Pattern of caries experience in a 12-year-old Brazilian population related to socioeconomic background

Maria Cristina Rigatto Witt
Department of Periodontology, Dental Faculty, University of Oslo, Oslo, Norway

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The aim of this work was to study the pattern of DMFT, DMFS, and DMFS components in groups of poor (91) and rich (89) 12-year-old children in Porto Alegre, Brazil. The results showed similar DMFT scores for the groups; however, the poor had a higher DMFS score than the rich. Filled surfaces comprised 96% (rich) and 50% (poor) of the DMFS values, and caries experience for the first molars were similar in the groups. Prevalence of interproximal caries was higher among the poor. It is concluded that the unequal access to dental care in the two populations may have influenced the DMFT values and concealed differences in the true disease experience. □ *Developing countries; epidemiology; health care delivery*

Maria Cristina R. Witt, University of Oslo, Dental Faculty, Department of Periodontology, Postboks 1109, Blindern, 0317 Oslo 3, Norway

Dental caries experience in Brazilian children is reported to be among the highest currently recorded in the world (1). Until recently, little information was available on its relationship with socioeconomic status, whereas this association has been widely reported elsewhere (for a review, see Ref. 2). Several studies from developing countries in Africa have shown that children belonging to higher social classes have a higher caries experience than children belonging to lower social classes (3–10). In industrialized countries this relationship is reversed (11–18).

Variations in caries experience presented by different socioeconomic groups are usually explained by differences in the most important dental health habits: sugar consumption, use of fluorides, and oral hygiene practices. In addition, utilization of oral health services has been related to social class differences in caries experience (19, 20). In Brazil it has been shown that access to dental care varies among social groups (21). Children from low socioeconomic groups receive irregular care through the school dental services, mostly on a pain relief basis. On the other hand, most of the children from higher socioeconomic groups receive regular dental check-ups and treatment through the private system. In epidemiologic studies the DMF index is a widely used and accepted measure of caries experience in populations. However, the DMF index is subject to some well-known limitations (22). Teeth may be filled for reasons other than decay (23) and to prevent decay in the future. In an epidemiologic survey such teeth must be included in the F component of the DMF, and if they had not been filled in the first place, the survey examiner might have diagnosed them as sound teeth. In highly treated populations in which many 'preventive fillings' have been placed, the DMF scores will tend to be increased (22). Therefore, care should be taken when using the DMFT index to study caries experience in populations from both developing and industrialized countries or from different socioeconomic backgrounds.

The purpose of the present work was to study the pattern of DMFT, DMFS, and DMFS components in groups of poor and rich 12-year-old children in Porto Alegre, Brazil.

Materials and methods

The study was carried out in 1987 in the urban area of Porto Alegre, Brazil—a city with fluoridated water and a population of 1.3 million (1985).

All children from three schools born in 1975 (mean age, 143 months) were included in the study after their parents' consent had been collected. Children wearing orthodontic appliances were excluded. To select children with markedly different socioeconomic backgrounds, a public school without tuition fee (poor school) and two private schools with high tuition fees (rich schools) were chosen. The distribution of children by age, sex, and type of school is shown in Table 1. In the poor school the mean age, expressed in months, was significantly higher than in the rich schools. The distribution of males and females also showed significant differences. Children from the poor school received dental care through the school dental service, where one dentist was working irregularly. Most of her time was used in pain relief treatment. In the rich schools children received dental care through the private system on a more regular basis.

Clinical examination

The DMFT and DMFS scores were recorded in accordance with the WHO criteria (24), modified as follows: the codes 'sealant, varnish' (6), 'excluded tooth' (9), and 'bridge abutment or special crown' (7) were excluded. Teeth 'filled, with decay' (2) were considered 'decayed', and an 'unerupted tooth' (8) was regarded as 'tooth missing for any other reason' (5). The code 'missing as a result of caries' (4) included teeth indicated for extraction due to caries. Recorded buccal and lingual caries experience included both carious and restored pits and fissures on these surfaces.

All subjects were examined by the same examiner equipped with a dental probe and a plane mouth mirror. No radiographs were taken, and the teeth were not dried before examination. In the poor school the clinical examination was carried out in the school dental office with a dental chair and normal dental illumination. In the rich schools the participants were examined in one of the classrooms, where a conventional chair was placed close to the wall in a manner so that the children's heads could be supported by a pillow. Natural daylight was avoided, and illumination was provided by a head-lamp.

The reliability with which the examiner applied the criteria of the DMF index was assessed by the test–retest method in 11% of the sample. The kappa value (25) obtained was 0.94. In spite of the high K value, the McNemar test (26) was used to assess bias between the first and second examination. On the basis of unsound/sound and sound/unsound pairings, the test showed no significant bias.

Table 1. Mean ($\bar{x}$) age in months and standard deviation (SD) in accordance with socioeconomic background and sex

	Age (in months)		
	n	$\bar{x}$	SD
Poor school			
Male	50**	148	4.9
Female	41	148	5.2
Sum	91	148*	5.1
Rich schools			
Male	32**	136	7.8
Female	57	138	7.0
Sum	89	138*	7.3
Total	180	143	8.1

* $p < 0.001$ (*t* test).
** $p < 0.05$ (chi-square test).

Statistical analysis

The *t* test was used for comparison of means between groups. The chi-square test was used to compare differences in distributions. Significance was claimed at $p < 0.05$.

Results

The total caries experience in the present population, expressed as mean DMFT, was 2.8. The difference between the DMFT in children from poor (3.1) and rich (2.5)

Table 2. Mean ($\bar{x}$) DMFT, DMFS, DS, MS, and FS and standard deviation (SD) in accordance with socioeconomic background

	DMFT		DMFS		DS		MS		FS	
School	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Poor	3.1	2.7	4.9*	4.6	1.7*	2.6	0.7	1.9	2.5*	2.9
Rich	2.5	2.0	3.6*	3.3	0.1*	0.5	0.0	0.0	3.5*	3.3
Total	2.8	2.4	4.3	4.1	1.0	2.0	0.4	1.4	3.0	3.1

* $p < 0.05$ (t test).

schools was not statistically significant (Table 2).

The mean DMFS and its components are displayed in Table 2. The total DMFS was 4.3, and a statistically significant difference between poor (4.9) and rich (3.6) schools was observed.

The mean number of decayed surfaces was significantly lower in rich (0.1) than in poor (1.7) schools. On the other hand, filled surfaces were significantly higher in rich (3.5) than in poor (2.5) schools (Table 2).

Further analysis to study the distribution of lesions and restorations by surface showed that caries experience in first molars comprised 83% of the total DMFS. The mean DMFS for these teeth did not differ significantly between poor (3.9) and rich (3.2) schools.

In addition, filled surfaces comprised 96% and 50% of the DMFS values in rich and poor schools, respectively. Approximal caries was predominantly detected in first molars and incisors in the poor school. Children in the rich schools presented mostly filled approximal surfaces in the first molars. In addition, decayed and filled approximal surfaces were almost four times more prevalent in the poor than in the rich schools. Missing teeth were only recorded in the poor school and comprised 13 first molars.

Discussion

In Brazil, families from clearly different socioeconomic levels select different schools for their children. Public schools with no tuition fees are usually preferred by socially underprivileged groups, whereas private schools with high tuition fees recruit their students from rich families. In the present study the possibility of a socioeconomic 'crossover' effect between the groups is unlikely but cannot be totally disregarded since the variable was assessed on a group level. Another aspect of concern was the age difference between the social groups (Table 1). Although children from the poor school as an average were approximately 10 months older than the rich children, an unexpected similarity in the number of erupted teeth was observed between the groups (25.4). It is generally believed that variation in tooth eruption age has a multifactorial basis (27–29). Some studies have shown an association between socioeconomic level and deciduous tooth eruption. Accordingly, tooth eruption was delayed in children from lower income groups (30, 31) compared with the higher income groups (9, 32, 33). To what extent variation in 'tooth eruption age' may have influenced the caries level in the present population cannot be assessed from this study. However, when caries experience is compared between groups, the physiologic age, as expressed by 'tooth eruption age', may be as important as the chronologic age. In the present study the groups are comparable in this respect. Since no difference in caries experience between girls and boys was observed, the difference between groups in sex distribution was disregarded in the analysis. It is not known whether the different light sources during clinical examination may have influenced the present results.

The DMFT score for 12-year-olds in the

present study was moderate (2.8). This finding was surprising and in contrast to the very high score (6.7) commonly reported for Brazilians at the same age (1, 21). Although the study population was not a statistically representative sample, the finding may reflect the effect of fluoridation of the drinking water of Porto Alegre.

No statistically significant differences were found in the DMFT values between the poor and the rich children, in spite of different socioeconomic status and dental care received. This finding disagrees with the recent report from the Brazilian National Oral Health Survey (21), in which a significant difference was observed in the DMFT between 12-year-olds from families with low (7.0) and high (5.9) income. Studies from other developing countries support these results (34, 35). On the other hand, when the data were further analyzed in accordance with the DMFS index, subtle differences between the groups became evident, corroborating the general idea that DMFS is a more sensitive measure of caries experience than the DMFT.

The DMFS score for poor children was significantly higher than for rich children. Poverty seems to result in more children with untreated caries lesions, whereas restorations reached almost 100% of the DMFS value for rich children. Moreover, missing teeth were observed exclusively in the poor school and comprised 13 first molars. This pattern of distribution of DMFS in population groups was also found by Antoft et al. (36), who pointed out that social factors seem to affect the number and the proportionate composition of the DMF index.

The difference observed in the DMFS between the social groups was due to the presence of missing teeth and the higher number of decayed surfaces in the poor children. Furthermore, the prevalence of approximal caries, which is regarded as an indicator of caries activity (37), was much higher and mainly detected as decayed surfaces in incisors and first molars in the children from the poor school. The DMFS score obtained for rich children can be almost totally explained by the caries experience of first molars, and the high proportion of filled surfaces indicates more dental treatment received. The similarity between the groups in total DMFT in spite of indications of higher caries activity among the poor children suggests that in the rich more often than in the poor children fillings have been inserted in lesions not qualifying for positive caries score according to our criteria. If so, this means that the unequal access to dental care in the two populations influenced the DMFT values and concealed differences in the true disease experience. This is in good agreement with observations made by other investigators (22, 23) and would call for great caution in using total caries experience (DMF) when disease levels are to be compared between groups of different socioeconomic levels.

In contrast to reports from other developing countries of higher caries experience in children from higher socioeconomic levels, the present study shows a tendency for lower caries experience with increasing social level. One of the reasons frequently reported to explain difference in caries between socioeconomic groups is sugar consumption (4, 5, 7, 9, 38–42). In Brazil, sugar and sugar products are highly available at a very low price, and it is not known whether sugar consumption differs among the socioeconomic levels. Further investigations are clearly required to explain the differences in dental caries between rich and poor children.

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References

1. Leclercq MH, Barmes de, Sardo Infirri J. Oral health: global trends and projections. World Health Stat Q 1987;40:116–28.
2. Carmichael CL, Rugg-Gunn AJ, French AD, Cranage JD. The effect of fluoridation upon the relationship between caries experience and social class in 5-year-old children in Newcastle and Northumberland. Br Dent J 1980;149:163–7.
3. Cleaton-Jones P, Richardson BD, Rantsho JM. Dental caries in rural and urban black pre-

schoolchildren. Community Dent Oral Epidemiol 1978;6:135–8.
4. Olsson B. Dental health situation in privileged children in Addis Abeba, Ethiopia. Community Dent Oral Epidemiol 1979;7:37–41.
5. Enwonwu CO. Review of oral disease in Africa and the influence of socioeconomic factors. Int Dent J 1981;31:29–38.
6. Klausen B, Fanoe JG. An epidemiologic survey of oral health in Swaziland. Community Dent Oral Epidemiol 1983;11:63–8.
7. Manji F. The prevalence of dental caries in children of African and Asian origin in Nairobi, Kenya. Odontostomatol Trop 1983;6:27–33.
8. Manji F, Mosha H, Frencken J. Tooth and surface patterns of dental caries in 12-year-old urban children in East Africa. Community Dent Oral Epidemiol 1986;14:99–103.
9. El-Beheri S. Dental caries among Egyptian school children of high and low socioeconomic level. Egyptian Dent J 1986;32:255–63.
10. Frencken JE, Truin G-J, Vant't Hof MA, et al. Prevalence of dental caries in 7–13 yr-old children in Morogoro District, Tanzania, in 1984, 1986, and 1988. Community Dent Oral Epidemiol 1990;18: 2–8.
11. Savara BS, Suher T. Dental caries in children one to six years of age as related to socio-economic level, food habits and tooth-brushing. J Dent Res 1955;34:870–5.
12. Wisan JM, Lavell M, Colwell FW. Dental survey of Philadelphia preschool children by income, age and treatment status. J Am Dent Assoc 1957;55:1–10.
13. Castaldi CR, Quigley W, Zacheral W. Fluoridation, dental health and socio-economic level [abstract 240]. J Dent Res 1961;40:726.
14. Samuelson G, Grahnén H, Arvidsson I. An epidemiological study of child health and nutrition in a northern Swedish county. VI. Relationship between general and oral health, food habits, and socio-economic conditions. Am J Clin Nutr 1971;24:1361–73.
15. Kohler L, Holst K. Dental health of four-year-old children. Acta Paediatr Scand 1973;62:269–78.
16. Holm AK, Błomquist HK, Crossner CG, Grahnén H, Samuelson G. A comparative study of oral health as related to general health, food habits and socio-economic conditions of 4-year-old Swedish children. Community Dent Oral Epidemiol 1975;3:34–9.
17. Gibson A, Gelbier S, Bhatia S. Dental health and treatment needs of 5-year-old children in the health area of Lambeth, Southwark and Lewisham. Community Dent Oral Epidemiol 1981;9:5–9.
18. Milen A, Hausen H, Heinonen OP, Paunio I. Caries in primary dentition related to age, sex, social status, and county of residence in Finland. Community Dent Oral Epidemiol 1981;9:83–6.
19. Richards ND. Utilization of dental services. In: Richards ND, Cohen LK, editors. Social sciences and dentistry. A critical bibliography. The Hague: FDI, 1971:209–40.
20. Schwarz E. Dental programmes for children and young adults in Denmark in a social perspective. Scand J Primary Health Care 1985;3:113–20.
21. Ministerio da Saude, Secretaria Nacional de Programas Especiais de Saude, Divisao Nacional de Saude Bucal, Fundacao Servicos de Saude Publica. Levantamento epidemiologico em saude bucal: Brasil, zona urbana, 1986. Brasilia: Centro de Documentacao do Ministerio da Saude, 1988. (Serie C: estudos e projetos 4).
22. Burt BA. Methods for assessing the distribution of oral diseases. In: Striffler DF, Young WO, Burt BA, editors. Dentistry, dental practice, and the community. Philadelphia: WB Saunders, 1983: 87–90.
23. Locker D. Measuring oral health: a conceptual framework. Community Dent Health 1988;5:3–18.
24. World Health Organization. Oral health surveys. Basic methods. 3rd ed. Geneva: WHO, 1987.
25. Cohen J. A coefficient of agreement for nominal scales. Educ Psychol Measurements 1960;20:37–46.
26. Siegel S, Castellan NJ Jr. Nonparametric statistics for the behavioral sciences. 2nd ed. New York: McGraw-Hill Book, 1988:75–80.
27. Brook AH, Barker DK. Eruption of teeth among the racial groups of Eastern New Guinea: a correlation of tooth eruption with calendar age. Arch Oral Biol 1972;17:751–9.
28. Rami Reddy V, Vijayalakshmi PB, Chandrasekhar Reddy BK. Deciduous tooth emergence and physique of Velama children of Southeastern Andhra Pradesh, India. Acta Odontol Pediatr 1986;7:1–5.
29. Ounsted M, Moar V, Scott A. A longitudinal study of tooth emergence and somatic growth in 697 children from birth to three years. Arch Oral Biol 1987;32:787–91.
30. Mukherjee DK. Deciduous dental eruption in low income group Bengali Hindu children. Environmental Child Health 1973;19(spec iss):207–10.
31. Visweswara Rao K, Susheela TP, Swaminathan MC. Association of growth status and deciduous teeth eruption among rural Indian children. Environmental Child Health 1973;19(spec iss): 223–7.
32. Rami Reddi V. Eruption of deciduous teeth among the children of Gulbarga, South India. Indian J Med Res 1981;73:772–81.
33. Struzak-Wysokinska M, Mierzwinska K, Emeryk B, Wolanska E. Socio-economic conditions and the beginning of first dentition in children. Czas Stomat 1986;39:151–4.
34. Zadik D. Epidemiology of dental caries in 5-year-old children in Israel. Community Dent Oral Epidemiol 1978;6:91–6.
35. Bastawi AL, Al-Khateeb TL, O'Mullane DM. Caries in private and public schools in Saudi Arabia [Abstract]. J Dent Res 1989;68(spec iss):874.
36. Antoft PE, Gadegaard E, Lind OP. Social inequality and caries studied in 1,719 Danish military recruits. Community Dent Oral Epidemiol 1974;2:305–15.
37. Klock B, Krasse B. A comparison between different methods for prediction of caries activity. Scand J Dent Res 1979;87:129–39.

38. Enwonwu CO. Socio-economic factors in dental caries prevalence and frequency in Nigerians. Caries Res 1974;8:155–71.
39. El-Hadary MS, El-Sharkawy MM, El-Kashlan K. Socio-economic status, general health among preschool children and its relation to dental caries. Egyptian Dent J 1975;21:39–48.
40. Sheiham A. Changing trends in dental caries. Int J Epidemiol 1984;13:142–7.
41. Newbrun E. Epidemiology of caries—worldwide. Dtsch Zahnaerztl Z 1987;42:8–15.
42. Heloe LA, Haugejorden O. 'The rise and fall' of dental caries: some global aspects of dental caries epidemiology. Community Dent Oral Epidemiol 1981;9:294–9.

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