Community Dental Health (2009) **26,** 116–120
Received 27 June 2006; Accepted 21 May 2007

doi:10.1922/CDH_2251Schriks05

Caries prevalence in Suriname schoolchildren

M.C.M. van Gemert-Schriks, W.E. van Amerongen and J.M. ten Cate.

Department of Cariology Endodontology Pedodontology, Academic Centre for Dentistry Amsterdam (ACTA), Universiteit van Amsterdam and Vrije Universiteit, Louwesweg 1, 1066 EA Amsterdam, the Netherlands

***Objectives*:** The aim of this study was to establish the oral health status of children living throughout the Interior of Suriname in order to define needs for dental care in line with WHO goals and guidelines. ***Basic research design*:** In this cross sectional study, dental caries was recorded according to the criteria of the WHO. Decayed, missing and filled (DMF)-teeth (T) and surfaces (S) indices for caries prevalence were used. A total of 951 children from four different regions and between 5-15 years of age, were examined. There was an approximately equal distribution of boys and girls. The children were divided into three age categories. ***Results*:** The mean dmfs in the youngest children (5-7.5 yrs) was 11.81 (SD 11.19) and the mean dmft 5.16 (SD 3.93). 17.2% of the children was caries free. Statisticaly significant regional, racial and gender differences were found The mean dmfs of children in the middle age category (7.5-10yrs) was 5.37 (SD 6.42) and the mean DMFS was 0.84 (SD 1.30). A mean DMFS of 2.31 (SD 4.97) was recorded in the oldest children. No regional, racial or gender differences were found in the last two categories. ***Conclusions*:** The results indicate that caries prevalence in young children in the Interior of Suriname is high according to the criteria of the WHO. In contrast, children in older age groups were found to experience low to moderate caries levels. This finding has consequences for the organisation and planning of future oral health care which should be focussed on young children.

Key Words: *Caries prevalence, children, developing countries*

Introduction

Dental caries is one of the most prevalent infectious diseases in the world. A substantial decline in dental caries prevalence has been noted in recent decades in the majority of industrialized countries (Marthaler *et al.*, 1996; Pakhomov, 1999; Pilot, 1988; Reich, 2001) although children from ethnic minority groups and low socio-economic backgrounds in these nations, still experience high levels of dental disease (Jamieson *et al.*, 2004; Reich, 2001). Recent studies have shown that in some industrialized countries caries levels are stabilizing or even rising again (Gray and Davies-Slowik, 2001; Haugejorden and Birkeland, 2002; Speechley and Johnston, 1996). Caries prevalence in developing countries used to be much lower than in the developed countries (Sardo-Inferri and Barmes, 1979; WHO 1996). However, an increase has been observed especially in those countries that are rapidly urbanizing and advancing socio-economically (Diehnelt and Kiyak, 2001; Jamieson *et al.*, 2004; Pakhomov, 1999; Pilot, 1988; Miura *et al*., 1997). Dental health in these countries is often of low priority due to major problems arising from communicable diseases, environmental hazards, and nutritional inadequacies.

In 1982, the World Health Organisation (WHO), in collaboration with the International Dental Federation (FDI), has formulated six oral health goals to be achieved by the year 2000 (FDI and WHO, 1982). One of the most important goals was that the mean number of decayed, missing or filled teeth (DMFT) should not exceed 3.0 at the age of 12 years and that 50 per cent of the 5- to 6-year-olds should be caries free. An acceptable level of oral health, however, should be interpreted differently by each country in the light of its social and economic characteristics, health status and morbidity patterns of its population and state of development of its health system (Pakhomov, 1999; Pilot, 1988).

Many countries lack national or regional epidemiological baseline surveys. One of these countries is Suriname. Suriname is a former Dutch colony and is situated on the northern coast of South America. The interior rainforest of Suriname, comprising about 80 per cent of the country, is sparsely populated by tribal communities, around 50.000 people (12 per cent of the total population), mainly Creole Bushnegroes (80%) and Amerindians (20%), who depend on hunting, fishing and agriculture. This area lacks an adequate infrastructure, electricity and running water (Pan American Health Organisation (PAHO), 1998).

The Ministry of Health assigned the Medical Mission (MM) with the responsibility for all medical care in the Interior. The MM aims to develop an affordable health care system based on the needs of the community and the promotion of health care awareness. Health care, including dental heath care, is provided by health care workers of different educational level. Due to a lack of knowledge, technical skills, time and proper equipment, the only dental treatment performed is tooth extractions in case of pain.

The MM does not have comprehensive information on the oral health status, with adequate epidemiological data lacking. Only a few national dental surveys were conducted in Suriname. The WHO Global Oral Data bank reported a DMFT of 4.9 in 12-year old Surinam children in 1978 (Guille, 1986) and of 2.7 in 1992 (Beltrán-Aguillar *et al.*, 1999). A survey, carried out by the

Correspondence to: Dr. M.C.M. van Gemert-Schriks, Department of Cariology Endodontology Pedodontologie, Academic Centre for Dentistry Amsterdam (ACTA), Louwesweg 1, 1066 EA Amsterdam, The Netherlands. E-mail: M.Schriks@acta.nl

Youth Dental Service Foundation in 1995 in the districts Paramaribo and Wanica, found an average dmft of 6.05 and 13% sound teeth among 6-year-olds and an average DMFT of 5.6 among 12-year-olds. These results were consistent with a survey conducted on the same sample in 1990 (PAHO, 1998). These studies do not report the caries prevalence or treatment need for the children in the Interior. Obviously this type of information is needed in order to plan adequate oral health care in this underprivileged part of the country.

The aim of the present study is to establish the oral health status of children living throughout the Interior of Suriname in order to define needs for dental care in line with WHO goals and guidelines.

Methods

The present study was carried out in the Interior of Suriname. Four different regions were included in the study: East Suriname, West Suriname, Brokopondo and Upper Suriname (Figure 1). The socio-economic status of the people living throughout these regions is comparable. People living in West Suriname are mainly from Amerindian origin, the other three regions are habited by Creole people. The study population consisted of primary school children of various ages. Because of the broad variation in age, the children were divided into three different age categories: children between 5 and 7.5 years, between 7.5 and 10 years and children between 10 and 15 years. This categorisation was based on the different phases of tooth exfoliation, taking into account that Negro children show an earlier eruption pattern than Caucasians (Stewart *et al.*, 1982). The youngest category represented the first eruption phase, children in the middle age group were in their second eruption phase and the eldest children had all their permanent teeth erupted. The participating schools were selected from the database of the Medical Mission (MM). For practical reasons, only schools that were able to be reached within two days were included. Ethical clearance was obtained from the director of the Suriname Ministry of Health. Children with a history of serious illness were excluded.

Oral examination using a headlamp, mouth mirror and dental probe, took place in the classroom whilst the child was lying on a table. All children were examined by one of the authors, calibrated with a golden standard (kappa 0.89). This golden standard document was prepared by two experienced investigators after assessing 25 pictures of (pre)molars with and without dentine carious lesions.

Caries was recorded according to the criteria and recommendations of the WHO (1987).

Statistical analyses were performed using SPSS for Windows, version 12.0.1. Non parametric statistics (Mann Whitney U or Kruskall Wallis tests) were used. For the evaluation of the nominal data, cross tabs with Pearson Chi-square test were applied. All significant differences were detected at a 95% confidence level.

Figure 1. *Map of Suriname*

Results

A total of 951 children was examined. The mean age of the children was 8.03 years (±2.60, range 5.11–14.99 years). The main relevant socio–demographic characteristics of the sample are presented in Table 1. There were significant differences in the representation of all age categories among the four regions (Pearson Chi square, p<0.001). Children in the Brokopondo and Upper Suriname regions were all in the youngest age category. Children that originated from the East and West Suriname regions showed more variation in age but were on average older. There was an approximately equal distribution of boys and girls within the four regions and within the different age categories. Regarding race, there were significant differences between the four regions (Pearson Chi square, p<0.001). Children from the West Suriname region were all from Amerindian origin, the other children were Creole Bushnegroes.

The mean dmfs of the overall sample of 5 - 7.5 year-olds was 11.81 (SD 11.19, median 9.0) and the mean DMFS was 0.26 (SD 0.75, median 0.0) (Table 2). The mean dmft of the overall sample was 5.16 (SD 3.93, median 5.0) and the mean DMFT was 0.24 (SD 0.67, median 0.0). Only 17.2% of all participating children was clinically free of caries in the primary dentition and 86.3% was clinically free of caries in the permanent dentition.

Between the four different regions, statistically significant differences were observed regarding the caries prevalence in both primary and permanent dentitions (KW, p<0.001). Post hoc Mann Whitney U tests showed that, regarding the primary dentition, children in the Eastern region had a significant lower dmfs than children from the West- (p=0.034), Brokopondo- (p=0.003) and Upper Suriname regions (p<0.001). Children in the Upper Suriname region had a significant higher dmfs than children from the Western- (p=0.004) and Brokopondo regions (p<0.001). Regarding the caries prevalence in the permanent dentition, children from the Western region showed a higher DMFS compared to the Eastern region (MW, p=0.006), Brokopondo and Upper Suriname regions (MW, p<0.001). The difference in DMFS between children from the Eastern region and children from both the Brokopondo and Upper Suriname regions was statistically significant as well (p=0.006, resp. p= 0.026). Children in the eastern region had higher caries prevalence.

In both primary and permanent dentitions, gender differences in caries prevalence were observed. Boys had a significantly higher mean dmfs (13.33, SD 12.23,

Table 1. Socio-demographic characteristics of the population

	East Suriname	*West Suriname*	*Brokopondo*	*Upper Suriname*
Gender				
Boys (%)	151 (51.9)	79 (46.7)	91 (43.8)	153 (54.1)
Girls (%)	140 (48.1)	90 (53.3)	117 (56.3)	130 (45.9)
Race				
Creole	291	--	208	283
AmerIndian	--	169	--	--
Mean age (SD, range)	10.39 (2.21, 5.92-14.99)	9.54 (2.51, 5.25-14.98)	6.17 (0.49, 5.12-7.06)	6.06 (0.47, 5.11-7.09)

Table 2. Caries prevalence for children in age category 5 - 7.5 years

	East Suriname	*West Suriname*	*Brokopondo*	*Upper Suriname*	*Total*
N	33	46	208	283	570
dmfs	5.12*	9.39	10.67	13.82*	11.81
SD, range, median	6.19, 0-23, 3.00	10.12, 0-3, 7.50	11.36, 0-67, 8.00	11.23, 0-59, 12.00	11.19, 0-67, 9.00
dmft	2.18	4.00	4.67	6.05	5.16
SD, range, median	2.39, 0-8, 1.00	3.44, 0-16, 3.50	4.01, 0-18, 8.00	3.82, 0-18, 6.00	3.93, 0-18, 5.00
% clinically caries free primary dentition	36.4	28.3	22.1	10.6	17.2
DMFS	0.57*	2.40*	0.19	0.26	0.26
SD, range, median	0.85, 0-2, 0.00	1.14, 1-4, 2.00	0.64, 0-5, 0.00	0.75, 0-6, 0.00	0.75, 0-6, 0.00
DMFT	0.57	2.40	0.15	0.25	0.24
SD, range, median	0.85, 0-2, 0.00	1.14, 1-4, 2.00	0.50, 0-3, 0.00	0.69, 0-4, 0.00	0.67, 0-4, 0.00
% clinically caries free permanent dentition	64.3	20.0	89.4	86.6	86.3

* significant at p = 0.05

median 11.0) than girls (10.33, SD 9.87, median 8.0) in their primary dentition (p=0.004). Girls had a significantly higher DMFS than boys, i.e. 0.33 (SD 0.75, median 0.0) compared to 0.19 (SD 0.74, median 0.0) (p=0.006). Regarding race, a difference in DMFS was observed (MW, $p < 0.001$). Children from Amerindian origin had a higher mean DMFS (2.40, SD 1.14, median 2.0) compared to the Creole children (0.24, SD 0.71, median 0.0).

Children aged 7.5 - 10 years originate from West and East Suriname only. Overall, a mean dmfs of 5.37 (SD 6.42, median 3.0) and a mean DMFS of 0.84 (SD 1.30, median 0.0) were observed (Table 3). The mean dmft of the overall sample in this age category was 2.24 (SD 2.31, median 2.0) and the mean DMFT was 0.78 (SD 1.14, median 0.0). Within this age category, 35.1% of the children was clinically free of caries in the primary dentition compared to 59.3% in the permanent dentition.

No statistically significant differences in caries prevalence in either the primary or the permanent dentition between the two regions or races, nor between the two sexes were found.

Children aged 10 - 15 years originate from West and East Suriname only. The majority of the children in this age category had lost their primary teeth, therefore, only the caries prevalence in the permanent dentition was evaluated (Table 4). For this group, a mean DMFS of 2.31 (SD 4.97, median 0.0) and DMFT of 1.27 (SD 1.78, median 0.0) were found. Within this age category, 54.3% of the children appeared to be clinically free of dental caries in the permanent dentition. No statistically significant differences could be found regarding the caries prevalence in the permanent dentition between either the two regions and races or between the two genders.

Discussion

This study revealed that caries prevalence in the deciduous dentition of young children in the Interior of Suriname is moderate to high according to the severity criteria of the WHO (Marthaler *et al.*, 1990). In contrast, caries prevalence in the permanent dentition (DMFT) was moderate to very low. Apparently, the greatest burden of dental decay is on young children.

Among these youngest children racial differences in caries prevalence appeared as well. Children from Amerindian origin (West Suriname) experience far more caries in their permanent dentition compared to their Creole peers living throughout the other regions.

This latter finding might be the result of a difference in eruption of the permanent teeth between the two races. More accurate research on this subject is needed in order to verify this hypothesis. Dietary differences are not likely to be responsible for racial differences in caries prevalence as Creole and Amerindian people have similar

Table 3. Caries prevalence for children in age category 7.5- 10 years

	East Suriname	*West Suriname*	*Total*
N	85	54	139
dmfs (SD, range, median)	4.35 (5.36, 0-23, 2.00)	6.96 (7.58, 0-31, 5.00)	5.37 (6.41, 0-31, 3.00)
dmft (SD, range, median)	1.87 (2.00, 0-7, 1.00)	2.83 (2.64, 0-9, 2.50)	2.24 (2.31, 0-9, 2.00)
% clinically caries free primary dentition	39.0	28.8	35.1
DMFS (SD, range, median)	0.91 (1.29, 0-6, 0.00)	0.72 (1.30, 0-5, 0.00)	0.84 (1.29, 0-6, 0.00)
DMFT (SD, range)	0.83 (1.11, 0-4, 0.00)	0.69 (1.20, 0-4, 0.00)	0.78 (1.14, 0-4, 0.00)
% clinically caries free permanent dentition	53.7	68.8	59.3

Table 4. Caries prevalence for children in age category 10- 15 years

	East Suriname	*West Suriname*	*Total*
N	173	69	242
DMFS (SD, range, median)	2.45 (5.55, 0-51, 0.00)	2.00 (3.35, 0-15, 0.00)	2.31 (4.97, 0-51, 0.00)
DMFT (SD, range, median)	1.40 (1.94, 0-8, 0.00)	0.99 (1.32, 0-4, 0.00)	1.27 (1.78, 0-8, 0.00)
% clinically caries free	53.3	56.5	54.3

dietary habits nowadays. Overall, the diet in the Interior is changing from traditional diets and low sugar consumption towards more "westernized" diets containing sugary sweets and soft drinks. This change might be ascribed to the improving infrastructure and could be causative for an overall increase in caries prevalence. The shortage of facilities and priorities to deliver oral health care within the current primary health care programs could conductively bring about oral health problems.

In this study, the presence of dental caries was assessed by clinical examination only. No radiographs were taken due to the absence of electricity and proper equipment. Hence, the caries prevalence is likely to be underestimated.

From an epidemiological perspective, the survey was not ideal; the sample was not randomized and this limits the possibility to generalize from the data. The samples derived from the four different regions are difficult to compare and the differences between the regions cannot be analysed independently since the variables age and race were not equally distributed. However, the children examined should be regarded as a convenience sample. Although the WHO might not be able to use the results for epidemiological purposes since it does not apply to the conditions of the so called Pathfinder Method (WHO, 1987), the results are indicative and can serve as a clinical baseline for further research. Part of this study population will be evaluated during subsequent years in order to establish possible trends in oral health which is important for long term planning and policy making.

Considering the current oral health status of these children with regard to the WHO oral health goals, one must conclude that these goals are not fully met in all age categories. The WHO states that the mean DMFT should not exceed 3.0 by the age of 12 years. According to the results of this study, this goal seems to be met. Furthermore, the WHO states that 50 per cent of the 5-6 year olds should be free of dental caries in the primary dentition. Obviously, this goal is not met in this particular Suriname population. Therefore, future plans regarding oral health care in this country should focus on young children.

Conclusion

Dental caries prevalence among young schoolchildren throughout some parts of the interior of Suriname is high. Far less than 50 per cent of the children in this age group is clinically free of dental decay. Obviously there is a need for more dental care in these regions in order to meet WHO oral health goals. The current primary health care programme should thus be extended to include a proper basic oral health care programme.

As a baseline study, the presented data can be considered very useful. Data of this type provide a significant essential background for long-term strategic planning of dental services and for predicting future need for manpower, facilities and resources for dental care.

Acknowledgments

This study was supported by the Netherlands Institute of Dental Sciences (IOT), the Netherlands Foundation for the advancement of Tropical Research (WOTRO), the Foundation "De Drie Lichten" in The Netherlands and 3M-ESPE. The authors would like to thank Dr. I.H.A. Aartman for her critical reading and advice. Furthermore, they would like to thank the director of the Suriname Ministry of Health and the Medical Mission of Suriname for the intensive and enthusiastic cooperation, the provision of all facilities and the inspiring input.

References

Beltrán-Aguillar, E.D., Estupiñán-Day, S., Báez, R. (1999): Analysis of prevalence and trends of dental caries in the Americas between the 1970s and 1990s. *International Dental Journal* **49**, 322-329.

Diehnelt, D.E., Kiyak, H.A. (2001): Socioeconomic factors that affect international caries levels. *Community Dentistry and Oral Epidemiology* **29**, 226-233.

Gray, M.M., Davies-Slowik, J. (2001): Changes in the percentage of 5-year-old children with no experience of decay in Dudley towns since implementation of fluoridation schemes in 1987. *British Dental Journal* **190**, 30-32.

Guille, E.E. (1986): Caries prevalence in Suriname school children. *Odonto-stomatology Tropicale* **9**, 183-188.

Haugejorden, O. and Birkeland, J.M. (2002): Evidence for reversal of the caries decline among Norwegian children. *International Journal of Paediatric Dentistry* **12**, 306-315.

International Dental Federation and World Health Organization (1982): Global goals for oral health by the year 2000. *International Dental Journal* **32,** 74-77.

Jamieson, L.M., Thomson, W.M., MCGee. R. (2004): Caries prevalence and severity in urban Fijian school children. *International Journal of Paediatric Dentistry* **14**, 34-40.

Marthaler, T.M., Møller, I.J., von de Fehr, FR. (1990): Symposium Report: Caries Status in Europe and Predictions of Future Trends. *Caries Research* **24**, 381-396.

Marthaler, T.M., O'Mullane, D.M., Vrbic, V. (1996): Symposium Report: The Prevalence of Dental caries in Europe 1990-1995. *Caries Research* **30**: 237-255.

Miura, H., Araki, Y., Haraguchi, K., *et al*. (1997): Socioeconomic factors and dental caries in developing countries: a cross-national study. *Social Science and Medicine* **44 (2)**, 269-272.

Pakhomov, G.N. (1999): Future trends in oral health and disease. *International Dental Journal* **49**, 27-32.

Pan American Health Organisation (PAHO). Health in the Americas, 1998 Edition, Volume II.

Pilot, T. (1988): Trends in oral health: a global perspective. *New Zealand Dental Journal*, 40-45.

Reich, E. (2001): Trends in caries and periodontal health epidemiology in Europe. *International Dental Journal* **51,** 392-398.

Sardo-Inferri, J. and Barmes, D.E. (1979): Epidemiology of oral disease - differences in national problems. *International Dental Journal* **29,** 183-190.

Speechley, M. and Johnston, D.W. (1996): Some evidence from Ontario, Canada, of a reversal in dental caries decline. *Caries Research* **30**, 423-427.

Stewart, R., Thomas, K., Troutman Kenneth, C., *et al*. (1982): Paediatric Dentistry: Scientific Foundations and Clinical practice. St. Louis, MO: CV Mosby.

World Health Organisation (1987): Oral health Surveys: Basic Methods, 3rd edition. *World Health Organization*.

World Health Organization.(1996): Oral Health Country Profiles 1996. *WHO, Geneva.*