

Oral health in transition: the case of Indigenous peoples from Brazil

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The objective of this paper is to summarise epidemiological information about the distribution of dental caries among Indigenous peoples in Brazil. The authors also present a case study of a specific group of Xavante Indians, one of the most numerous of Brazil's Indigenous peoples, describing how their oral health has deteriorated over recent decades, and showing how an oral health programme is attempting to reverse the present trend of increase in caries. The programme at Etenheritipá Xavante village incorporated three principal components: educational, preventive, and clinical. From the beginning, the programme included epidemiological record keeping for monitoring the level of caries in the population. Transversal studies of the condition of oral health among the Xavante of Etenheritipá were undertaken in 1999, 2004, and 2007. In the period from 2004 to 2007 the DMFS values in the 11-15 age cohort had a significant reduction in caries experience. The mean DMFS score fell from 4.95 in 2004 to 2.39 in 2007 ($p < 0.01$). An increase in the percent of individuals who were free from caries was also noted: in 1999, 20% of adolescents 11-15 had no caries; in 2007, the proportion had risen to 47%. The Xavante case is a prime example of the transition in oral health that is taking place among the Indigenous peoples of the Americas, and it highlights the importance of oral health promotion through preventive measures such as access to fluoridation and basic care in reducing the inequality between Indians and non-Indians.

Key Words: Caries, oral health programmes, epidemiology, South American Indigenous peoples

More than 400 different Indigenous peoples, with a population of 45-48 million, live in the countries of Latin America and the Caribbean, making up around 10% of the population of these countries¹. While Brazil's Indigenous population is small by comparison, numbering only 500-600,000 (less than 0.5% of the total population of the country) it is a highly diverse socio-cultural mosaic, as it is divided among 225 distinct Indigenous people, more than half of all those in Latin America. Since the end of the sixteenth century, the process of contact resulting from the expansion of Western society has resulted in profound transformations of the socio-cultural, political, and economic systems of Indigenous

peoples at every level, with repercussions on their means of subsistence and on their demographic and epidemiological characteristics^{2,3}, including oral health^{4,7}.

One objective of this paper is to summarise epidemiological information about the distribution of dental caries among Indigenous peoples in Brazil. We also present a case study of a specific group of Xavante Indians, one of the most numerous of Brazil's Indigenous peoples, describing how their oral health has deteriorated over recent decades, and showing how an oral health programme is attempting to reverse the present trend of increase in caries.

Caries among native peoples in Brazil

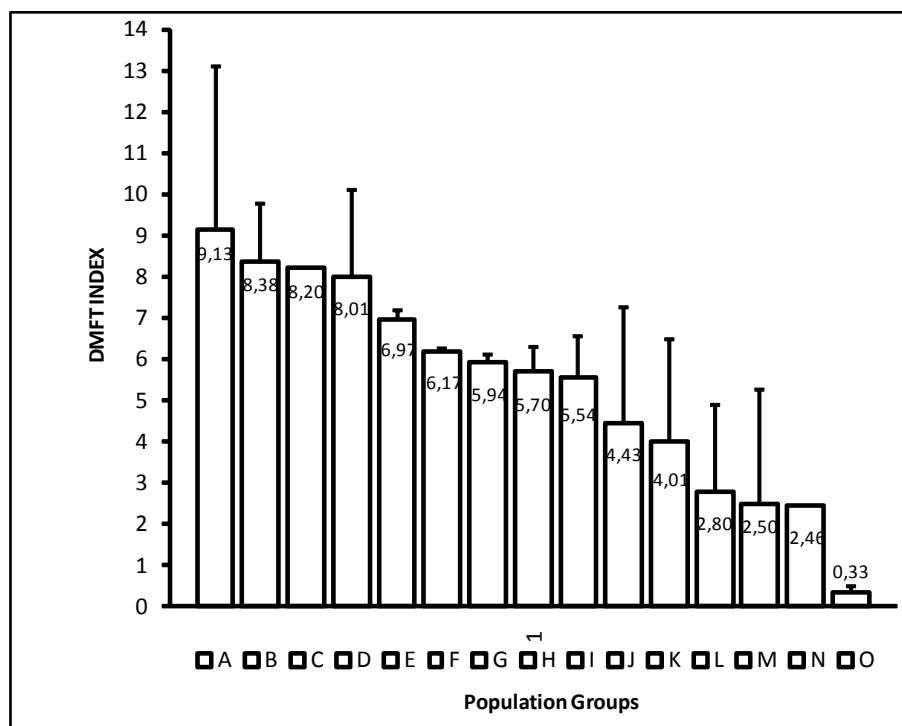
The first epidemiological studies of oral health conditions among the native peoples of Brazil were carried out in the 1950s⁸. Scientific research since that time has shown that the risk of developing dental caries increases progressively as these groups interact with the non-Indigenous population⁵⁻⁷. Changes in subsistence pattern that come with contact, involving dietary innovations such as the consumption of refined sugar and other industrialised foods, have a negative effect on dental health, with a pronounced increase in caries⁵⁻⁷. However, as Arantes⁶ points out, there are exceptions to this rule, since there are cases of groups that, even before contact, had high levels of caries due to particular aspects of their diets.

The epidemiological picture of Indigenous peoples in Brazil at the start of the 21st century is both complex and diverse. In *Figure 1* we present estimates of caries experience for the non-Indigenous Brazilian popula-

tion in the 15-19 age cohort and for some Indigenous peoples in the same cohort. On the one hand, there are groups with very high levels of caries, such as the Kinsedjê and the Ikpeng of the Xingu Indigenous Park in central Brazil. On the other hand there are groups with very little caries, such as a Yanomami subgroup in western Amazonia whose diet includes little refined sugar and other industrialised foods. The general pattern that emerges is of higher prevalence among populations consuming more westernised diets.

The Xavante intervention project

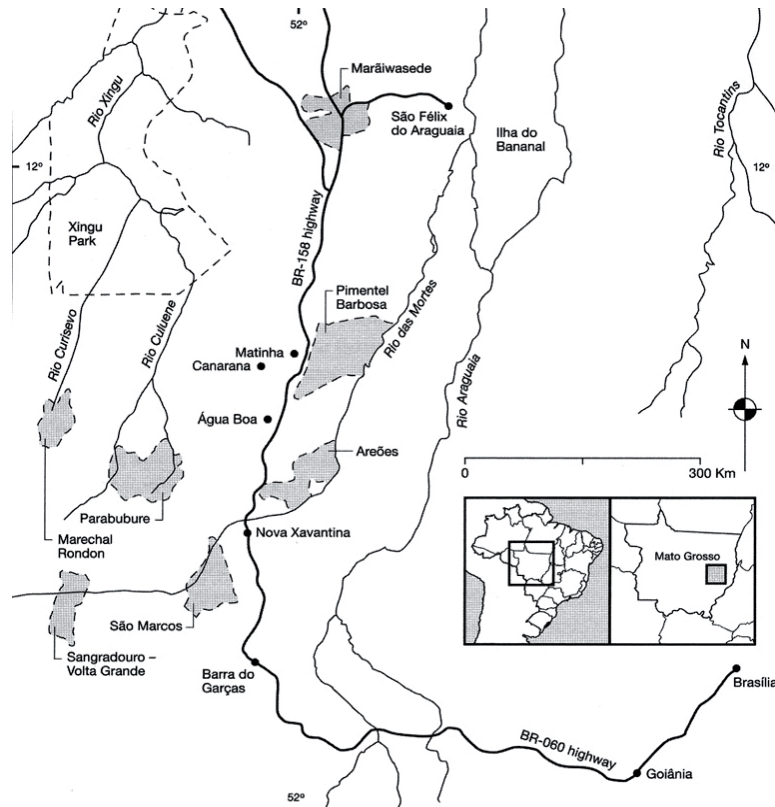
The Xavante are one of the most numerous native peoples of Brazil, with a total population of 15,000 living on seven reservations in the central region of Brazil (*Figure 2*). After contact the Xavante underwent, during the 1950s and 1960s, a period of high mortality from epidemic diseases. Moreover, as the country filled with



Legend					
A	Kinsedje 2006	F	Brazil 2003	K	Kamaiurá 2006
B	Ikpeng 2006	G	Brazil Southeast 2003	L	Guarani RJ 2007
C	Baniwa 2004	H	Xavante 2004	M	Waurá 2006
D	Kayabi 2006	I	Guarani SP 2001	N	Yanomami Maiá 2007
E	Brazil Center West 2003	J	Trumai 2006	O	Yanomami Xitei 2007

Sources: Kinsedje²⁰, Ikpeng²⁰, Baniwua²¹, Kayabi²⁰, Brazilian population from the Central West Region²³, Brazilian population²³, Brazilian population from the Southeast Region²³, Xavante²⁴, Guarani from São Paulo State²⁵, Trumai²⁰, Kamaiurá²⁰, Guarani from Rio de Janeiro State²⁶, Waurá²⁰, Yanomami Maiá²⁷, Yanomami Xitei²⁸.

Figure 1. Comparison of caries levels (mean DMFT scores and 95% confidence interval) in the 15-19 year old Brazilian population (general and located in Center West and Southeast regions), and in various Brazilian Indigenous groups.



Source: Coimbra *et al.*²

Figure 2. Geographic location of Xavante reservations in Mato Grosso State, Brazil

farms and urban settlements the Xavante subsistence pattern, which involved mobility to explore the resources of their environment over a wide area, became restricted. This led to a more sedentary life style, a decline in hunting and gathering and the increased importance of agriculture, with resulting dietary changes, including a growing dependence on industrialised products^{2,9-11}. The Xavante diet, formerly based on gathered wild fruits and tubers, game, and maize grown in small forest gardens, after the 1970s became based on upland rice^{2,12}.

Anthropological and epidemiological studies of the Xavante since the 1960s have shown an increase in health problems related to socio-cultural, economic and ecological changes, with increase in overweight, obesity, diabetes, and arterial hypertension^{2,10}. Data indicating a tendency for caries increasing over time makes the Xavante case a typical example of oral health transition⁶. At the beginning of the 1960s the level of caries, even among adults, was very low: the mean DMFT for individuals between the ages of 20 and 34 was 0.7; three decades later the mean DMFT for individuals of the same age cohort was 9.7 (*Table 1*).

In 1999, one of the authors of this paper (Arantes) took the initiative of starting a programme with the aim of implanting measures to control caries and promote oral health in the Xavante village of Etenheritipá (The Etenheritipá-Xavante Program to Promote Oral

Health). From the start, the programme took a multi-sectoral approach that adopted as principles the participation of the community, promotion of general health, personnel training, utilisation of appropriate technology, and the use of fluoride¹³. As a rule, health programmes are implemented with little sensitivity to the peculiarities of the social groups they are intended to serve, adopting practices that ignore local models and internal resources that could be brought to bear on specific health problems affecting the community¹⁴. Local models are linked with culturally-determined ways of understanding the processes of becoming ill, of suffering, and healing. Especially in working with Indigenous peoples, understanding, appreciation, and respect for their explanatory models of health and illness are very important so that the programmes may incorporate these values rather than try to substitute them.

When the programme began, the Xavante did not know about the use of the toothbrush to clean the mouth and prevent dental disease. However, they had other forms of oral hygiene based on wooden toothpicks and rinsing out the mouth with water. It took some time for the new form of oral hygiene with the use of unfamiliar tools and techniques to be accepted and spread in the community. For example, when toothpaste was first distributed the children thought it was more fun to use it as body paint than to brush their teeth.

Table 1 Mean DMFT scores from epidemiological surveys carried out in the Xavante at different years by age group. Xavante Etenheritipá Community, Mato Grosso, Brasil.

Age group (years)	1962		1991		1997	
	N	Mean	n	Mean	n	mean
06-12	14	0.21	35	0.37	60	1.08
13-19	21	0.30	25	1.16	37	4.54
20-34	17	0.71	23	8.13	46	9.72
35-44	5	2.40	10	9.10	24	14.25
45 or over	3	3.60	18	13.78	16	17.75

Note: Values for 1962 from Neel *et al.* (1964)⁶; for 1991 and 1997 from Arantes *et al.* (2001)⁵. Standard deviations were not included in the reports.

Table 2 Mean values, standard deviations (SD), and confidence intervals (CI) for DMFT scores, and percentage of caries-free individuals in 1999 and 2004, by age cohort. Xavante Etenheritipá Community, Mato Grosso, Brasil.

Age Group	1999					2004				
	DMFT					DMFT				
	N	Means	SD	CI (95%)	Caries free	N	Means	SD	CI (95%)	Caries free
2 to 5 *	21	2.05	2.82	076 – 3.33	33.3%	34	2.71	3.89	1.58 – 4.06	41.1%
6 to10 *	67	3.51	2.54	2.89 – 4.13	11.9%	76	3.22	3.08	2.51 – 3.92	25.0%
11 to 15	29	2.17	2.63	1.17 – 3.17	20.7%	64	2.31	2.45	1.70 – 2.92	31.3%
16 to 20	23	3.87	4.09	2.10 – 5.63	-	21	4.33	3.09	2.92 – 5.73	-
21 to 30	36	8.14	6.67	5.88 – 10.40	-	49	7.98	6.02	6.25 – 9.70	-
31 to 40	22	10.55	5.72	8.01 – 13.08	-	22	9.18	6.47	6.13 – 12.05	-
41 or over	14	15.71	4.27	13.24 – 18.17	-	15	13.47	5.79	10.26 – 16.67	-

Table 3 Mean values, standard deviations (SD) and confidence intervals (CI) for DMFS scores, and percentage of caries-free individuals in 2004 and 2007 by age cohort. Xavante Etenheritipá Community, Mato Grosso, Brasil.

Age Group	2004					2007				
	DMFS					DMFS				
	N	Means	SD	CI (95%)	Caries free	N	Means	SD	CI (95%)	Caries free
2 to 5 *	34	4.62	8.20	1.75 – 7.48	44.1%	60	2.82	5.83	1.31 – 4.32	43.3%
6 to10 *	76	6.71	7.58	4.98 – 8.44	25.0%	85	4.98	6.14	3.65 – 6.30	29.4%
11 to 15	64	4.95	6.21	3.39 – 6.50	31.3%	66	2.39	4.01	1.40 – 3.27	47.0%
16 to 20	21	9.57	10.29	4.88 – 14.25	-	54	10.61	11.86	7.37 – 13.84	13.0%
21 to 30	49	21.84	20.48	15.95 – 27.72	-	44	23.30	23.26	16.22 – 30.37	-
31 to 40	22	31.45	26.05	19.90 – 43.00	-	37	34.84	25.51	26.33 – 43.34	-
41 or over	15	54.93	24.35	41.44 – 68.41	-	24	54.46	28.39	42.47 – 66.44	-

* The "dmfs" index was used in this age group.

By recognising the traditional means of oral hygiene and associating them with Western techniques the Xavante were gradually brought to recognise and accept the use of the toothbrush and toothpaste for oral health.

The programme at Etenheritipá incorporated three principal components: educational, preventive, and clinical. The aim of the educational component was to foster interest in oral health through the introduction of new concepts of health and disease so as to build habits of

self care. The preventive component consisted of regular use of fluoride, both in the form of toothpaste and topical application. This component involved the willing collaboration of the Indigenous health agents, who were trained to make the topical fluoride applications and distribute the oral hygiene material. The clinical component consisted of dental services to alleviate pain, treat infection, restore teeth that could be recuperated, and apply basic periodontal therapy.

From the beginning, the programme included epidemiological record keeping for monitoring the level of caries in the population. Transversal studies of the condition of oral health among the Xavante of Etenheritipá were undertaken in 1999, 2004, and 2007. Between 1999 and 2004, a tendency was found for the caries experience to level off, reversing the trend toward increase observed in previous decades. For adults in the 21-30 age cohort the mean DMFT scores were respectively 8.1 and 7.9 (Table 2). In the period from 2004 to 2007 the DMFS values remained at much the same level. However, in the 11 to 15 age cohort there was a significant reduction in caries experience from 2004 to 2007. In this age cohort the mean DMFS score fell from 4.95 in 2004 to 2.39 in 2007. ($p < 0.01$). The reduction in caries observed among adolescents was mainly due to the prevention training strongly directed toward this age group. An increase in the percent of individuals in this age group who were free from caries was also noted: in 1999, 20% of adolescents 11-15 years had no caries; in 2007, the proportion had risen to 47% (Table 3).

As part of the activities of the programme Arantes *et al.*¹⁵ carried out a longitudinal analysis of the data collected at Etenheritipá for a group of individuals who were examined both in 1999 and in 2004. They observed that risk of caries was significantly different according to age and sex. The lowest incidence was among children between the ages of six and twelve, who were assisted by the programme as a part of their school activities. The incidence of caries was substantially higher in the 20-24 age cohort, especially among women, who had four times the risk of men in the same age group. The authors argued that the different social roles of men and women may be linked to unequal access to information, health services, and education in oral health, leading to the disparity in incidence of caries. In view of these observations, special attention within the programme was directed to this high-risk group.

In order to verify the situation of Etenheritipá within other Xavante communities, Arantes *et al.*¹⁶ carried out a comparative study in four communities located on three different Xavante reservations. They found important differences in prevalence of caries among these communities, which the authors attribute to differences in the processes of socio-cultural, economic, and ecological change, with corresponding pressure to adopt a more western diet. These differences were apparent in untreated caries and missing teeth both in men and women independently of the age variation¹⁶. The lowest levels of caries were observed at Etenheritipá, which they attributed in part to the programme directed specifically to the promotion of oral health, while the other villages had no corresponding programme.

Final comments

Beginning in 1999, health care for Indigenous peoples in Brazil became the responsibility of the Ministry of Health, which was charged with implanting a Subsystem of Indigenous Health Care designed to provide a special health care system for Indigenous populations that would respect their specific socio-cultural characteristics¹⁷. This process made available more financial and professional resources for Indigenous health care. Nevertheless, the effects of the new system have not been felt evenly throughout Brazil. While in some districts it is possible to see the results of certain activities, in others difficulties have appeared to impede the implantation and organisation of oral health services, often leaving a large part of the Indigenous population with no assistance whatsoever¹⁸. These difficulties have led to a picture of inequality between Indigenous and non-Indigenous people in access to basic health services and health promotion, which over time is reflected in significant epidemiological differences between Indigenous and non-Indigenous people^{6,19}.

Some initiatives, supported by agreements between public and private institutions and Indigenous associations, have tried to overcome cultural, economic, and geographic barriers to assure attention to the oral health of Indigenous peoples. Among these initiatives is the Program for Oral Health, implemented at the Xavante village of Etenheritipá, described above. The Xavante case is a prime example of the transition in oral health that is taking place among the Indigenous peoples of the Americas, and it highlights the importance of oral health promotion through preventive measures such as access to fluoridation and basic care in reducing the inequality between Indians and non-Indians. Within a few years this programme, through basic preventive care and education, succeeded in reversing the prevailing trend of increase in caries and tooth loss. However, oral health programmes like this are still an exception in the reality of the Indigenous situation in Brazil. The great challenge to be confronted is not only to guarantee the sustainability of such programmes but, above all, to widen their scope to cover other communities and so reduce the inequalities that separate Indigenous from non-Indigenous populations.

Acknowledgements

We thank the Xavante for participating in this investigation Project. Funding was provided by

Colgate, Capes (through the Prodoc Program) and CNPq (through a doctoral fellowship awarded to Arantes). We also thank Nancy Flowers for translating this paper from Portuguese.

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