

**Analysis of the dental extraction index in a municipal context**  
**Análise do indicador de extração dentária a partir do contexto municipal**  
**Análisis del indicador de extracción dental a partir del contexto municipal**

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This study aims to evaluate the dental extraction index considering the many contextual variables of municipalities. This is a cross-sectional and ecological study. Data on odontological production (the number of Dental Extractions relative to the number of Individual Basic Odontological Procedures) in the year 2016, from all Brazilian municipalities, was found through DATASUS. These data were related to Brazilian Regions, Proportion of estimated populational coverage regarding oral health in the Family Health Strategy, number of Centers of Odontological Specialties (CEOs); Municipal Human Development Index (M-HDI) and the Gini coefficient (or Gini index). From the 12,1-25%, the Northeast region has a superior index when compared to the other regions. The north and northeast regions show the highest percentage of cities that conduct the highest number of dental extractions, as well as those who present the smallest Oral Health coverage, do not have CEOs, have a low M-HDI, and a Gini index lower than the national average. Therefore, it becomes necessary to Invert the offer of odontological procedures and guarantee to the population, especially for those in difficult socioeconomic conditions, health care and services that can carry out preventive actions to maintain and recover oral health, so that dental loss can be avoided.

**Descriptors:** Oral health; Health status indicators; Tooth extraction.

Este estudo tem como objetivo analisar o indicador de exodontia em relação às variáveis de contexto dos municípios. Realizou-se um estudo transversal e ecológico. Por meio do DATASUS, coletaram-se dados do indicador de produção odontológica (Razão do Número de Exodontias sobre Procedimentos Odontológicos Básicos Individuais) referentes ao ano de 2016, de todos municípios brasileiros. Estes dados foram relacionados a Regiões do Brasil, Proporção de cobertura populacional estimada de saúde bucal na Estratégia Saúde da Família, número de Centros de Especialidades Odontológicas (CEO); Índice de Desenvolvimento Humano Municipal (IDHM) e coeficiente de Gini (ou índice de Gini). A região nordeste possui um número maior de municípios com resultados entre 12,1% e 25%, quando comparada às demais regiões. As Regiões Norte e Nordeste apresentaram o maior percentual de municípios que realizam mais extrações dentárias, assim como aqueles que apresentam menor cobertura de Saúde Bucal. Não possuem CEO, têm IDHM muito baixo e índice GINI maior do que a média nacional. Conclui-se a necessidade de se inverter a oferta dos procedimentos odontológicos e garantir para a população, principalmente a menos favorecida socioeconomicamente, atendimentos e serviços que realizem ações de prevenção, manutenção e recuperação da saúde bucal, para que se possa reverter a perda dentária.

**Descritores:** Saúde bucal; Indicadores básicos de saúde; Extração dentária.

Este estudio tiene como objetivo analizar el indicador de exodoncia en relación a las variables de contexto de los municipios. Se realizó un estudio transversal y ecológico. Por medio del DATASUS, se colectaron datos del indicador de producción odontológica (Razón del Número de Exodoncias sobre Procedimientos Odontológicos Básicos Individuales), referentes al año 2016, de todos los municipios brasileiros. Estos datos fueron relacionados a Regiones de Brasil; proporción de cobertura poblacional estimada de salud bucal en la Estrategia Salud de la Familia; número de Centros de Especialidades Odontológicas (CEO); índice de Desarrollo Humano Municipal (IDHM) y coeficiente de GINI (o índice de GINI). De los 12,1-25%, la región Noreste posee un índice superior al compararlo a las demás regiones. Las regiones Norte y Noreste presentaron el mayor porcentaje de municipios que realizan extracciones dentales, así como aquellos que presentan menor cobertura de Salud Bucal, no poseen CEO, tienen IDHM muy bajo e índice GINI mayor que el promedio nacional. Se concluye la necesidad de invertir en la oferta de los procedimientos odontológicos y garantizar para la población, principalmente la menos favorecida socioeconómicamente, atención y servicios que realicen acciones de prevención, mantenimiento y recuperación de la salud bucal, para que se pueda revertir la pérdida dental.

**Descriptores:** Salud bucal; Indicadores de salud; Extracción dental;

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## INTRODUCTION

The proposal to include oral health in the public health system took place in 1986, year of the 1st National Oral Health Conference (CNSB). However, it was in 2003, with the implementation of "Brasil Sorridente" (Brazil Smiles), that the National Policy of Oral Health (PNSB) was created, converging towards principles and directives from the Unified Health System (SUS). That was done through sizeable technical efforts and the allocation of unprecedented financial resources. Local systems received incentives to seek new reorganizations of work, counting on the disposition of the public powers to manage Primary Health Care and increasing the offer of medium and high complexity procedures<sup>1</sup>.

With the insertion of oral health in the Family Health Strategy (ESF), it became necessary to seek new ways to practice and understand the exercise of odontology in the scope of collective health. This reorganization of odontological practices transformed the subjects in the oral health team, the dental surgeon (DS) and the oral health auxiliary/technician (OHA/OHT), in parts of a constant search for professional qualification, aiming to be part of a collective and develop programmatic actions inserted in this populational intervention strategy based on family-territory-community, aimed at effecting the principles of SUS<sup>1</sup>.

Therefore, in 2006, the Ministry of Health published the pact for health, a new perspective for the strategic advance in public health services and actions, aimed at overcoming the different evolution levels between states, thus consolidating SUS and approving the operational directives inherent to the System<sup>1,2</sup>.

The objective is that of promoting innovations in the management processes and instruments, so that the responses from SUS became better and more efficient. It also made explicit the commitment between health managers when it comes to actions that have an impact in the health of the Brazilian population. Still according to its decree, the Pact for Health defines its articulated and integrated priorities in three complementary

dimensions: Pact for Life, Pact in Defense of SUS and Pact for the Management of SUS<sup>1,2</sup>.

In the field of Odontology, specifically, the Pact for Health expresses its relevance in the process of evaluating and monitoring programs and services from Primary Care, through an inclusion of oral health indexes: estimated population coverage of Oral Health Teams in Family Health Strategy, means of the collective action of supervised dental brushing, and the proportion of dental extraction when compared to clinical procedures<sup>2</sup>.

Therefore, as an important subsidy to the organization and planning process of public services in Brazil, these indicators show themselves to be essential for the strengthening of oral health in Primary Care<sup>2</sup>.

The publishing of Decree n. 7,508, on July 28, 2011, as it regulated the aspects of Law n. 8.080, from September 19, 1990, when it comes to health planning, health assistance, inter-federation articulation and regionalization, among other aspects, fulfills its role in the improvement of processes and practices that are inherent to a new cycle of management at SUS<sup>3</sup>.

The Ministry of Health, the National Council of Health Secretaries (Conass) and the National Council of Municipal Health Secretariats (Conasems) made a pact, in February 28, 2013, involving seven premises to guide the definition of the index. Based on these premises, the Directives, Objectives, Goals and Indexes 2013-2015 were determined, aimed at strengthening the Integrated Planning of the Unified Health System and at the implementation of the Organizational Contract of Public Health Action (COAP)<sup>3</sup>.

The indexes are essential in the processes of monitoring and evaluating, as they allow one to monitor goals and are useful to: substantiate the critical analysis of the results found and help in the decision-making process; contribute to continuously improve the organizational processes; and comparatively analyze development<sup>3</sup>.

Risk and protective factors unequally affect different social strata, with negative or positive effects that reach the population in

heterogeneous ways and increase the inequalities in health. In this context, it is necessary to evaluate health policies not only considering the general effect they have on collective health, but also the result of their interventions on the pre-existing framework of health inequality<sup>4</sup>.

This study aims to evaluate the dental extraction index considering the many contextual variables of municipalities.

## METHOD

This is a cross-sectional and ecological study. Data on odontological production indexes (Number of Dental Extractions relative to the number of Individual Basic Odontological Procedures - EXO/POI) in the year 2016, from all Brazilian municipalities, was found through DATASUS.

This indicator was divided into 6 categories of analysis, which are: 0.1% - 5% (meaning that from the total number of individual basic clinical odontological procedures conducted in the city, from 0.1% to 5% were extractions of permanent teeth); 5.1% - 12% (meaning that from the total number of individual basic clinical odontological procedures conducted in the city, from 5.1% to 12% were extractions of permanent teeth); 12.1% - 25% (meaning that from the total number of individual basic clinical odontological procedures conducted in the city, from 12.1% to 25% were extractions of permanent teeth); 25.1% - 50% (meaning that from the total number of individual basic clinical odontological procedures conducted in the city, from 25.1% to 50% were extractions of permanent teeth); >50% (meaning that more than half the total number of individual basic clinical odontological procedures conducted in the city were extractions of permanent teeth); and no information (meaning it was not possible to calculate the index due to a lack of information about the city in the Outpatient Information System - SIA).

To analyze the context of the cities, the following indexes were used: Region (North, Northeast, Midwest, South and Southeast); Proportion of estimated populational coverage regarding oral health in the Family

Health Strategy (ESB/ESF); number of Centers of Odontological Specialties (CEOs); Municipal Human Development Index (MHDI) and the Gini coefficient (or Gini index).

The EXO/POI was initially analyzed according to Region, to observe the differences between them. It was related to the Proportion of estimated populational coverage regarding oral health in the Family Health Strategy (ESB/ESF), in a dichotomized way, considering the groups below 50% and equal or above 50%. As the number of Odontological Specialty Centers were described, it was checked if they did or not have a CEO, and whether they had more than one. Both information was acquired from the Strategic Management Support Room at the Ministry of Health (SAGE).

The composed Municipal Human Development Index (MHDI) brings together three of the most important dimensions of human development: the opportunity of living a long and healthy life, of accessing knowledge and having a life standard that guarantees that one can attend to one's basic needs, represented by health, education and income. The index varies from 0 to 1. The closer to 1, the higher the human development. In this study, the municipalities were divided, according to this index, in those with very low, low, medium, high and very high MHDI<sup>5</sup>.

The Gini Index, which points out a difference between the income of the poorest and of the richest, varying from zero to one (some show use numbers from zero to a hundred). Zero represents a situation of equality, in which every person has the same income. One (or one hundred) is the opposite, that is, one person withholds all wealth. In practice, the Gini Index usually compares the 20% poorer people to the 20% richest<sup>6</sup>. The national mean was taken into consideration. Some municipalities were below it, while others were above it.

## RESULTS

According to Table 1, the North and Northeast regions presented the highest number of municipalities, 23.3% and 14.4%, respectively, in which more than 25% of basic odontological clinical procedures were dental

extractions. The South and Southeast, on the other hand, had a high percentage of municipalities, 70.9% and 83.9%, respectively, the extractions correspond to less than 12% of clinical procedures.

**Table 1.** Percentage of Dental Extractions relative to the number of Individual Basic Odontological Procedures according to region in Brazil. 2016.

REGION	EXO/POI Index										999		Total	
	0.1% - 5%		5.1% - 12%		12.1% - 25%		25.1% - 50%		> 50%		N	%	N	%
	N	%	N	%	N	%	N	%	N	%				
Midwest	105	22.5	201	43.0	110	23.6	26	5.6	3	0.6	22	4.7	467	100.0
North	70	15.6	111	24.7	137	30.4	81	18.0	24	5.3	27	6.0	450	100.0
Northeast	158	8.8	613	34.2	668	37.2	208	11.6	50	2.8	97	5.4	1.794	100.0
South	378	31.7	466	39.1	234	19.6	39	3.3	7	0.6	67	5.6	1.191	100.0
Southeast	638	38.2	761	45.6	197	11.8	27	1.6	12	0.7	33	2.0	1.668	100.0
Total	1.349	24.2	2.152	38.6	1.346	24.2	381	6.8	96	1.7	246	4.4	5.570	100.0

Source: TABNET - DATASUS.

As the estimated populational coverage regarding oral health in the Family Health Strategy was considered, from the cities whose extractions represented more than 25% of clinical procedures, 11.1% had

coverage below 50%. Simultaneously, 63.6% of this coverage profile conducted less than 12% of dental extractions when compared to other clinical procedures (Table 2).

**Table 2.** Percentage of Dental Extractions relative to the number of Individual Basic Odontological Procedures according to the Estimated ESB/ESF Population Coverage Proportion. Brazil. 2016.

Estimated ESB/ESF Population Coverage Proportion	EXO/POI Index										999		Total	
	0.1% - 5%		5.1% - 12%		12.1% - 25%		25.1% - 50%		> 50%		N	%	N	%
	N	%	N	%	N	%	N	%	N	%				
< 50	366	23.6	621	40.0	317	20.4	128	8.2	45	2.9	76	4.9	1.553	100.0
≥ 50	983	24.5	1.531	38.1	1.029	25.6	253	6.3	51	1.3	170	4.2	4.017	100.0
Total	1.349	24.2	2.152	38.6	1.346	24.2	381	6.8	96	1.7	246	4.4	5.570	100.0

Source: TABNET - DATASUS

As the number of CEOs was related to the EXO/POI index, it can be noted that in approximately 10% of the cities with no CEOs, 25% of odontological clinical procedures correspond to the extraction of permanent teeth, as opposed to the cities that have at least one CEO. However, regarding the percentages, in 92.6% of cities with one or more CEOs, less than 12% of the odontological

clinical procedures were extractions (Table 3).

The municipalities with very high MHDI had the lowest percentages of extraction (<12%). On the other hand, in 37.5% of the cities with very low MHDI, more than 25% of clinical procedures are dental extractions, as Table 4 shows.

**Table 3.** Percentage of Dental Extractions relative to the number of Individual Basic Odontological Procedures according to number of CEOs. Brazil. 2016.

Number of CEOs	EXO/POI Index												Total	
	0.1% - 5%		5.1% - 12%		12.1% - 25%		25.1% - 50%		> 50%		999			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Cities with NO CEOs	1.077	22.8	1.731	36.7	1.209	25.6	364	7.7	88	1.9	245	5.2	4.714	100.0
Cities with ONE CEO	241	31.1	377	48.6	132	17.0	17	2.2	7	0.9	1	0.1	775	100.0
Cities with MORE THAN ONE CEO	31	38.3	44	54.3	5	6.2	0	0.0	1	1.2	0	0.0	81	100.0
Total	1.349	24.2	2.152	38.6	1.346	24.2	381	6.8	96	1.7	246	4.4	5.570	100.0

Source: TABNET - DATASUS.

**Table 4.** Percentage of Dental Extractions relative to the number of Individual Basic Odontological Procedures according to MHDI. Brazil. 2016.

MHDI	EXO/POI Index												Total	
	0.1% - 5%		5.1% - 12%		12.1% - 25%		25.1% - 50%		> 50%		999			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
0 - 0.499	1	3.1	5	15.6	7	21.9	11	34.4	1	3.1	7	21.9	32	100.0
0.500 - 0.599	97	7.1	394	28.8	523	38.3	208	15.2	53	3.9	92	6.7	1.367	100.0
0.600 - 0.699	501	22.4	896	40.1	579	25.9	133	6.0	28	1.3	96	4.3	2.233	100.0
0.700 - 0.799	721	38.2	841	44.5	235	12.4	29	1.5	12	0.6	51	2.7	1.889	100.0
0.800 - 1	28	63.6	15	34.1	0	0.0	0	0.0	1	2.3	0	0.0	44	100.0
999	1	20.0	1	20.0	2	40.0	0	0.0	1	20.0	0	0.0	5	100.0
Total	1.349	24.2	2.152	38.6	1.346	24.2	381	6.8	96	1.7	246	4.4	5.570	100.0

Source: TABNET - DATASUS

In the cities with a GINI index above national average, 16.3% presented the highest percentages of dental extraction, that is, >25%. On the other hand, in 63.9% of the

cities with a lower index than national average, extractions represented less than 12% of individual clinical odontological procedures (Table 5).

**Table 5.** Percentage of Dental Extractions relative to the number of Individual Basic Odontological Procedures according to the GINI index. Brazil. 2016.

GINI Index	EXO/POI Index												Total	
	0.1% - 5%		5.1% - 12%		12.1% - 25%		25.1% - 50%		> 50%		999			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
<0.6	1.299	24.6	2.069	39.3	1.247	23.7	343	6.5	85	1.6	227	4.3	5.270	100.0
≥ 0.6	49	16.6	82	27.8	97	32.9	38	12.9	10	3.4	19	6.4	295	100.0
999	1	20.0	1	20.0	2	40.0	0	0.0	1	20.0	0	0.0	5	100.0
Total	1.349	24.2	2.152	38.6	1.346	24.2	381	6.8	96	1.7	246	4.4	5.570	100.0

Source: TABNET - DATASUS

**DISCUSSION**

Ecological studies are deemed appropriate to investigate the effects of the environment on the health of a population, as well as to aid in the management of public policies<sup>7</sup>.

Cross-sectional studies are recommended to estimate the frequency with which a certain health event takes place within a specific population, in addition to

factors that are related to it<sup>8</sup>. Health data systems allow for the surveying of information, and thus, are used as evaluation instruments.

The choice of the proportion of dental extractions is very important to evaluate the odontological practices currently being used<sup>7</sup>.

This study compared the indicator of EXO/POI in municipalities of the different

Brazilian regions, observing whether there were differences between them. The most critical situation was found in the north, where, in nearly 1/4 of the cities, dental extractions represented more than 25% of the total number of clinical procedures.

A study<sup>9</sup> showed that in the cities in the state of Pará, from 2001-2010, the percentage of individual odontological procedures represented by dental extractions diminished although the number of annual procedures remained stable in the same period. That indicates that a change took place throughout the years, and the number of permanent tooth extractions diminished. However, the numbers are still high when compared to other localities.

The ESB coverage was used to compare the offer of assistance to the index. Although Decree 1,101 from June 12, 2002, from the Ministry of Health (created to establish assistance parameters for the SUS) suggests that the percentage of dental surgeons per person can vary from 1:1,500 to 1:5,000, there is no ideal number established for this relationship, since in order to determine the proportion, it is necessary to consider elements that involve the planning of the odontological human resources needed for each community<sup>7</sup>. The results of this study indicated that, in the places with lower ESB/ESF coverage, higher index categories (25.1 - 50% and >50%) were more common.

Another study<sup>10</sup>, which analyzed the association between populational ESB coverage in ESF and the different rates in the use of public odontological services in the Brazilian cities from 1999 to 2011, demonstrated that the increase in the use of public odontological services in Brazil is associated to an increase in the rates of ESB at ESFs, independently of structural expansions.

The increase in individual assistance coverage may be privileging other types of procedure, thus generating changes in the oral health conditions of the population which is being attended in the public services<sup>7</sup>. In spite of this work's result, it can be assumed that this index tends to decrease in regions with higher coverage.

Determinants of life and health

conditions (MHDI and primary and secondary health care availability, respectively) of people interfere in dental losses<sup>11</sup>.

A research<sup>12</sup> that evaluated the CEO from the State of Pernambuco, found that the highest the MHDI, the better the performance of Odontological Specialty Centers.

The availability of secondary care through CEOs increases the number of specialized procedures and is essential for the oral health network to be less aggressive<sup>11</sup>. The results of this study corroborate expectations according to which 95% of municipalities with at least one CEO had the best extraction percentages.

Regarding low MHDI cities, it can be inferred that educational and/or income related variables interfere in the accumulation of the population's odontology needs<sup>13</sup>. In this context, municipalities with very low MHDIs (<0.499) had the highest percentages of extraction. The high proportion of dental extractions is opposed to the offer of preventive procedures and is directly related to the socioeconomic conditions of the population<sup>14</sup>.

In another study<sup>15</sup>, it was shown, through a beta regression, that, in the state of Paraíba, dental mutilations happened more frequently in cities with low Gini index values, lower number of ESBs, and lower proportion of basic odontological needs. In this study, however, extraction percentages above 25% were linked to cities with higher income inequality, that is, in which the GINI index was  $\geq 0,6086$ .

Misinformation and, especially, the lack of awareness about the importance of oral health among the population with low educational levels impacts in the oral health condition of the individual, as well as in their general health<sup>13</sup>.

More resources are expected to be destined to the teams and the municipalities are expected to increase their primary health care network, which would positively impact in the quality of the oral health of the population. For that to happen, the adoption of public policies of social development that go beyond the health sector is important, so the benefits can be directed to areas where it

is more needed, thus contributing to diminish inequality<sup>7</sup>.

The time it takes to perfect the information in the database that is maintained by SUS and made available to researchers is also a problem.

Managers responsible for the evaluation and monitoring of the administration of SUS are expected to have substantiated knowledge and do their jobs adequately.

The users and professionals must exert social control and demand the completion of this evaluation, as it is so important for the planning of improvements to the oral health services at SUS<sup>16</sup>.

## CONCLUSION

One of limitations of this study is that it uses secondary data, which means that the records might be of questionable consistency. In spite of that, it is worth highlighting the importance of the public availability of this data and its use by researchers, health professionals and managers, to health in the process of planning and programming of health actions and services.

The results of the EXO/POI index show that it is necessary to Invert the offer of odontological procedures and guarantee to the population, especially for those in difficult socioeconomic conditions, health care and services that can carry out preventive actions to maintain and recover oral health, so that dental loss can be avoided.

Nonetheless, new studies that evaluate the quality of the services being offered are necessary, to prevent these evaluations from becoming purely quantitative.

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#### CONTRIBUTIONS

All authors contributed equally in the conception, design, analysis, data interpretation, and writing of this article.

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