health services can also be seen in the absence of significant association between not having medical consultations and UBSF coverage or ACS visits. Given that the Family Health Strategy (ESF) is characterized by continuing care and actively tracing patients,²⁷ it was to be expected that the group of individuals living in a UBSF catchment area would have been more likely to have had a medical consultation in the last 12 months.²⁵ However, according to a study conducted with 812 young adults/adolescents in Camaçari, BA, in 2012,²⁸ generally speaking, difference in the use of Primary Healthcare Services was also not statistically significant between those who lived in areas covered by the Family Health Strategy and those who did not.

The characteristics reported by the population we studied lead to the perception that some groups use health services according to their needs: individuals who feel they have less need had fewer medical consultations in the 12 months prior to the study, as did those reporting fewer morbidities or who perceived their state of health as being positive. In turn, during the same period analyzed, groups lacking greater care and closer monitoring (such as smokers, alcohol users and those with no health insurance) also had significantly fewer medical appointments. Identifying factors with the power to influence the use or otherwise of health services contributes to more adequate planning of services, enabling committed health service managers and health professionals to work so as to achieve the health conditions desired for the population they serve.¹³

Investigating only non-use of the health services, taken here to be medical consultations, is the first limitation of this study: interviewees can include both (i) the group of people who do not want/need to have a medical consultation and also (ii) the group of people with unmet demands, i.e. they seek health services but are unable to get an appointment that meets their needs. These are distinct and unelucidated factors among the study participants, although both groups are in a more vulnerable situation for not having sought medical care during the last 12 months. The second limitation of the study is the fact of it only having interviewed people living in the urban area, where access to health services can be easier when compared to the rural area, leading an underestimation of the true prevalence of not having medical consultations among the general population of Rio Grande. Finally, having

9.8% losses/refusals reduces the variability of the results found, despite this apparent shortcoming having been taken into account when calculating the sample size. The demographic profile of these individuals was not significantly different to that found in the sample, whereby the mean age of those lost to the study was that same as that of the respondents, although fewer males were lost in one of the neighborhoods visited.

Among the strong points of the study is the nature of population-based research and, consequently, the extent to which its results are representative. The authors were responsible for the only study conducted thus far in the municipality on this theme and which was unique with regard to the diversity of risk factors analyzed. We were able to find associated factors different to those reported in the literature but equally capable of interfering in the approach taken by the health professionals involved and improved access and care of health service users in the municipality. We recommend new studies intended to identify other factors associated with this population having medical consultations, as well as to identify those who seek medical consultations but whose needs go unmet.

Identification of such associated factors enables services to be planned in a manner more coherent with the reality and the needs of the municipality, enabling health service managers and health professionals to work more effectively in solving the population's health problems.¹³ Maximizing access, investing in specific health promotion, prevention and rehabilitation actions can have an impact – including an economic impact – on Public Health in Rio Grande, as per the conclusions reached by other studies conducted in the municipality and elsewhere in Brazil.^{3,4,13}

Authors' contributions

Almeida LMS and Ferreira LS contributed to the definition and interpretation of the analyses and to writing the article. Teixeira TP contributed to data interpretation and critical review of the article. Dumith SC conceived the study, conducted the data analysis and critically reviewed the article. All four authors made substantial contributions to data analysis and interpretation, analyzed and approved the draft and final versions of the manuscript, ensuring its accuracy and integrity.

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