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Research Article

Oral Health Services Inequalities: Uses and Supply in Different Brazilian Capital Cities

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Abstract

The aim of the present study was to identify if there is any associations between income inequality in the supply and use of oral health services in the 26 capitals and the Federal District, in 2006, 2010, and 2016. For each year group, the Gini coefficient, was use for the capitals, resulting in four possible outcomes: lower percentage of first programmatic dental consultation; lower percentage of Oral Health Teams; higher rate of medical plans with dentistry; and higher rate of exclusive dental plans. There was negative correlation between the number of Dental Specialty Centers and coverage of Oral Health Teams. There was an increase in Oral Health Teams and Dental Specialty Centers, especially between 2006 and 2010, and between 2010 and 2016. However, the impact of the National Oral Health Policy on equity of use of services remains unknown. Although there was no consistent and significant increase in the supply and use of public oral health services during the period studied, this cannot be attributed to income inequality. The more expressive increase in rate of exclusive dental plans in the more unequal capitals, probably to compensate for the deficiencies of the Unified Health System, constitutes an additional inequality for individuals with lower income.

Keywords: Oral Health; Inequality; Income per capita; Service Access

Introduction

Over the last 30 years, the Brazilian Unified Health System (SUS) has sought to observe the principles of universality, equity, integrality, and social participation, as established in the 1988 Federal Constitution [1].

According to a recent Human Development Report from the United Nations Development Programme (UNDP), among 140 countries, Brazil ranks as the tenth most unequal country in the world. Brazil has the third worst Gini coefficient for Latin America and the Caribbean, and most of its income is concentrated in the richest 1% of its population [2].

Beginning in 2004, with the formal adoption of the National Oral Health Policy (PNSB), also known as "Brasil Sorridente" (Smiling Brazil), there was an increase in funding and authorization of the oral health services network [3]. However, on its own, the growing deployment of Oral Health Teams (ESB) in the country has not been able to guarantee the greater use of services [4]. A 2017 study showed that the use of public dental services in Brazil remains around 30.7%, against 69.3% of private dental services [5]. This pattern of inequality has been associated, mainly with greater access for those with higher incomes [6-8]. This inequality in use was also demonstrated in the 2003 National Household Sample Survey (PNAD), in which researchers found that 18.7% of Brazilians had never consulted a dentist, and this proportion was significantly higher among the poorest Brazilians [9].

Evidence shows that the pattern of inclusion of the population into the health system is not linear and unidirectional [10]. According to Moreira, in "richer" families or in families with

an educated head of household, the majority of expenses are payments for private health plans, to the detriment of not using public services. The "poorer" and less educated families are at greater risk of not being able to obtain dental care, and spend more on purchasing medicines and resolving urgent problems [11].

The PNSB proposes to overcome inequality in health through the reorganization of care practices and improving the quality of the services [1]. Despite advances in recent years, the access to dentistry for the majority of Brazilians, in terms of a public health policy, remains a major challenge [6].

This study attempts to verify possible associations between income inequality and the supply and use of oral health services in the 26 capitals and in the Federal District (DF) in 2006, 2010, and 2016.

Methodology

An analytical study was undertaken using state capitals and the Federal District as observational units, with cut-off time comprising 2006, 2010, and 2016 using the oral health indicators from the Pact for Health (Pacto 2006), the population base update in the 2010 census, and the interest in analyzing the data, 10 years after the health pact.

The capitals assessed were grouped according to the Gini coefficient averages in each year (average in 2006 = 0.63, in 2010 = 0.62, and in 2016 = 0.53). Consequently, the capitals were classified each year into groups: G106, G110, and G116, consisting of one capital with less inequality, and G206, G210, and G216, the capital cities with the greatest inequality in each period.

The other variables adopted in this study were:

- Per capita income;
- Percentage coverage of Oral Health Teams (%ESB);
- Number of Dental Specialty Centers (nCEO);
- Percentage of first dental program consultation (1ªCons);
- Basic dental procedures per inhabitant per year (PAB/hab/year);
- Specialized care per inhabitant per year (MAC/hab/year);
- Number of dentists per thousand inhabitants (nºdent/1000hab);
- Rate of medical plans with dentistry (Txplmed);
- Rate of dental plans exclusively (Txplodont).

The information was obtained from different secondary databases as follows: Brazilian Institute of Geography and Statistics - IBGE, Department of Informatics of SUS - DATASUS, National Registry of Health Establishment - CNES, National Agency of Supplementary Health - ANS and National Health Fund - FNS

Statistical analysis

The Shapiro-Wilk test was used to verify the normal distribution pattern of the continuous variables. Those with normal distributions were expressed as means and standard deviations (mean ± SD), while those with non-normal distributions were expressed as medians and interquartile range (IQ).

For the comparative analyses between the groups (G106 and G206), (G110 and G210), and (G116 and G216), Student's unpaired t test or the Mann-Whitney test were used, according to the normality pattern of the continuous variables. The chi-square test was used to analyze categorical variables and for comparisons between two groups. The Pearson or Spearman correlation tests were used according to the normality pattern of the continuous variables. As shown in Table 1, to test the possible associations between income inequality and the use of oral health services, taking the medians as a cut-off point, four response variables (outcomes) were created as follows.

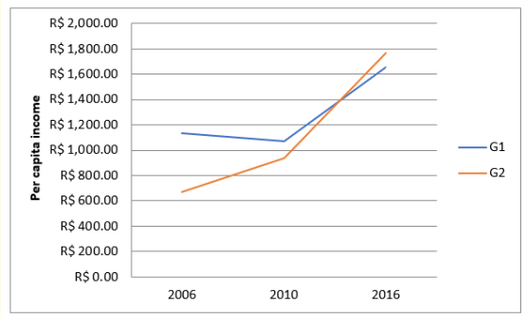
Response variables (outcomes)	Cut-off points		
	2006	2010	2016
Lower percentage of Oral Health Teams	<0.08	<0.07	<0.05
Lower percentage of first programmatic dental consultation	< 11.0	< 21.7	< 22.4
Higher rate of medical plans with dentistry	>23.0	>26.8	>35.5
Higher rate of exclusive dental plans	> 6.3	> 11.3	>17.1

Table 1: Cut-off points of outcomes (response variables), per year.

Univariate logistic regression analysis was used to identify the association between the percentage of ESB Coverage and the percentage of 1ªCons, and to test the association between income inequality and outcomes. Statistical analyses were performed using IBM SPSS software version 20.0. The significance level adopted was $p < 0.05$.

Results

In 2006, G1 had 69% higher per capita income than G2. In 2010, this difference decreased to 14.5%, while, in 2016, G2 had 6.3% higher per capita income than G1 (Figure 1).



	G1	G2
2006	1135.90	669.20
2010	1071.20	935.20
2016	1655.50	1768.00

Figure 1: Per capita income over the years.

Table 2 shows the results of the comparison of capital groups in each year. Although not significant, the percentage of the 1ªCons was higher in G2 in all years, but there was a decrease in this percentage in the period studied. On the other hand, in G1 this percentage remained the same in all years.

The results evidenced a tendency of increase in the rate of beneficiaries of medical plans with dentistry (Txplmed) in G210 and G216. On the other hand, the rate of beneficiaries of exclusively dental plans (Txplodont) was significantly higher in G210 and G216 (Table 2).

Table 3 shows the correlations between the variables used. There was a positive correlation, in all years, between per capita income and the variables, Txplmed, Txplodont, and nºdent/1000hab. Txplmed presented a positive correlation in all years, with the following variables: Txplodont and nºdent/1000hab. In 2006 and 2010, %ESB correlated positively with % 1ªCons and with the PAB/hab/year. There was a negative correlation between nCEO and %ESB in all years.

Variables	2006			2010			2016		
	G106		p	G110	G210	p	G116	G216	p
Per capita income (R$)	1135.9 (594.7-1267.5)	669.2 (582.3-738.0)	0.128	1071.20 (816.6-1495.9)	935.20 (792.8-1262.5)	0.252	1655.5 (1280.0-2459.0)	1768.0 (1461.0-1912.5)	0.252
%ESB	8.1 (2.7-20.0)	16.2 (9.4-29.6)	0.704	26.2 (12.2-41.3)	10.0 (5.0-22.0)	0.054	22 (13.6-42.5)	24.1 (11.0-31.6)	0.704
nCEO	5 (2.0-.5.5)	5.0 (2.5-5.5)	0.252	3.0 (2.0-3.5)	5.0 (5.0-10.5)	0.002	2.5 (2.0-5.0)	3.0 (4.0-7.5)	0.054
%1ªCons	0.07 (0.06-0.1)	0.12 (0.07-0.14)	0.252	0.07 (0.05-0.1)	0.08 (0.04s-0.18)	1	0.07 (0.05-0.10)	0.04 (0.03-0.07)	0.12
nDent/ 1000hab	0.5 ± 0.1	0.5 ± 0.5	0.992	0.9 (0.52-1.05)	0.6 (0.5-0.8)	0.252	0.9 ± 0.1	0.9 ± 0.1	0.959
PAB hab/year	0.4 (0.3-1.0)	0.8 (0.55-1.0)	0.252	0.6 (0.4-1.0)	0.7 (0.5-1.2)	0.707	1.1 (0.9-1.0)	0.8 (0.5-1.0)	0.11
MAChab/year	0.05 (0.0-0.2)	0.1 (0.0-0.1)	0.249	0.1 (0.1-0.1)	0.1 (0.0-0.2)	0.139	0.1 (0.5-0.1)	0.1 (0.5-0.1)	0.687
Txplmed (%)	38.0 (13.5-47.5)	23.0 (18.0-27.0)	0.449	24.8 (17.7-48.3)	27.4 (24.6-36.8)	0.994	29.4 (21.5-42.1)	38.6 (33.5-45.1)	0.166
Txplodont (%)	5.9 (2.0-8.5)	6.8 (3.1-7.5)	0.704	4.4 ± 1.0	8.7 ± 1.8	0.023	16.8 (6.8-23.0)	20.8 (12.9-22.2)	0.009

G106, GI10 and GI16: groups of state capitals with less inequality in 2006, 2010 and 2016; G206, G210 and G216::groups of state capitals with the greatest inequality in 2006, 2010 and 2016; 1ªCons: percentage of first dental program consultation; %ESB: percentage coverage of Oral Health Teams; nCEO: number of Dental Specialty Centers; PAB/hab/year: basic dental procedures per inhabitant per year; MAC/hab/year: specialized care per inhabitant per year; nDent/1000hab: number of dentists per thousand inhabitants; Txplmed :rate of medical plans with dentistry; Tx-plodont: rate of dental plans exclusively. Note: p value = G1 vs G2 in each year. Values expressed as mean and standard deviation or median and interquartile range.

Table 2: Comparison between state capitals groups in each year.

	2006		2010		2016	
	R	p	R	p	R	p
Per capita income						
Txplmed	0.848	0.000	0.757	0.000	0.792	0.000
Txplodont	0.402	0.038	0.535	0.004	0.54	0.004
nDent/ 1000hab	0.542	0.003	0.711	0.000	0.612	0.001
% ESB						
%1ªcons	0.515	0.006	0.455	0.017	-0.235	0.237
PAB/hab/ year	0.601	0.001	0.462	0.015	0.103	0.609
nCEO						
%ESB	-0.518	0.006	-0.65	0.000	-0.467	0.000
Txplmed						
Txplodont	0.651	0.000	0.638	0.000	0.682	0.000
nDent/ 1000hab	0.435	0.023	0.541	0.004	0.602	0.001

Txplmed:: rate of medical plans with dentistry; Txplodont; rate of dental plans exclusively; %ESB: percentage coverage of Oral Health Teamsl; %1ª cons:: percentage of first dental program consultation; nDent/1000hab: number of dentists per thousand inhabitants; nCEO: number of Dental Specialty Centers; PAB/ hab/year: basic dental procedures per inhabitant per year.

Table 3: Correlation between income inequality and the supply and use of oral health service variables, in 2006, 2010 e 2016.

Table 4 shows the results of the logistic regression analysis. In 2006, capital inequality was not associated with the outcomes tested (lower %ESB, lower % 1ªCons, higher Txplmed and higher Txplodont). However, when comparing the capital cities with higher and lower %ESB, the capitals with the lowest %ESB presented 5.6 times higher chance of presenting a lower %1ªCons (OR = 5.6 (1.1 - 29.4), p = 0.041).

The most unequal capitals in 2010 had 13.8 times higher chance of presenting higher Txplodont (OR = 13.8 (2.1 - 92.0), p = 0.007). Similarly, the odds of presenting lower %ESB were 20 times higher (OR = 20.0 (2.8-144.3), p = 0.003), and this significant association remained independent of per capita income (OR = 37, 7 (3.11-461.8), p = 0.005).

The most unequal capital cities in 2016 had 6.0 times higher chance of presenting lower %1ªCons (OR = 5.9 (1.1-32.0); p = 0.004), and 16.7 times greater chance of presenting greater Txplodont (OR = (16.7 - 164.8), p = 0.016). This association also remained significant, independent of per capita income (OR = 14.5 (1.4 - 149.9), p = 0.002).

%ESB (2006)	outcome: lower 1ªcons	Odds ratio (95%, IC)	p	
2006				
Higher %ESB (n=14)	4 (31%)	1	0.041	
Lower %ESB (n=13)	9 (69%)	5.6 (1.1-29.4)		
Income inequality	outcome: lower %ESB	Odds ratio (IC95%)	p	p*
2010				
G1 (n=15)	3 (23%)	1	0.003	0.005
G2 (n=12)	10 (77%)	20.0 (2.8-144.3)		
Income inequality	outcome: higher Txplodont	Odds ratio (IC95%)	p	p*
2010				
G1 (n=15)	2 (17%)	1	0.007	0.005
G2 (n=12)	10 (83%)	13.8 (2.1-92.0)		
2016				
G1 (n=16)	6 (37.5%)	1	0.016	0.026
G2 (n=11)	10 (62.5%)	16.7 (1.7-164.8)		

%ESB: percentage of Oral Health Teams; %1ªCons: percentage of first dental program consultation; Txplodont: rate of dental plans exclusively; IC: interquartile range; n: number.

Note: p*: p value after adjustment for *per capita* income.

Table 4

Discussion

The Gini coefficient measures inequality on a scale of 0 to 1. The closer to 1, the higher the concentration of income, and therefore, the greater the inequality [12]. In 2016, G2 capitals showed higher per capita income; however, they also had the worst Gini coefficients. It is believed that societies with a high level of income

concentration invest the least in social programs, resulting in poor public education and insufficient healthcare [13].

Several studies [14,15] have highlighted income inequality as a determinant of oral health, even in countries with universal health care systems [16]. Oral health, as an inseparable part of general health, is directly related to socioeconomic conditions and access to health services [17]. Surveys based on data from the latest epidemiological survey, SBBrasil 2010, showed important regional inequalities in oral health, and unfavorable positions for capitals in the North and Northeast regions [16,18]. According to Roncalli, maintaining good a level on the Human Development Index (HDI) is necessary to improve oral health levels, but to accelerate this process, it is necessary to tackle income inequality [19]. Considering that there was no difference between the groups regarding the supply and use of public services, and that in 2010 the most unequal capitals were 20 times more likely to have lower %ESB, the results suggest that the implementation of ESB in Brazilian capitals presented an "equity trend" [20]. The term "equity trend" has been adopted in studies that reveal associations in favor of cities with socioeconomic disadvantages [21].

Analysis of data from the National Program for Improving Access and Quality of Primary Care (PMAQ) showed that oral health did not follow the equitable implementation of primary care services. In 2013, approximately 31% of basic health units (BHU) in Brazil did not have oral health services [20].

The first dental programmatic consultation reveals the proportion of people living in a certain place attending programmatic dental consultations, that is, for dental treatment [22]. The results showed a decrease in the %1ªCons in recent years and did not follow the % ESB increase. In this respect, income inequality proved to be truly detrimental, since G216, despite having a higher % ESB, presented a six-fold higher chance of lower %1ªCons.

Rocha and Goes, 2012, when comparing access to oral health services in areas covered and not covered by the ESB, found no association with residing in one or another area, and that the number of individuals seeking the public service was much lower than those who sought private or contracted services [14].

The PNSB has boosted the growth of specialized care throughout the country. However, the results of this study demonstrated a stabilizing trend in nCEO. Investigations that have evaluated the implementation of PNSB in specialized care indicate that use of specialized services depend on the adequate functioning of primary care [5,22]. The research points to several problems in the functioning of this level of care, such as, meeting the demand for free services, prioritization of basic procedures, low productivity, and inadequate use of services [24,25].

Thus, the increase in Txplodont in recent years may relate to the difficulty in using CEOs. According to Cascaes, private expenditure on specialized dental treatment was about 10 times higher than that with basic procedures, and the acquisition of a dental plan is generally linked to the search for facilitation of payments for specialized procedures not included in the coverage role of the operators [26].

There was an increase in the number of dentists, nºdent/1000hab, in both groups, in the period studied. According to the Demographic Census of Dental Specialties in Brazil, conducted in 2010, municipalities with a Gini coefficient above 0.50 had 97% of the registered specialists; and the percentage of dentists in the capitals was 43.3% [27]. The positive correlation between the nºdent/1000inhab and per capita income can indicate the predominance of private and agreed practice in dentistry, and consequently, the increase in inequalities in the use of oral health, linked to income [21].

In 2010 and 2016, Txplodont was significantly larger in the most unequal capitals. The relationship between income inequality and the acquisition of health insurance plans became more evident, when in those years, the most unequal capital group (G2) presented a greater chance of acquiring a dental plan. The increase observed in the number of beneficiaries of dental plans can be attributed, among several factors, to difficulties in accessing oral health services, to changes in the profile of dentistry, as well as to income growth and employer benefits [28-30].

Although some authors correlate the difficulties faced by the SUS with the expansion of supplementary care, suggesting a compensation or substitution process, the data suggest a greater correlation between coverage by private insurance plans and the concentration of income and service provision [29].

Limitations of the study

Some limitations of this study include the restricted use of capital and not considering the potential inequalities between the various municipalities in Brazil. However, the choice of capitals is justified

because they have the highest urban concentrations of population and income, which are the focus of nation-wide studies. Another limitation could be the choice of the Gini coefficient as an indicator of socioeconomic inequality, to the detriment of other indicators. However, this option was chosen due to the availability of data, and met the methodological design parameters. A final limitation could be the use of secondary data, which may not include all aspects inherent in the service provision, and use patterns; however, they are official tools and may reveal key points that help evaluate public policies.

Conclusion

The impact of the PNSB on equity in use of services is still unknown. Although there was no consistent and significant increase in the supply and use of public oral health services during the period studied, this fact cannot be attributed to income inequality.

On the other hand, the more expressive increase in the acquisition of dental plans in the more unequal capitals, probably to compensate for the deficiencies in SUS, constitutes an additional inequality for individuals with lower incomes.

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