

Oral health access in Brazil: analysis of inequities and non-access from the service user's perspective, according to the National Primary Care Access and Quality Improvement Program, 2014 and 2018*

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Abstract

Objective: To investigate factors associated with non-access to oral health in Brazil. **Methods:** This was a cross-sectional study of data from external evaluations of the National Primary Care Access and Quality Improvement Program (2014 and 2018), using hierarchical multivariate logistic regression. 'Non-access' was defined as the service user not being able to make an appointment with a dentist. **Results:** We analyzed data on 37.262 individuals (2014 sample) and on a further 117.570 individuals (2018 sample). Greater likelihood of non-access was found for those who live in municipalities with greater inequalities and with less oral health coverage, those whose travel time to the health center is more than 11 minutes, being female, being aged between 25 and 39 years and those whose income was up to 1 minimum wage. **Conclusion:** Non-access was associated with municipal factors such as greater inequality; organizational factors such as less oral health coverage and travel time to the health center; and individual factors such as sex, age and income.

Keywords: Cross-Sectional Studies; Health Services Accessibility; Dental Health Services; Primary Health Care.

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Introduction

Despite the constitutional guarantee of health as a universal right, including oral health as a component of quality of life in comprehensive health care, the expansion of oral health services within the Brazilian National Health System (SUS) has encountered barriers such as lack of resources, limited availability of services, and the influence of socioeconomic and demographic factors.^{1,2}

Inequalities in access to health services are, generally, related to socioeconomic, demographic and organizational factors, and can result in poorer oral health conditions among historically excluded groups, such as the elderly and people with low levels of schooling and/or low income.

Diverse studies have addressed oral health access, especially with the objective of evaluating the impact on the improvement of the coverage of these services after the implementation of the National Oral Health Policy in 2004.³⁻⁵ Progress has been achieved. However, several national studies have shown that despite this many Brazilians do not have full access to these services, and that access is conditioned to intense inequalities.^{4,6,7}

Expanding oral health care continues to be challenge for the SUS.^{8,9} Inequalities in access to health services are, generally, related to socioeconomic, demographic and organizational factors, and can result in poorer oral health conditions among historically excluded groups, such as the elderly and people with low levels of schooling and/or low income.⁵ Such access should be prioritized for these groups, in order to mitigate the inequities generated by adverse social conditions.¹⁰ It is also important to evaluate the socio-spatial context of health centers, in order to understand certain health inequalities based on socioeconomic and demographic-territorial patterns.⁵

The National Primary Care Access and Quality Improvement Program (PMAQ-AB) was implemented in 2011, with the aim of improving public health service access and quality.¹¹ The program underwent three

external evaluation cycles between 2012 and 2018. However, it is necessary to assess whether PMAQ-AB has effectively contributed to improving access to primary health care services, including oral health care services, or whether adverse municipal, organizational, or individual factors related to users of these services having difficulty in accessing them remain or are even reinforced. Evaluation of this contributes to identifying possible barriers, capable of interfering in the availability of oral health care services and their use by the population.

It is also important to monitor investments and strategies relating to these actions, their effectiveness in consolidating the National Oral Health Policy and reducing oral health inequalities in Brazil. Comparing the results of the different PMAQ-AB external evaluation cycles will allow us to accompany the evolution of access indicators and possible determining factors, thus contributing to the evaluation of services and supporting decision making in oral health practice planning.

In the midst of this broad scope of National Oral Health Policy and PMAQ-AB issues, the objective of this study was to investigate factors associated with non-access to oral health from the perspective of SUS users, based on data collected during the 2nd and 3rd external evaluation cycles of the PMAQ-AB.

Methods

This was a cross-sectional study using secondary data taken from the 2nd and 3rd PMAQ-AB external evaluation cycles conducted in 2014 and 2018. The study also used demographic data for Brazil as a whole. The average national human development index (HDI) was estimated as being 0.755 for a population of 209,895,323 inhabitants in 2020 (<https://www.br.undp.org/content/brazil/pt/home/idh0/rankings/idh-global.html>).

PMAQ-AB, established by the Ministry of Health through the publication of Ordinance MS/GM No. 1,654 dated July 19, 2011, consists of five phases: (i) adherence by municipalities and health teams and agreement setting, (ii) development of actions, (iii) external evaluation, and (iv) agreement resetting with health teams and identification of new indicators.

PMAQ-AB external evaluation involves on-site verification of health service access and quality conditions. These are organized into six distinct modules:

Module I - Observation at primary health care centers;

Module II - Interview with a Primary Care team health professional and checking documents at the health center;

Module III - Interview with a service user at the primary health care center;

Module IV - Interview with a Family Health support group professional;

Module V - Observation of oral health care at the health center;

Module VI - Interview with an oral health team professional and checking documents at the health center.

By means of interviews with oral health team service users, Module III evaluated issues related to satisfaction with services, and service use and access conditions.¹¹

The data were selected from the interviews conducted with service users who answered the questions on the study outcome variable, i.e. access to dental services. In the 2nd and 3rd PMAQ-AB external evaluation cycles, which occurred in 2014 and 2018, 114,615 and 140,444 interviews were conducted, respectively.

This study used the micro-database available on the webpage of the Health Ministry's Primary Health Care Secretariat (<https://aps.saude.gov.br/ape/pmaq>), for the 2nd and 3rd PMAQ-AB external evaluation cycles. Specifically, we used the Module III database – Interviews with service users at primary health care centers.

Data on the HDI and the Gini Index were retrieved from the website of the Brazilian Institute of Geography and Statistics (IBGE) (<http://atlasbrasil.org.br/2013/>) for Brazil's 5,570 municipalities based on the 2010 Demographic Census. Data on oral health coverage in Brazil were retrieved from the Ministry of Health website (<https://egestorab.saude.gov.br/paginas/ acessoPublico/relatorios/relHistoricoCoberturaSB.xhtml>). In both these procedures, data were retrieved from the Ministry of Health and IBGE websites relating to the same periods in which the PMAQ-AB interviews were conducted, i.e. 2014 and 2018. The data were retrieved in October 2019.

To avoid possible bias, the data was tabulated and analyzed in a 'blind' coded manner, using the same codes as those contained in the original spreadsheets.

The 'access to dental services' outcome variable was collected during PMAQ-AB Module III, by asking the following guiding question: *Are you able to make an appointment with a dentist at this health center?*

The answer categories 'Yes' and 'Never tried to make an appointment' were considered to be absence of barriers to access, i.e. access; while the 'No' answer

category was taken to be non-access. The 'Never tried to make an appointment' category was included as absence of barriers (and therefore considered to be access) because if the service user had never tried to use the service, it is not possible to affirm that there was an impediment to its use.

The independent variables selected for the study were divided into 'municipal environmental variables', 'health service organization variables' and 'individual variables'.

The municipal environmental variables were the HDI, the Gini Index and the history of oral health coverage in the interviewee's municipality of origin. The health service organization variables used were 'time taken to get to the health center', 'type of service provision', 'appointment made for the same day', whether 'opening hours meet user needs', number of 'periods of the day in which the health service is open' and 'how many days a week the health service is open'. Finally, the individual variables were 'sex', 'age group', 'race/skin color', 'schooling', 'income' and 'registered with a minimum income program' (in this case, '*Bolsa Família* Program beneficiary'). The description of the variables and respective categorizations are shown in Figure 1.

Initially, the variables were analyzed descriptively, with the objective of characterizing the sample, through frequency distribution.

Following this, hierarchical logistic regression analysis was performed, with the municipal environmental variables on the first level, the service organization variables on the second level, and the individual variables on the third level. Odds ratio measurements (odds ratio, OR, and respective 95% confidence intervals, 95%CI) were obtained considering $p < 0.05$. The Wald backward stepwise selection method was adopted, and only variables that obtained a p -value < 0.20 were kept in the final model. The Hosmer-Lemeshow goodness of fit method was applied. The analyses were performing using the Statistical Program for the Social Sciences: SPSS for Windows, Version 20.0 (IBM Corp., Armonk, NY, USA).

Results

There were 114,615 respondents in the 2nd cycle (2014) and 140,444 in the 3rd cycle (2018) of the PMAQ-AB external evaluation. Only 32.5% ($n=37,262$) answered the outcome variable during the 2nd cycle and most of them were female (82.6%), in the 25-39 year age group (39.7%), of non-white race/skin color (65.1%),

Variables	PMAQ-AB ^a interview question	Categorization
Dependent variable		
Access to oral health services	<i>Are you able to make an appointment with a dentist at this health center?</i>	1. Access or never tried to make an appointment 2. Non-access
1st Level – Municipal environmental variables		
Municipal human development index (HDI-M)	(b)	1. Low HDI-M ^d 2. High HDI-M
Gini Index	(b)	1. Low Gini ^d 2. High Gini
Oral health coverage	(c)	1. Low or medium coverage ^d 2. High coverage
2nd Level – Health service organizational variables		
Time taken to get to the health center	<i>How long does it take you to get from your home to this health center?</i>	1. Up to 10 min. 2. Up to 30 min. 3. Over 30 min.
Type of service provision	<i>Usually, when you manage to make an appointment, what sort of appointment is it?</i>	1. Scheduled appointment 2. Order of arrival 3. Fitting in/other
Appointment made for the same day	<i>When you manage to make an appointment is it usually on the same day?</i>	1. Yes 2. No
Opening hours meet user needs	<i>Do the opening hours of this health center meet your needs?</i>	1. Yes 2. No
Periods of the day in which the health service is open	<i>During what period of the day is this health center open?</i>	1. 1 to 2 periods 2. 3 periods
How many days a week the health service is open	<i>How many days a week is this health service open?</i>	1. Up to 5 days 2. 6 days 3. 7 days
3rd Level – Individual variables		
Sex	Sex	1. Male 2. Female
Age group (years)	<i>How old are you?</i>	1. 6 - 14 2. 15 - 24 3. 25 - 49 4. 50 - 64 5. 65 or over
Race/skin color	<i>From among the options I'm going to read, what is your skin color or race?</i>	1. White 2. Non-white
Schooling	<i>What is your level of education?</i>	1. None or just able to read and write 2. Elementary education 3. High school education 4. Higher education
Income (minimum wages: MW)	<i>Do you know how much salary or payment for your work you received last month? If yes, how much?</i>	1. Up to 1 MW 2. More than 1 MW
Registered with a minimum income program	<i>Are you a Bolsa Família beneficiary?</i>	1. Yes 2. No

Figure 1 – Description of the study variables

a) PMAQ-AB: National Primary Care Access and Quality Improvement Program; b) municipal environmental variables, retrieved from the Brazilian Institute of Geography and Statistics (IBGE) (<http://atlasbrasil.org.br/2013/>); c) oral health coverage variable, retrieved from the e-Gestor Atenção Básica platform (<https://egestorab.saude.gov.br/paginas/ acessoPublico/relatorios/ relHistoricoCoberturaSB.xhtml>); d) categorization according to the median.

Table 1 – Descriptive analysis of the municipal environmental variables, service organization variables and individual variables, taken from the National Primary Care Access and Quality Improvement Program 2nd and 3rd evaluation cycles, Brazil, 2014 and 2018

Variables		2 nd Cycle				3 rd Cycle			
		Access/never tried to access		Unable to access		Access/never tried to access		Unable to access	
		n	%	n	%	n	%	n	%
Level 1 – Municipal environmental variables									
HDI-M^a	Low HDI-M	17,508	47.0	2,135	5.7	53,791	45.8	1,664	1.4
	High HDI-M	14,998	40.3	2,621	7.0	59,031	50.2	3,053	2.6
Gini Index	Low Gini	17,981	48.3	2,354	6.3	59,518	50.6	1,926	1.6
	High Gini	14,525	39.0	2,402	6.4	53,304	45.4	2,791	2.4
Oral health coverage	Low or medium coverage	12,184	32.8	2,410	6.5	50,998	43.4	3,086	2.6
	High coverage	20,223	54.4	2,333	6.3	61,854	52.6	1,632	1.4
Level 2 – Service organization variables									
Time taken to get to the health center	Up to 10 min.	19,992	53.8	2,695	7.2	67,684	58.2	2,450	2.1
	11 - 30 min.	10,189	27.4	1,694	4.6	37,013	31.9	1,905	1.6
	Over 30 min.	2,233	6.0	361	1.0	6,834	5.9	313	0.3
Type of service provision	Scheduled appointment	6,628	17.8	1,266	3.4	96,050	84.4	4,049	3.6
	Order of arrival	25,233	67.7	3,356	9.0	12,147	10.7	470	0.4
	Fitting in or other	645	1.7	134	0.4	984	0.9	44	0.0
Appointment made for the same day	Yes	16,036	43.5	1,755	4.8	46,677	41.2	1,155	1.0
	No	16,149	43.8	2,924	7.9	62,170	54.8	3,404	3.0
Opening hours meet user needs	Yes	28,697	77.7	3,799	10.3	107,484	91.8	4,082	3.5
	No	3,539	9.6	913	2.4	4,911	4.2	613	0.5
Periods of the day in which the health service is open	1 to 2 periods	31,000	83.2	4,471	12.0	97,219	89.0	4,013	3.7
	3 periods	1,506	4.0	285	0.8	7,715	7.0	335	0.3
How many days a week the health service is open	1 - 4 days	1,724	4.6	296	0.8	2,782	2.4	200	0.2
	5 days	29,529	79.3	4,258	11.4	101,881	88.8	4,042	3.5
	6 or 7 days	1,253	3.4	202	0.5	5,531	4.8	292	0.3
Level 3 – Individual variables									
Sex	Male	5,881	15.8	633	1.7	24,936	21.2	729	0.6
	Female	26,625	71.4	4,123	11.1	87,916	74.8	3,989	3.4
Age group (years)	≤24	5,193	13.9	841	2.3	14,250	12.1	632	0.5
	25-39	12,736	34.2	2,032	5.5	34,726	29.5	1,821	1.6
	40-59	10,278	27.6	1,455	3.9	38,581	32.8	1,633	1.4
	≥60	4,299	11.5	428	1.1	25,295	21.5	632	0.6
Race/skin color	White	11,168	30.5	1,629	4.4	36,484	31.4	1,230	1.1
	Non-white	20,801	56.8	3,051	8.3	74,899	64.5	3,445	3.0
Schooling	None or just able to read and write	3,179	8.5	330	0.9	12,049	10.3	278	0.2
	Elementary education	14,863	39.9	2,111	5.7	48,855	41.7	1,989	1.7
	High school education	12,086	32.5	1,971	5.3	41,545	35.4	2,037	1.7
	Higher education	2,344	6.3	339	0.9	10,248	8.7	407	0.3

a) HDI-M: municipal human development index.

To be continued

Continuation

Table 1 – Descriptive analysis of the municipal environmental variables, service organization variables and individual variables, taken from the National Primary Care Access and Quality Improvement Program 2nd and 3rd evaluation cycles, Brazil, 2014 and 2018

Variables	2 nd Cycle				3 rd Cycle				
	Access/never tried to access		Unable to access		Access/never tried to access		Unable to access		
	n	%	n	%	n	%	n	%	
Level 3 – Individual variables									
Income (minimum wages: MWs)	No income	20,651	58.3	2,974	8.4	12,326	12.5	627	0.6
	Up to 1 MW	3,183	9.0	481	1.4	28,092	28.6	1,152	1.2
	1 - 3 MWs	6,717	19.0	1,034	2.9	42,936	43.7	1,781	1.8
	4 or more MWs	331	0.9	46	0.1	10,997	11.2	366	0.4
<i>Bolsa Família</i> Program beneficiary	Yes	12,241	32.9	1,767	4.7	34,409	30.2	1,804	1.6
	No	20,236	54.4	2,988	8.0	74,988	65.7	2,839	2.5

a) HDI-M: municipal human development index.

Table 2 – Multivariate binary logistic regression of factors related to user non-access to Primary Care oral health services, based on the National Primary Care Access and Quality Improvement Program 2nd external evaluation cycle, Brazil, 2014

Variables		β	p-value	OR ^a	95%CI ^b
Level 1 – Municipal environmental variables					
HDI-M ^c	Low HDI-M	-0.168	p<0.001	0.86	0.78;0.91
	High HDI-M	1.00		1.00	
Gini index	Low Gini	1.00		1.00	
	High Gini	0.106	0.002	1.11	1.04;1.19
Oral health coverage	Low or medium coverage	0.362	p<0.001	1.44	1.33;1.55
	High coverage	1.00		1.00	
Level 2 – Service organization variables					
Time taken to get to the health center	Up to 10 min.	1.00		1.00	
	11 - 30 min.	0.153	p<0.001	1.17	1.09;1.25
	Over 30 min.	0.181		1.20	1.05;1.36
Type of service provision	Scheduled appointment	1.00		1.00	
	Order of arrival	-0.120	p<0.001	0.89	0.82;0.96
	Fitting in or other	0.240	0.042	1.27	1.01;1.60
Appointment made for the same day	Yes	1.00		1.00	
	No	0.325	p<0.001	1.39	1.29;1.49
Opening hours meet needs	Yes	1.00		1.00	
	No	0.545	p<0.001	1.73	1.58;1.88
Periods of the day in which the health service is open	1 to 2 periods	-0.096	0.194	0.91	0.79;1.05
	3 periods	1.00		1.00	
How many days a week the health service is open	1 - 4 days	0.118	0.002	1.13	0.91;1.39
	5 days	-0.113		0.89	0.76;1.05
	6 or 7 days	1.00		1.00	

a) OR: odds ratio; b) 95%CI: 95% confidence interval; c) HDI-M: municipal human development index. Note: The 'income' and '*Bolsa Família* Program beneficiary' variables were removed during the regression stages.

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Continuation

Table 2 – Multivariate binary logistic regression of factors related to user non-access to Primary Care oral health services, based on the National Primary Care Access and Quality Improvement Program 2nd external evaluation cycle, Brazil, 2014

Variables		β	p-value	OR ^a	95%CI ^b
Level 3 – Individual variables					
Sex	Male	-0.227	p<0.001	0.80	0.72;0.88
	Female	1.00		1.00	
Age group (years)	≤24	1.00		1.00	
	25-39	0.014	P<0.001	1.01	0.93;1.11
	40-59	-0.077		0.93	0.84;1.02
	≥60	-0.458		0.63	0.55;0.73
Schooling	None or just able to read and write	-0.149	0.062	0.86	0.72;1.03
	Elementary education	-0.011		0.99	0.87;1.13
	High school education	-0.043		1.04	0.92;1.19
	Higher education	1.00		1.00	

a) OR: odds ratio; b) 95%CI: 95% confidence interval; c) HDI-M: municipal human development index.
 Note: The 'income' and 'Bolsa Família Program beneficiary' variables were removed during the regression stages.

Table 3 – Multivariate binary logistic regression of factors related to user non-access to Primary Care oral health services, based on the National Primary Care Access and Quality Improvement Program 3rd external evaluation cycle, Brazil, 2018

Variables		β	p-value	OR ^a	95%CI ^b
Level 1 – Municipal environmental variables					
HDI-M^c	Low HDI-M	-0.272	p<0.001	0.76	0.70;0.84
	High HDI-M	1.00		1.00	
Gini Index	Low Gini	1.00		1.00	
	High Gini	0.321	p<0.001	1.38	1.28;1.48
Oral health coverage	Low or medium coverage	0.602	p<0.001	1.83	1.67;1.99
	High coverage	1.00		1.00	
Level 2 – Service organization variables					
Time taken to get to the health center	Up to 10 min.	1.00		1.00	
	11 - 30 min.	0.250	p<0.001	1.29	1.19;1.38
	Over 30 min.	0.165		1.18	1.01;1.37
Type of service provision	Scheduled appointment	1.00		1.00	
	Order of arrival	0.213	0.002	1.24	1.10;1.40
	Fitting in or other	-0.101		0.90	0.60;1.36
Appointment made for the same day	Yes	1.00		1.00	
	No	0.570	p<0.001	1.77	1.63;1.93
Opening hours meet needs	Yes	1.00		1.00	
	No	0.954	p<0.001	2.60	2.32;2.91
How many days a week the health service is open	1 - 4 days	0.250		1.28	1.02;1.62
	5 days	-0.221		0.80	0.69;0.93
	6 or 7 days	1.00		1.00	

a) OR: odds ratio; b) 95%CI: 95% confidence interval; c) HDI-M: municipal human development index.
 Note: The 'Periods of the day in which the health service is open' variable was removed during the regression stages.

To be continued

Continuation

Table 3 – Multivariate binary logistic regression of factors related to user non-access to Primary Care oral health services, based on the National Primary Care Access and Quality Improvement Program 3rd external evaluation cycle, Brazil, 2018

Variables		β	p-value	OR ^a	95%CI ^b
Level 3 – Individual variables					
Sex	Male	-0.200	p<0.001	0.82	0.74;0.91
	Female	1.00		1.00	
Age group (years)	≤24	1.00		1.00	
	25-39	0.159	p<0.001	1.17	1.05;1.31
	40-59	0.088		1.09	0.97;1.23
	≥60	-0.290		0.75	0.64;0.87
Race/skin color	White	1.00		1.00	
	Non-white	0.283	p<0.001	1.33	1.22;1.44
Schooling	None or just able to read and write	-0.404	p<0.001	0.67	0.54;0.82
	Elementary education	-0.032		0.97	0.84;1.11
	High school education	0.066		1.07	0.94;1.22
	Higher education	1.00		1.00	
Income (minimum wages: MWs)	No income	0.339		1.40	1.18;1.66
	Up to 1 MW	0.273	0.001	1.31	1.14;1.52
	1 - 3 MWs	0.195		1.22	1.07;1.38
	4 or more MWs	1.00		1.00	
Bolsa Família Program beneficiary	Yes	0.263	p<0.001	1.30	1.19;1.42
	No	1.00		1.00	

a) OR: odds ratio; b) 95%CI: 95% confidence interval; c) HDI-M: municipal human development index. Note: The 'Periods of the day in which the health service is open' variable was removed during the regression stages.

with elementary education (45.6%), with no income (66.7%) and not registered with *Bolsa Família* Program (62.4%). In the 3rd cycle, 83.7% of the interviewees (n=117,570) answered the outcome variable, mostly of the female gender (78.2%), in the 40-59 year age group (34.2%), with elementary education (43.4%), non-white (67.5%), with income between 1 and 3 minimum wages (45.5%), and were not *Bolsa Família* program beneficiaries (68.3%). Table 1 shows the descriptive analysis of the municipal environmental variables, health service organization variables and individual variables, for each cycle.

In the 2nd cycle, we found that living in municipalities with a lower HDI reduced the odds of not having access to oral health services (OR=0.86 - 95%CI 0.78;0.91). However, individuals living in more unequal municipalities, with higher a Gini Index, had greater odds of not having access to these services (OR=1.11 - 95%CI 1.04;1.19), compared to those

living in municipalities with a lower Gini Index. Greater odds of not having access was also found among residents of municipalities with lower oral health coverage (OR=1.44 - 95%CI 1.33;1.55) (Table 2).

With regard to the health service organization variables, also according to data from the PMAQ-AB 2nd external evaluation cycle, when the time taken to get to the health center was more than 30 minutes this increased the odds of not having access to oral health services (OR=1.20 - 95%CI 1.05;1.36), as did well as being fitted in to an appointment (OR=1.27 - 95%CI 1.01;1.60). The fact that appointments were not scheduled on the same day also increased the odds of not having access (OR=1.39 - 95%CI 1.29;1.49). Regarding health center opening hours, if the available appointment times did not meet the service user's needs, the odds of not having access increased (OR=1.73 - 95%CI 1.58;1.88).

With regard to the individual variables, male service users (OR=0,80 – 95%CI 0,72;0,88) and elderly

service users (OR=0,63 – 95%CI 0,55;0,73) had lower odds of not having access. The ‘race/skin color’, ‘income’ and ‘*Bolsa Família* beneficiary’ variables were not kept in the final regression model.

Table 3 shows the logistic regression results for the 3rd cycle. Living in municipalities with a lower HDI also reduced the odds of not having access to oral health services (OR=0.76 - 95%CI 0.70;0.84). Individuals living in more unequal municipalities (OR=1.38 - 95%CI 1.28;1.48) had higher odds of not having access, compared to those living in municipalities with a lower Gini Index. Greater odds of not having access were also found among residents of municipalities with lower oral health coverage (OR=1.83 - 95%CI 1.67;1.99).

With regard to the health service organization variables, according to data from the 3rd PMAQ-AB external evaluation cycle, taking between 11 and 30 minutes to get to the health center increased the odds of not having access to oral health (OR=1.29 - 95%CI 1.19;1.38), as well as care provided by order of arrival (OR=1.24; 95%CI 1.10;1.40). The fact that appointments at the health center were not scheduled for the same day also increased the odds of not having access to these services (OR=1.77 - 95%CI 1.63;1.93); likewise, if health center opening times did not meet the user’s needs, the odds of not having access increased (OR=2.60 - 95%CI 2.32;2.91). When the health service was open fewer days a week – between 1 and 4 days – this increased the odds of not having access (OR=1.28 - 95%CI 1.02;1.62), compared to health centers that were open 6 or 7 days a week. The ‘periods of the day in which the health service is open’ variable was not part of the final logistic regression model for the 3rd cycle.

Regarding the individual variables, males had less odds of not having access to services (OR=0.82 - 95%CI 0.74;0.91). With regard to age group, those aged 25 to 39 years had greater odds of not having access (OR=1.17 - 95%CI 1.05;1.31), compared to younger individuals, while the odds of elderly people not having access were lower (OR=0.75 - 95%CI 0.64;0.87). Those who referred to themselves as being non-white had greater odds of not having access (OR=1.33 - 95%CI 1.22;1.44), compared to those of white race/skin color, as did individuals who had no income (OR=1.40 - 95%CI 1.18;1.66) and *Bolsa Família* Program beneficiaries (OR=1.30 - 95%CI 1.19;1.42). Individuals who had no formal education or had not completed elementary

education had lower odds of not having access (OR=0.67 - 95%CI 0.54;0.82), compared to those who had complete higher education.

Discussion

This study assessed factors associated with non-access to oral health services during the 2nd and 3rd PMAQ-AB external evaluation cycles. The greatest odds of non-access were found among individuals living in municipalities with higher levels of inequality and lower oral health coverage, for whom it took more than 11 minutes to get from their home to the health center. Similarly, greater odds of non-access to oral health services were found when dental appointments were not available on the same day, when health center opening hours did not meet user needs, and when health services were open fewer days a week. Greater odds of non-access were found for females and being in the 24-39 year age group, not having income or having income of up to one minimum wage. It can therefore be inferred that characteristics related to municipalities, health service organization characteristics and individual characteristics of the Brazilian population as a whole, directly influence access to health services.

The most important characteristic for services being used is perhaps the availability of services that meet the user’s current needs.¹² This is why investment was made in expanding oral health coverage throughout Brazil by means of including oral health teams as part of the Family Health Strategy and also through the implementation of the National Oral Health Policy.¹³

Notwithstanding, it can be seen that availability alone is not sufficient to guarantee effective access. It is essential that services are used by those who need them.¹⁴ The data found by this study, in both PMAQ-AB external evaluation cycles, show that although the increase in oral health coverage has resulted in lower odds of non-access, the mere existence of dental services does not necessarily imply effective changes in service organization, so that barriers may remain which hinder their use.

It should be noted that service opening hours do not meet the needs of part of the population, and that this became worse between the 2nd and 3rd cycles, especially in the latter cycle when even greater difficulties were found in accessing health centers that

open fewer days a week and for less periods of the day. The presence of organizational barriers, such as incompatibility between health center opening hours and days and times that workers can attend appointments, hinders access and prevents their needs from being met, and can also generate health inequities. It is recommended that services also be offered at alternative times and days, such as during the night and/or at weekends, in order to meet this previously unattended portion of the population.¹⁵

It is also noteworthy that appointments at fixed times and by order of arrival, following appointment booking, favor access. This was found in particular in the 3rd PMAQ-AB external evaluation cycle. Organizing health care by booking appointments tends to be beneficial for the system, since it directs demands and enables actions to be organized better. On the other hand, only providing care in this way can lead to waiting lists and delays, in addition to not meeting the spontaneous demands of the community, which should also be equally met and attended to.²

In a study based on data from the 1st PMAQ-AB external evaluation cycle, conducted in 2012, Casotti et al.¹³ found that less than half the respondents in that cycle stated being able to make a dental appointment at health centers, and that organization of demand is one of the main difficulties for accessing these services, resulting in spontaneous demands not being met and longer waiting times.

Accessibility, i.e. absence of geographic barriers, is another aspect that has been evaluated and can be analyzed according to time taken to get to the health center, distance between home and health center, among other determinant factors.^{2,12} Our study revealed that when it takes longer to get to the health center there are greater odds of not having access to services, according to both the evaluation cycles we considered.

With regard to individual variables, diverse national ecological studies have used data from the health service access and use module of the IBGE National Household Sample Surveys. Examples include the study conducted by Barros & Bertoldi³ on data from the 1998 survey; and the study conducted by Peres et al.,⁴ who used data from the 2003 and 2008 surveys and also from the IBGE National Health Survey. Although those studies point to a reduction in access inequalities, individuals with lower levels of schooling and income, as well as older people, continue to report lower frequency of dental service use.^{1,3,4,6}

There was a reduction in the odds of non-access to oral health by elderly people in both PMAQ-AB external evaluation cycles studied here. This finding may represent a change in the historical model of oral health service organization, which used to prioritize younger age groups.¹⁶ Despite demographic transition having resulted in a growing elderly population, it can be inferred that policies and actions concerned with ensuring that this population has access to quality services are being prioritized.¹⁷ It is also important to verify whether actions are being taken to promote provision of comprehensive care for this population, such as home care and referral of care needs, when necessary, to specialized dental care services, such as provision of dentures, which are not available in Primary Health Care services.¹⁸

National surveys indicate that, even with decreasing inequalities in access to oral health, individuals belonging to the highest income quintiles have more access to these services when compared to those with lower income.^{4,19} The results of the 2nd cycle corroborate those surveys, although this problem became statistically insignificant in the 3rd cycle. However, the 3rd cycle showed that user participation in minimum income programs was a determinant of higher odds of non-access. In theory, affirmative policies should contribute to access to oral health care, since beneficiaries are required to undergo regular monitoring at their health center. However, oral health is not always included in the list of mandatory appointments, except in the case of pregnant women.

Studies point to access inequalities associated with educational level. In this sense, the odds of individuals with lower levels of schooling not accessing dental services are greater when compared to those with higher levels of education.²⁰

Individuals who live in more vulnerable social situations are more likely to become ill and therefore more likely to accumulate a greater number of health needs.⁸ For this reason, the principle of equity proposes that services should target these individuals.

The results of the study point to slight progress in oral health coverage and a decrease in the odds of elderly and illiterate individuals not accessing oral health services. Even so, comparing the PMAQ-AB external evaluation cycles allowed us to observe that municipalities where inequalities are greater and the presence of organizational barriers, such as scheduling appointments, insufficient availability of time and how

many days a week the health service is open, as well as access inequities, including non-prioritization of low-income individuals, are still present and require considerable efforts to reduce social inequalities.

The cross-sectional nature of this study should be considered, since it is not possible to identify a chronological relationship between the independent variables and the study outcome. Moreover, during the PMAQ-AB external evaluation phase, interviews are only conducted with Family Health Strategy service users and at health centers that have adhered to PMAQ-AB, and may represent a selection bias. Comparison of data from the two cycles should be done with caution, since the individuals interviewed are not the same. The study aims to provide information that enables accessibility indicators to be monitored, for the purposes of action planning and reduction of inequities in access to and use of oral health services.

Although progress has been observed in increasing oral health coverage in Brazil, the factors associated with non-access to oral health care in SUS primary care have not changed over the PMAQ-AB external evaluation cycles. Inequalities in access to dental services are still

observed, determined by organizational factors such as insufficient service hours to meet needs, restriction in the number of days these services operate, as well as health inequalities related to individual factors, such as income. Access of specific groups to dental care needs to be prioritized, by means of strategies for organizing health team work processes. Moreover, the implementation of public policies to combat socioeconomic inequalities is an essential measure to ensure equitable access to oral health services.

Authors' contributions

Freire DEWG, Freire AR, Lucena EHG and Cavalcanti YW contributed to the study concept and design. Freire DEWG and Freire AR drafted the first version of the manuscript. Freire DEWG and Cavalcanti YW contributed to the analysis and interpretation of the results. Lucena EHG and Cavalcanti YW critically reviewed the contents of the manuscript. All the authors have approved the final version and are responsible for all aspects of the study, including the guarantee of its accuracy and integrity.

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