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Access to oral health services in the Xukuru do Ororubá Indigenous Territory (2017-2018): analysis of performance indicators

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Abstract *This ecological study conducted with secondary data extracted from the Indigenous Health Care Information System (SIASI) analyzed the access to oral health services provided to Xukuru do Ororubá Indigenous peoples from 2017 to 2018. The units of analysis were the Indigenous villages. The services delivered by the oral health teams working in the context were analyzed, verifying access and performance indicators and their parameters. The socioeconomic and demographic conditions, the provision of services, and the spatial components of the territory were characterized. The correlation coefficients between indicators were estimated. The results showed a growing coverage of first dental appointments, the mean number of procedures per capita, the percentage of tooth extractions, the coverage of supervised tooth brushing, and a decrease in the rate of completed treatments. There were better access opportunities for the Xukuru do Ororubá Indigenous people in the period analyzed. However, there is a persistent need to strengthen the continuity of services to complete treatments. The study points to the need for indicators suitable for the context of Indigenous health and the potential of the SIASI for oral health surveillance.*

Key words *Health of Indigenous peoples, Oral health, Health services accessibility, Indicators of health services*

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Introduction

Indigenous populations worldwide suffer from significant oral health inequalities, an issue linked to the social determination of health, understanding that the dynamic mediations of factors such as poverty, the consequences of colonialism, social exclusion, the development of public policies, and racism are related to the community and reflect the historical-social nature of the health-disease process[1,2]. The epidemiological profile of oral health in different countries, including Brazil, indicates disparities in indicators and the provision of services between Indigenous and non-Indigenous people, and the former invariably displays the worst results[2,3].

Unequal access to services is a central issue in these people's poor oral health. These subjects are less likely to receive timely or culturally sensitive treatment to prevent and treat oral and dental problems. The result is often dental care based on already established problems, associated with more tooth extractions, as opposed to preventive interventions or care for dentition recovery, rehabilitation, and preservation[4].

In 2011, the Ministry of Health (MS) defined the reorganization of the oral health care model aimed at Indigenous peoples in the country to expand access to dental care in the Indigenous villages, structuring and qualifying the services in the 34 Special Indigenous Health Districts (DSEI). Actions were proposed to control, promote, and recover oral health, planned based on diagnosing health-disease conditions, subsidized by epidemiology and information about the territories, and monitoring the actions' impact through indicators[5].

An aggregate analysis of the DSEI[6] from 2015 to 2017 concluded significant growth in the Indigenous population's access to primary dental care and a strengthening of the Indigenous Health Care Information System (SIASI) regarding reporting oral health information. A study with peoples of the Xingu Indigenous Park (MT)[7] analyzed the evolution of indicators from 2004 to 2013 and identified good coverage over the years concerning access to oral health, emphasizing the rate of completed treatments.

The Xukuru do Ororubá Indigenous people are the largest Indigenous population in the State of Pernambuco, inhabiting an Indigenous Land (IL) part of the municipality of Pesqueira[8]. Besides official records on the health of this population, specific studies have already focused on understanding their epidemiological profile[6,9-11]. Considering oral health, a temporal epidemiological analysis showed that less than 30% of individuals aged 10-14 were caries-free in 2010, and the same group of individuals showed an increase in the disease over time, reaching a prevalence of 97% in 2018[9,10].

In oral health studies, adopting indicators and secondary data extracted from the SIASI is still limited, especially concerning access to and use of health services by traditional peoples who inhabit the Brazilian Northeast. Using these indicators to assess Indigenous oral health programs shows high potential as an instrument for monitoring, planning, and assessing actions, services, and health situations[12]. Given the above, to bridge this gap to qualify SIASI data and indicators for Indigenous peoples' social and organizational context, this study aimed to assess the performance of oral health service indicators in the Xukuru do Ororubá IL and their correlation with socioeconomic factors.

Methods

This ecological study was conducted with secondary data organized in an aggregated manner. The analysis units were the villages, and the Socioenvironmental Regions of the Xukuru do Ororubá Indigenous Land (TIXO).

TIXO was approved in 2001 and is divided into 24 villages distributed across three socioenvironmental regions (Serra, Ribeira, and Agreste) along the Serra do Ororubá. The IL is located in the rural area of Pesqueira, 216 km from the capital of the state of Pernambuco, in the Agreste region and the Brazilian Northeast (Figure 1). The three socioenvironmental regions are spatial categories established by the Indigenous people based on their territory's geoclimatic and socioeconomic characteristics. As of 2018, this IL had a population of 8,002 people[10,13].

The data used were obtained from three sources: the SIASI database in its local and national versions (oral health module, demographic module, and data on human resources and health establishments); the database of the 2010 Xukuru do Ororubá Participatory Census (socioeconomic data aggregated by households and villages), produced by Fiocruz Pernambuco; and records from the National Registry of Health Establishments – CNES/DATASUS (data on establishments and specialized services offered).

Socioeconomic indicators were constructed for 2010, considering IBGE suggestions and

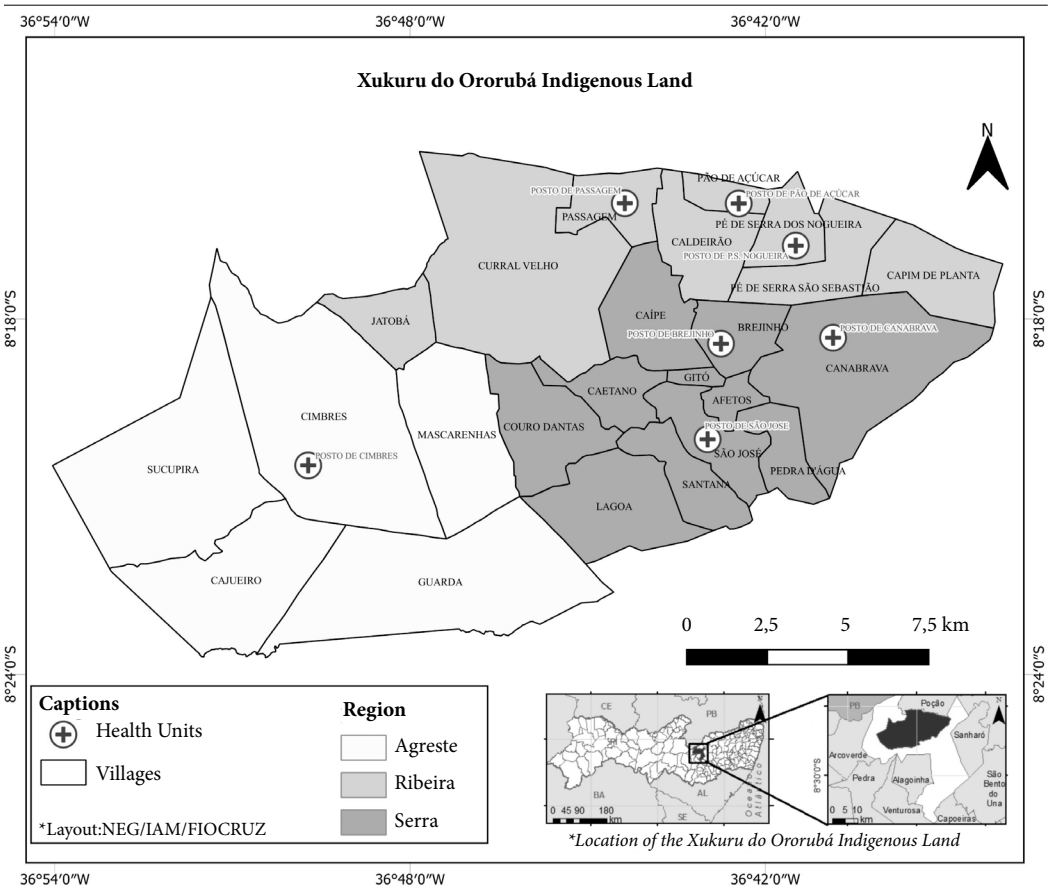

Figure 1. Geographical location of the Xukuru do Ororubá Indigenous Land and its division by socioenvironmental region and village.

Production: Statistics and Geoprocessing Center (NEG) – IAM/Fiocruz.

Source: FUNAI/IBGE, 2021; SIASI/SESAI/MS, 2019; http://cnes.datasus.gov.br/.

recommendations from studies that analyzed the socioeconomic and demographic profile of Brazilian Indigenous peoples[8,11,14,15]. The indicators used were (1) *Percentage of households with inadequate sanitation* (SIN), which corresponds to households with concomitant inadequate conditions of water supply, sewage, and garbage disposal/collection; (2) *Percentage of households with electricity* (DEL), quantifying the percentage of households with electricity availability; (3) *Mean household income in minimum wages* (RMD), representing the monthly household income by village, in 2010 values; (4) *Illiteracy rate of the population aged 15 or over* (ANF), indicating the population that cannot read and write at least a simple note in the language they know.

Regarding oral health, data from individual and collective care (variables related to appointments, procedures, and actions performed) for 2017 and 2018 were used. Based on these variables, performance indicators were selected considering the recommendations of the Ministry of Health and specific studies, besides the context and population data obtained on the Xukuru do Ororubá Indigenous people[6,16-20].

The following oral health indicators were selected: (1) *Coverage of the first programmatic dental appointment* (CPC) to measure access obtained, indicating the percentage of users who received their first dental appointment in a given year. Values equal to or above 15% were considered satisfactory under the national parameters[18]; (2) *Ratio between completed essential dental treatments and first dental appointments* (TOC), indicating the ratio of users who completed their treatment compared to those who had their first

appointment. Values between 0.5 and 1.0 were considered satisfactory[18]; (3) *Percentage of tooth extractions against individual clinical procedures* (PEX), indicating the percentage of tooth extractions performed within the total of individual preventive and curative clinical procedures. Values equal to or below 8% were considered satisfactory[17]; (4) *Mean monthly coverage of the collective supervised tooth brushing action* (CED) to measure the access performed, indicating the average percentage of users who participated monthly in supervised tooth brushing actions in a given year. Values equal to or above 8% were considered adequate[17]; (5) *Mean number of individual basic dental procedures per capita* (MPI) measures the mean number of primary procedures performed per individual in a given population. No parameters were found for this indicator in the literature; (6) *Estimated population coverage of oral health teams (ESB) in Indigenous Health* (CESB), applied to measure potential access, evaluating the number of ESB implemented for each group of 3,000 users against the population in the same location and period. Values equal to or above 50% were considered satisfactory[17].

Based on the oral health indicators used, the Rate Ratio (RR) was calculated to measure the performance and relative differences between TIXO's socioenvironmental regions between years. The RR was obtained by the ratio between the indicator's rate and its respective reference value (parameter), representing how far each region was from the reference. Values above or below one (1.0) correspond to excess or deficiency, respectively, against the parameter[21]. For the indicator without an identified parameter (MPI), its general rate obtained for the TIXO for each year was used as a reference.

Mean coefficients (accumulated indicators) were constructed for the oral health indicators to measure the accumulated effect over time, using as numerator the mean variable applied for the two years analyzed and, as the denominator, the population of the center of the period (mean number of inhabitants for the two years).

Data distribution non-normality for most variables was verified by the Shapiro-Wilk test, suggesting the application of non-parametric tests for analysis. Thus, the correlation between the indicators were examined applying the Spearman test, considering a macrosocial level of health of ecological determination to estimate the relationship of influence of variations between indicators in the set of villages[22]. The estimated tests considered a statistical significance level of 5%.

Data was managed using Microsoft Office 365 Excel (Version 2106) software. Descriptive and analytical statistics were performed using Excel and IBM SPSS Statistics (version 22), and maps were created using QGIS (version 3.18).

This study is nested in a larger research project entitled "*Oral health of an Indigenous people in the State of Pernambuco: A cohort study*", which, in compliance with Resolutions N°466/12 and nº 304/00 of the National Health Council (CNS) of the Ministry of Health (MS), and obtained the consent of the Xukuru do_Ororubá ethnic group through its Health Council and the Indigenous Health District Council (CONDISI), being approved by the IAM/FIOCRUZ Research Ethics Committee (CEP) under Opinion nº 2.839.310/2018 and by the National Research Ethics Commission (CONEP) under Opinion nº 3.050.331/2018.

Results

Demographic data from SIASI indicate adult and older adult population growth between 2010 and 2018. However, a young population still predominates, with 29.4% under 15 and 11% over 60. The distribution between genders is similar (51.2% male). Three of the 24 villages comprise around 33% of the TIXO population (Cimbres, Sucupira, and Canabrava, with 843, 803, and 959 inhabitants, respectively). Eight villages have populations below 200 inhabitants, namely: Caldeirão (159), Curral Velho (188), and Jatobá (116), in the Ribeira region; Afetos (146), Brejinho (183), Gitó (23), Santana (79), and Pedra d'água (184) in the Serra region. The Agreste and Serra regions represent similar portions of the total TIXO population, approximately 36% (2,869) and 37% (2,995), respectively.

Figure 2 shows the socioeconomic indicators constructed from the 2010 Xukuru do Ororubá Participatory Census data. The Agreste region has the highest concentration of households (823), followed by Ribeira (551) and Serra (520).

More than half (52.3%) of TIXO households were identified as having inadequate sanitation. The Serra region had the highest proportion (64%). Regarding household electricity availability, all regions reached values above 95%. Among the villages, only the Guarda village (Agreste region) had a value below 90%.

The Serra region had the highest mean monthly household income among the three regions, with a mean of 1.16 minimum month-

ly wages per household. Regarding the illiteracy rate, seven TIXO villages scored above 40%, four of which are in the Agreste region, another in the Ribeira region, and two in the Serra region. The Pão de Açúcar village (Ribeira) has the lowest illiteracy rate in TIXO (13.4%). The overall rate for the territory reached 37.3%.

Regarding the provision of dental services in TIXO, seven villages each have a Health Unit (HU) with a dental office. There are three main HUs (Cimbres, Canabrava, and São José), with the others functioning as support points. There are three Multidisciplinary Indigenous Health Teams (EMSI) working in rotations at the HUs, with a Dental Surgeon and an Oral Health Assistant (ASB) in each. The distribution of the HUs in TIXO is illustrated in Figure 1.

As for the secondary care network, there is the Center for Dental Specialties (CEO) of Pesqueira-PE (in an urban area, approximately 6 kilometers away from TIXO) and the CEO of Caruaru-PE (Regional), a municipality approximately 90 kilometers from Pesqueira. They differ in the offer of specialties, with the Regional being

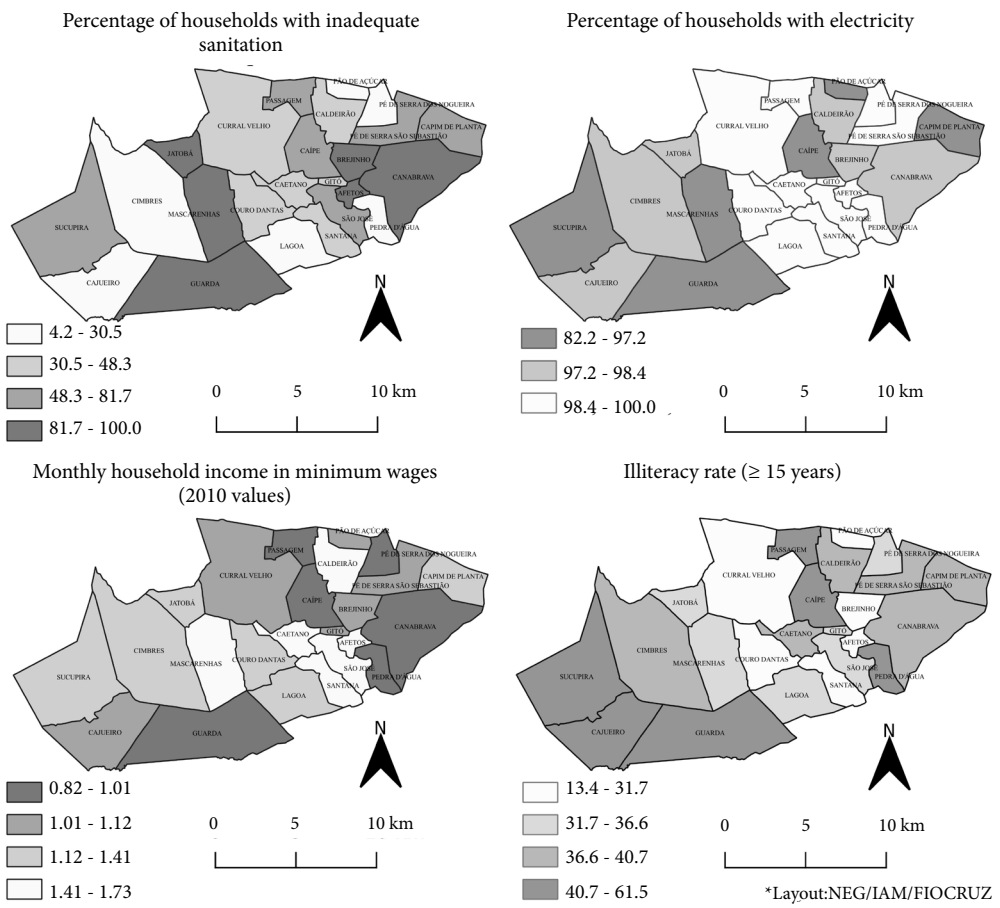

Figure 2. Sanitation conditions, electricity availability, mean monthly household income, and illiteracy rate (≥ 15 years), by village, 2010.

Production: Statistics and Geoprocessing Center (NEG) – IAM/Fiocruz.

Source: FUNAI/IBGE, 2021; SIASI/SESAI/MS, 2019; Participative Census of Xukuru do Ororubá, 2010.

the largest, with a linked dental prosthesis laboratory (LRPD), a reference for the entire Pernambuco Agreste mesoregion.

Table 1 presents the performance indicators of oral health services by socioenvironmental region and village, with the total value for TIXO and the respective parameters.

The CPC grew between 2017 and 2018 for all villages, with values below 30% in only one village (Lagoa). All others reached values above 35% in 2018, with 13 villages ranging from 50% to 79%. The rate for TIXO increased by 20.1% between the years.

The TOC ratio fell between the years analyzed in practically the entire TIXO. The representative rates of the regions also indicate a decline. Only eight villages had slight increases in the rate of completed treatments, varying proportionally between 1.6 and 25%.

PEX increased in the TIXO in general between the two years. Eleven of the 24 villages showed a reduction in the proportion of tooth extractions, emphasizing four villages (Jatobá, Brejinho, Caetano, and Santana), with a decline of around half the value of the first year.

CED had a positive variation between the years, with an increase of 11.1% in the general TIXO rate. Only five villages reduced brushing coverage between years (Brejinho, Canabrava, Couro Dantas, Mascarenhas, and Pé de Serra dos Nogueira).

The MPI showed growth for the TIXO in general and for the socio-environmental regions. Only four villages showed a reduction in the indicator (Capim de Planta, Curral Velho, Passagem, and Caípe).

Due to their nature, the population coverage indicator of oral health teams (CESB) was not estimated for villages. Regarding the socioenvironmental regions, the estimated coverage for 2017 and 2018 were 139.2% and 140.3% for Ribeira; 106.7% and 104.6% for Agreste; and 101.5% and 100.2% for Serra. There was a negligible decline in the indicator for TIXO between the years, down from 113.6% (2017) to 112.5% (2018).

Figure 3 shows the Rate Ratios (RR) for TIXO's socioenvironmental regions. For CPC, the rates were consistently above the parameter, with significant growth for the three regions in 2018. Concerning TOC, the indicator dropped for the three regions, but only the Agreste region reached a value below the parameter in 2018. PEX was always below the defined parameter (desirable for the indicator) but showed slight growth in the Agreste and Serra regions in 2018.

The CED rates were consistently above the parameter, with growth for the three regions between 2017 and 2018, and were more significant in the Ribeira region. Regarding the MPI, only the Serra region had rates above the reference used (general TIXO rate). The Agreste region was the only one to show growth over the years. The CESB was at least twice above the parameter in all regions and years. The differences between years were not significant.

Regarding the correlation coefficients between the 2017 oral health indicators and socioeconomic indicators, a positive and significant correlation between the proportion of households with inadequate sanitation (SIN) and PEX (0.46 or 46.5%; $p = 0.022$) and between SIN and CED (0.47 or 47.5%; $p = 0.019$) were identified.

In the correlation between the 2018 oral health indicators and the socioeconomic indicators, was observed a positive and significant correlation between households with electricity (DEL) and TOC (0.64 or 63.6%; $p < 0.001$); between DEL and CED (0.41 or 41.4%; $p = 0.045$); between DEL and MPI (0.48 or 47.6%; $p = 0.019$); and between literacy rate (ALF) and TOC (0.47 or 46.7%; $p = 0.021$). There was also a negative and significant correlation between ALF and PEX (-0.45 or 45.4%; $p = 0.026$).

Regarding the correlation between accumulated 2017 to 2018 oral health indicators, four positive and significant correlations were noted: between CPC and CED; between CPC and MPI; between TOC and MPI; and between CED and MPI. The correlation coefficients and respective p-values are described in the correlation matrix (Figure 4).

Discussion

Considering the study period, this paper identified a favorable trend for the performance indicators of oral health services provided within the TIXO, except for the indicators of completed treatments and tooth extractions performed. However, all reached or remained within the parameter stipulated for the national Primary Health Care (PHC) context. Relevant socioeconomic indicators, such as the rate of inadequate sanitation and available electricity in homes, were correlated with oral health indicators, indicating influences on the variation in the percentage of tooth extractions; coverage of supervised brushing, treatment completion, and the mean number of procedures per capita.

Table 1. Performance of indicators of access to primary oral healthcare in the Xukuru do Ororubá Indigenous Land, 2017-2018.

Region	Village	CPC (%)		TOC		PEX (%)		CED (%)		MPI	
		2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Ribeira		34.7	52.6	0.59	0.50	3.74	3.76	24.3	42.9	1.95	2.47
	Caldeirão	53.4	79.0	0.61	0.44	2.11	4.17	14.8	21.4	2.88	4.22
	Capim de Planta	28.7	40.8	0.77	0.42	4.62	5.12	13.6	31.3	1.94	1.75
	Curral Velho	38.2	57.5	0.55	0.57	3.17	3.25	53.8	84.3	2.72	2.65
	Jatobá	34.2	50.4	0.55	0.51	6.70	3.72	49.6	55.0	1.79	2.07
	Pão de Açúcar	13.9	39.3	0.44	0.42	2.37	1.46	0.5	2.3	1.04	1.27
	Passagem	51.5	64.3	0.53	0.57	3.54	3.07	43.7	119.1	3.07	3.03
	Pé de Serra dos Nogueira	29.9	48.7	0.61	0.62	4.42	3.23	4.0	2.7	1.24	2.90
	Pé de Serra São Sebastião	37.2	52.6	0.63	0.42	4.11	5.35	34.4	44.3	1.83	2.36
Agreste		28.3	48.2	0.61	0.48	2.91	3.84	32.1	37.0	1.73	2.71
	Cimbres	39.4	56.8	0.66	0.54	2.18	3.67	27.5	31.0	2.57	3.79
	Guarda	20.3	36.9	0.62	0.36	5.33	4.75	33.8	44.8	0.99	2.23
	Mascarenhas	30.4	39.8	0.51	0.58	3.36	2.29	29.9	25.9	2.02	2.30
	Sucupira	25.2	47.0	0.62	0.50	3.28	4.31	36.7	42.3	1.46	2.30
	Cajueiro	19.5	52.4	0.43	0.38	2.35	3.43	32.5	36.8	1.26	2.08
Serra		38.5	59.2	0.61	0.58	3.18	3.46	50.0	60.5	2.56	3.14
	Afetos	38.3	55.2	0.68	0.58	4.62	4.20	37.8	47.7	2.53	2.94
	Brejinho	46.7	54.8	0.64	0.56	3.35	1.79	67.1	64.5	2.42	3.40
	Caetano	29.8	35.5	0.87	0.89	4.83	2.43	46.3	88.6	1.96	2.54
	Caípe	55.8	75.1	0.69	0.30	2.33	6.14	81.0	81.1	3.61	1.83
	Canabrava	38.1	57.6	0.40	0.50	2.88	3.70	65.5	62.9	2.69	3.21
	Couro Dantas	27.3	40.9	0.67	0.42	2.76	4.19	18.8	15.5	1.82	2.10
	Gitó	0.0*	136.3	0.00*	0.57	0.00*	2.17	171.6	218.5	0.00*	10.45
	Lagoa	25.2	26.7	0.60	0.68	2.27	4.76	11.1	22.6	1.47	1.94
	Santana	50.6	66.7	0.83	0.72	7.52	3.53	85.9	87.8	3.78	5.25
	São José	55.5	119.2	0.70	0.86	2.49	1.74	27.5	67.9	3.72	5.92
	Pedra d'água	26.5	52.9	0.80	0.53	4.13	5.81	29.8	83.6	1.99	2.94
Total TIXO		33.8	53.9	0.60	0.53	3.24	3.67	36.6	47.7	2.10	2.83
Parameter[17,18]		≥ 15%		> 0.5		≤ 8%		≥ 8%		Not identified	

CPC – Coverage of the first programmatic dental appointment, TOC – Ratio between completed basic dental treatments and first dental appointments, PEX – Percentage of tooth extractions against individual preventive and curative clinical procedures, CED – Mean monthly coverage of the collective supervised tooth brushing action, MPI - Mean number of individual basic dental procedures per capita, * Blank data in the database

Source: SIASI/SESAI/MS. 2019.

Among the oral health indicators for the CPC, conducted to achieve an initial diagnosis and prepare a care plan for users' needs, excluding urgent/emergency care or return visits[19], overall growth and compliance with the stipulated parameter[18] were observed, reaching more than half of TIXO users with a first appointment in 2018.

A recent analysis of oral health indicators in the Xingu Indigenous Park[7] identified that coverage was above 60% in most of the years analyzed, corroborating an apparent movement toward expanding access to dental care. An aggregate analysis of regions and DSEIs in Brazil[6] from 2015 to 2017 identified an growing rate for Indigenous peoples in the Northeast, reaching 30.2%, and a decline for the peoples of Pernambuco, reaching 18.3%. Therefore, the findings suggest that the TIXO stands out in the CPC against the other Indigenous peoples linked to the DSEI Pernambuco.

Concerning the TOC indicator, which measures access to and resolution of basic dental care[6,20], a declining overall performance in the

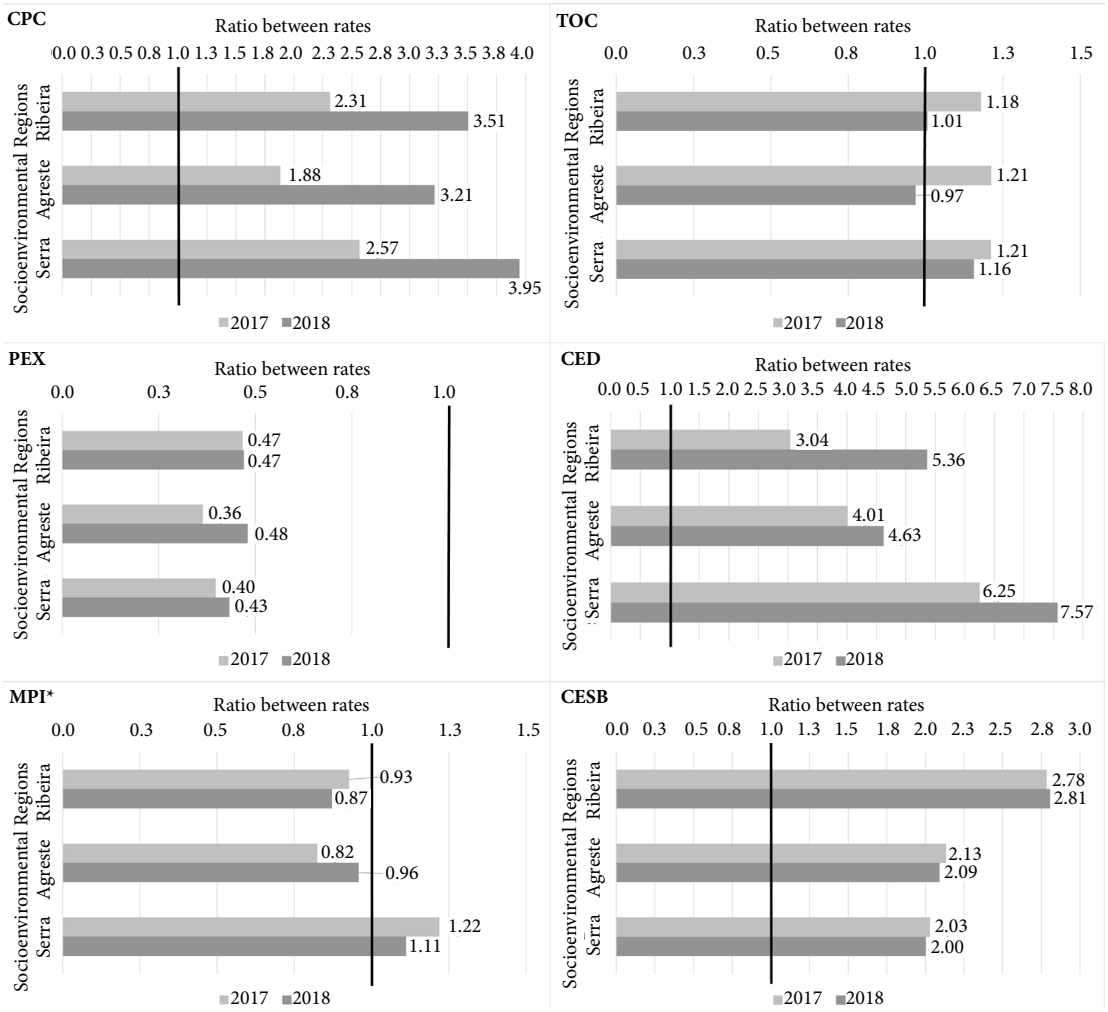

Figure 3. Ratio between access indicator rates and respective reference values for the Socioenvironmental Regions. 2017-2018.

CPC – Coverage of the first programmatic dental appointment, TOC – Ratio between completed essential dental treatments and first dental appointments, PEX – Percentage of tooth extractions against individual preventive and curative clinical procedures, CED – Mean monthly coverage of the collective supervised tooth brushing action, MPI – Mean number of individual basic dental procedures per capita CESB – Estimated population coverage of oral health teams in Indigenous Health, * The reference value for MPI was the general rate for Indigenous Land., The thicker line on the graphs (= 1.0) marks the equality between the indicator and the reference value.

Source: SIASI/SESAI/MS. 2019; Ministry of Health[17,18].

TIXO was noted. In a national analysis of the DSEI, the indicator remained stable from 2015 to 2017, with values around 0.5. Thus, despite the decline, the TIXO regions have followed the trend within the national standard and parameter range[18], representing the completion of approximately half of the dental treatments initiated.

The higher PEX in the territory may suggest accumulated dental care demands in previous periods, which could be related to lower completed treatments and possible local difficulties in accessing CEOs (outside the TIXO), linked to the evident decreasing trend in performance related to endodontics in Brazilian CEOs[23].

As fewer essential treatments are completed or endodontics are not performed timely, this will reflect an increased need for tooth extractions due to accumulated and deteriorated pathological conditions. Despite the increase, PEX values were consistently below the param-

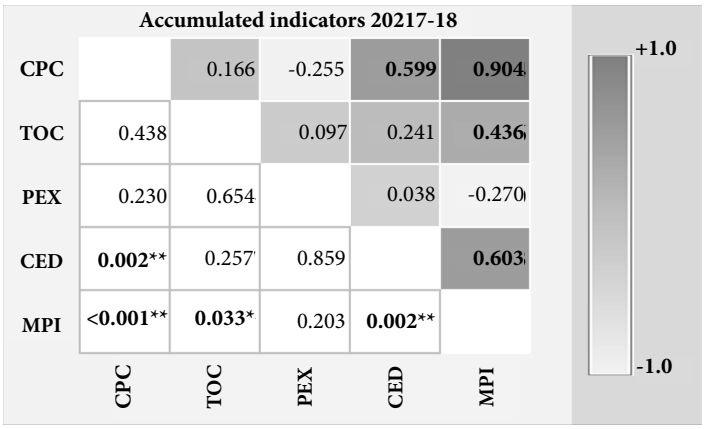

Figure 4. Correlation matrix between accumulated oral health indicators (2017-2018).

CPC – Coverage of the first programmatic dental appointment, TOC – Ratio between completed essential dental treatments and first dental appointments, PEX – Percentage of tooth extractions against individual preventive and curative clinical procedures, CED – Mean monthly coverage of the collective supervised tooth brushing action, MPI – Mean number of individual basic dental procedures per capita, Grayscale boxes indicate correlation coefficients; white boxes with gray borders indicate p-value; bold values indicate statistical significance. * The correlation (Spearman's test) is significant at the 0.05 level (2 tails). ** The correlation (Spearman's test) is significant at the 0.01 level (2 tails).

Source: SIASI/SESAI/MS, 2019.

eter[17], which, in the case of this indicator, is desirable, as it indicates a reduced level of tooth extractions performed, thus, a more conservative conduct, adopting more preventive and restorative procedures[7,19].

The CED indicator is related to the concept of integrality proposed by the PNSB, considering its intersectoral and interprofessional articulation and collective nature, in a preventive dimension (access to fluoride through toothpaste) and educational dimension (oral healthcare, through teeth brushing)[7,19]. The TIXO results showed a substantial increase, with values constantly above the parameter[17], reaching almost half of the territory's population in the time interval, pointing to advances in the prioritization of the mentioned dimensions.

Supervised tooth brushing is an action that depends on the Oral Health Team (ESB), the articulation with Indigenous Community Health Agents (AIS) and Indigenous schools, and the availability of oral hygiene materials from the DSEI[5,24]. A study in the Xingu Indigenous Park identified a considerable variation in values over ten years, from 1% to 23%, arguing the need for improved access to oral hygiene materials[7].

Regarding the CESB indicator, which aims to measure potential access to services in terms of how many users each team covered and guaranteed access, rates were always found above 100%, well above the stipulated parameter (50%)[17], which would represent excellent coverage, with teams capable of serving the entire enrolled population[17,19].

As for the correlations between oral health measures and socioeconomic conditions, taken at an ecological level, it is conjectured that a reduced opportunity to build and maintain hygiene habits at home due to inadequate sanitation in the users' villages[13] may have deteriorated oral diseases, leading to a higher community need for tooth extractions; likewise, the lack of sanitation and difficulties in brushing teeth may have encouraged users to participate in collective brushing actions or even as an element of planning for ESB actions, conducting more actions in villages with known substandard conditions.

The other correlations confirm the findings in the literature that reveal a positive association between access to oral health services and better socioeconomic and demographic conditions, favoring the continuity/completion of dental treat-

ments, the positive impact of prevention/health promotion actions, the reduced deterioration of pathologies, and the lower frequency of mutilating procedures[25,26]. Worse socioeconomic and oral health conditions are also related to lower coverage of fluoridated water[25], another critical issue in the TIXO, where fluoridation is not a reality[9].

The correlations between the accumulated oral health indicators suggest that expanding access contributes positively to expanding oral healthcare. Possible access to the first dental appointment can function as a moment of building bonds and encouraging continuity of dental treatment[24,27,28], producing subsequent appointments where the necessary procedures will be performed and generating an increasing MPI. The correlation between MPI and TOC also fits into this context since the completed dental treatment plans are based on the procedures performed and thus recorded in the indicator.

The relationship between the increase in CPC and CED may express a more significant presence of ESB in certain villages, a concomitant action in individual and collective actions, albeit geographically restricted. The interaction between the growing CED and MPI can also be thought of concerning the more significant presence of ESB in certain villages, but also due to the potential of the collective action of supervised teeth brushing in the preventive and educational dimensions, encouraging oral health care and the search for dental services[7,10,13] to fulfil perceived needs through clinical procedures.

By critically analyzing the results and interpreting the indicators, questions are raised about their actual suitability to the context of Indigenous peoples' oral health, understanding the particularities regarding the composition of the healthcare network and the work process of the ESBs. TIXO comprises an unbalanced distribution of the HUs between regions, which can interfere with access to and continuity of care, considering geographic barriers/distances between villages, population contingent and its pulverization.

Furthermore, when management inserts them into a work process based on rotations between units[9,13], the three active ESBs produce fragmented care, which goes against the guidelines of the Indigenous *Brasil Sorridente* Program[5]. This hampers actions and procedures, hinders the construction of bonds with communities, and compromises the integrality, longitudinality, and resolvability of dental treatments[27].

Many of the workforce working in the DSEIs (including DSEI Pernambuco) are hired by entities under agreements with the government. This mixed model has created management difficulties nationwide, hindering the production of care adapted to Indigenous needs by causing discontinuous and low-quality technical care, high turnover or lack of professionals, and a shortage of materials and equipment for developing health actions, besides logistical problems that challenge professionals' travel to work regularly in the villages[29,30].

The evident burden of accumulated oral disease in the Xukuru do Ororubá community (less than 30% of children aged 10-14 are free from caries in 2010[9], and 97% prevalence of caries in young adults in 2018[10]), which demands more complex and extensive treatments, hinders teams' actions that, despite the good performance identified, do not appear to be reflected in the epidemiological profile of this population's oral health.

Adopting SIASI data in oral health studies is an approach that has not yet been fully explored, and, as in this study, the available analyses were performed using "traditional" indicators[6,7]. Various performance indicators for public oral health services have been agreed upon in Brazil over the last two decades, with a continuous reduction in the indicators in force[19,20,28,31]. However, although the available indicators are substantial subsidies for oral health management, the evidence points to the need to qualify the current ones and incorporate new indicators.

According to França *et al*.[20], the methodological proposal for evaluating and monitoring the actions and performance of public health services must broaden the focus to include elements that favor the analysis of compliance with the SUS principles, which includes adapting to different sociocultural realities so that management can strengthen and qualify the system.

However, the indicators still cover few dimensions[20]in oral health, including a low level of adequacy to the sociocultural reality of Indigenous peoples, with indicators and performance parameters that were not designed for the particularities of the organizational model adopted by the Indigenous Peoples' Healthcare Subsystem (SASI-SUS) and the socio-spatial context of Brazilian Indigenous lands. As a result, contradictions arise regarding the guidelines of the proposed model, besides imprecise analyses regarding the oral health needs of Indigenous peoples, over/underestimating the performance of the ESB that operate in the territories and the

conditions of access to services in this context, due to the attempt to adapt the indicators already used in the context of "urban" PHC to the variables recorded and made available in SIASI.

Reinforcing the need to qualify oral health analyses and indicators, Jamieson et al.[1] argue that the current measures used to assess inequalities in oral health among Indigenous peoples do not sufficiently capture the inequalities resulting from colonial influences that have resulted in the ongoing loss of land, identity, languages, and control over traditional cultural practices, which are significant for Indigenous peoples. Therefore, indicators developed within this perspective will allow for better assessment and monitoring of the oral health of Indigenous peoples in a way that interrelates geographic factors, the structure of the local network, the specific work process of health teams, the target audience, and frequency for specific actions, traditional practices, and other socio-historical contextual/cultural factors.

This study's limitations include the impossibility of concluding individual levels or regarding the population that did not use SASI-SUS. Furthermore, causal associations cannot be shown, but promising research pathways are offered in the projections of associations and for the evaluation of oral healthcare for Indigenous peoples. Furthermore, given the use of secondary data, verification of incompleteness of variables cannot be adjusted in the database, and analyses are subject to information biases related to the quality and accuracy of the data stored in the SIASI. Regarding performance results above 100%, despite the impossibility of verifying the causes from the databases, they may indicate erroneous records regarding the village to which a user belongs, overestimating the production for a given village in the database and corroborating the criticism about inadequate indicators.

Finally, the SIASI oral health module was implemented from 2007 to 2008 to monitor epidemiological indicators of caries and periodontal disease, individual and collective procedures, and productivity by villages and the different Indigenous peoples. However, the data currently available refer only to Indigenous people who are served by oral health services and are limited to information on coverage and use of services[12,32,33]. Studies indicate that the SIASI is not implemented with consistent and publicly available data. Several problems are faced in consolidating the system, making it challenging to develop a reliable picture of Indigenous peoples' demographic and epidemiological profile, limiting the possibility of the system functioning as an instrument for planning, monitoring, and evaluating health[12,29,30,34].

Despite these difficulties, there is evidence of an increased reporting of oral health information in SIASI over the last decade, which strengthens and qualifies the information system as a fundamental strategy for improving public policies within the SASI-SUS[6]. This study proposed to take a step towards analysis to identify inconsistencies and possibilities for improvements to reaffirm the importance of SIASI as a system that considers the socio-territorial dynamics of Indigenous peoples and integrality by aggregating multiple pieces of information about the reality of these peoples[12,29,34].

Conclusions

The study exposes the socioeconomic difficulties in the territory of the Xukuru do Ororubá people, with widespread poor sanitation conditions and low household income, evidencing their impacts on oral hygiene practices, the probable collective deterioration of oral diseases, and the opportunity to access dental services.

The geographical and health service provision peculiarities of the Indigenous Land are illustrated, as it is vast, has a dispersed population distribution, and health units are concentrated in a few villages, along with the need for users to travel by car outside the IL when they need to access the specialized oral healthcare. On the other hand, the outnumbered EMSI work process is based on seasonal rotations. The accumulation of these characteristics results in difficulties in the continuity of oral healthcare, fragmented care, and reduced capacity to resolve dental treatments.

Access to oral health services improved between the analyzed years, with growth for all indicators (except for completion of dental treatments). However, the indicators and parameters must be qualified to adapt to Indigenous peoples' sociocultural and territorial reality. Moreover, there are challenges related to the completeness and reliability of the data recorded in the SIASI, a system with great potential as a qualified instrument for comprehensive monitoring of Brazilian Indigenous peoples' health and living conditions.

Collaborations

LFR Santos, FB Andrade, HA Mauricio and RS Moreira actively participated in the study's conception and design; data analysis and interpretation; the article's writing and critical review and approval of its final version. ALS Oliveira and TR Fávaro contributed to the data analysis and interpretation; the article's critical review and approval of its final version.

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