Journal of the Dental Association of South Africa, 45, 109-111

Permanent dentition caries in KwaZulu and Namibia 11-year-olds

J A Hargreaves*, P Cleaton-Jones**, J Matejka**, D Beere***, and V Hargreaves****

*Faculty of Dentistry, University of Alberta, Edmonton, Canada, **MRC/University of the Witwatersrand Dental Research Institute, Johannesburg, RSA, ***South African Medical Services, Pretoria, RSA, and ****Edmonton, Canada

Keywords: Dental caries; epidemiology.

SUMMARY

The permanent dentitions of 11-year-old children in Namibia (n = 295) and KwaZulu (n = 308) living in rural and urban areas were examined using WHO caries diagnostic criteria. In low fluoride areas (<0,15ppm F) significantly more caries was present in rural compared to urban KwaZulu but the prevalences in rural and urban Namibia were similar although significantly higher than in an area with 1,56ppm F in the drinking water. There was significantly more caries in rural Namibia than KwaZulu but the urban prevalences in both regions were similar. It is suggested that the urban findings are useful predictors for the needs of 11-year-old black children but local baseline surveys should be undertaken before considering dental programmes, treatment or preventive, for different rural communities in South Africa.

OPSOMMING

Die sekondêre gebitte van elfjarige kinders in Namibië (n=295) en in KwaZulu (n=308), woonagtig in plattelandse en stedelike gebiede, is ondersoek met gebruikmaking van die WGO kriteria vir diagnose van karies. In lae-fluoried gebiede (<0,15 dpm F) in KwaZulu is betekenisvol meer karies in plattelandse gebiede as in stedelike gebiede gevind. In Namibië was die voorkoms in die twee gebiede soortgelyk, alhoewel betekenisvol hoër as in 'n area met 1,56 dmp F in die drinkwater. Meer karies is gevind in plattelandse gebiede in Namibië as in KwaZulu, terwyl die voorkoms in stedelike gebiede soortgelyk was. Dit word voorgestel dat die bevindinge in stedelike gebiede waardevol kan wees in die voorspelling van die behoeftes van elfjarige Swart kinders, maar plaaslike ondersoeke behoort onderneem te word voor oorweging van programme vir behandeling of voorkoming vir verskillende plattelandse gemeenskappe in Suid-Afrika.

INTRODUCTION

Recently, dental caries prevalence among 11-12-year-olds has been reported in several groups of black children in low fluoride areas of South Africa (Cleaton-Jones and Hargreaves, 1988) as well as prevalences in 12-year-olds in South Africa (Steyn *et al*, 1987) and elsewhere in Africa (Manji, 1983; Manji, Mosha and Frencken, 1983; Olujugba and Lennon, 1987; Mosha *et al*, 1988).

These studies have shown that dental caries prevalence varies from region to region with similar levels of fluoride in the drinking water but with differences between populations such as geographic location or socio-economic level. What needs more investigation is whether caries prevalences observed in a population in a particular area are reasonable estimates of caries likely in another similar area in similar populations. Such information could be of use in the planning of dental health services.

The present study reports and compares dental caries prevalence in rural and urban areas of KwaZulu and Namibia.

MATERIALS AND METHODS

Prior to undertaking this study the protocol was approved by the University of the Witwatersrand's Committee for Research on Human Subjects (Clearance 86/1/1).

The field work was carried out in KwaZulu and Namibia, chosen to represent widely differing geographic areas of southern Africa. The largest cities in each region were chosen with their adjacent black residential area to approximate the environment of Soweto, the large urban black area adjacent to the City of Johannesburg. In each of these regions local educational and health authorities helped to select school districts to provide representative rural and urban samples of children aged 11 at their last birthday. The districts were KwaZulu rural - Nqutu 65 km east of Dundee and urban - KwaMashu 20km north of Durban; Namibia rural - Grootfontein 460km north of Windhoek, Otjiwarongo 250km north of Windhoek and urban Katatura on the outskirts of Windhoek. In Otjiwarongo the fluoride concentration in the drinking water was 1,56ppm and in all other areas was less than 0,15ppm.

At each school all the children of the target age group were examined in the supine position on folding chairs in good natural light using mirror and curved probe. WHO *(1979)* caries diagnostic criteria were used. Calibration prior to the study was on extracted teeth (Cleaton-Jones *et al.* 1989) and kappa scores of 0,8 or higher were obtained within and between examiners and maintained during the study indicated by re-examination of 10 per cent of the sample. Only permanent teeth were recorded.

The data were analysed using SAS (1985). Statistical tests used were the Chi square for the numbers of children with dental caries and the median test for the DMFT and DMFS scores. The critical level of statistical significance chosen was $p<0,05$.

RESULTS

Dental caries observations for each region are shown in Table I. Within KwaZulu there were significantly more children with dental caries in urban compared to rural areas ($p<0.001$). In low fluoride regions of Namibia the percentage prevalence was similar in both rural and urban areas. Caries was, however, significantly less common in the higher fluoride area ($p<0,001$) but in urban areas there was no statistically significant difference. The mean and median DMFT and DMFS scores shown in Table I reflect the same patterns as the prevalence of caries. The low DMFS scores compared to DMFT for the same group indicate that generally few surfaces were carious.

When mean DMFT and DMFS scores are calculated for children with caries only, that is a correction is made for

Table I: **Details of dental caries observations**

Region	Environment	n	Caries-free	DMFT mean	DMFT SD	DMFT median	DMFS mean	DMFS SD	DMFS median
KwaZulu	rural	156	62	1,2	2,0	0	1,7	3,1	0
	urban	152	42	2,0	2,4	1	2,6	3,6	1
Namibia	rural (higher F)	86	74	0,6	1,2	0	0,7	1,7	0
	rural	77	27	2,7	2,7	2	3,1	3,4	2
	urban	132	33	2,2	2,4	2	3,0	3,7	2

Table II: **Corrected mean DMFT and DMFS scores**

Region	Environment	n	All children corrected for erupted teeth mean DMFT/28 teeth	mean DMFS/128 surfaces	n	Children with caries only mean DMFT	mean DMFS
KwaZulu	rural	156	1,4	2,2	75	3,2	4,5
	urban	152	2,3	4,0	88	3,5	4,5
Namibia	rural (higher F)	86	0,8	1,4	22	2,4	2,7
	rural	77	3,2	4,2	56	3,2	5,4
	urban	132	2,7	5,3	86	3,3	4,5

Table III: **Percentage of carious permanent teeth within each tooth type in each jaw**

Region	Environment	Jaw	7	6	5	4	3	2	1
KwaZulu	rural	maxilla	6,2	15,8	2,2	0,8	0,5	0,7	0
		mandible	9,4	26,1	4,2	2,0	0	1,0	1,0
	urban	maxilla	12,4	26,8	2,4	2,0	1,5	0,7	2,0
		mandible	23,0	40,8	5,8	0,4	0,8	1,3	1,3
Namibia	rural (higher F)	maxilla	0	13,5	0	0	0	0	0
		mandible	0	13,0	1,1	1,7	0	0	0
	rural	maxilla	22,6	33,8	2,9	3,4	0,8	3,3	3,3
		mandible	48,0	44,5	8,9	8,9	0	1,3	0,7
	urban	maxilla	24,7	33,0	3,8	3,3	0,7	1,5	1,2
		mandible	23,6	46,0	7,5	2,0	0	0	0

Table IV: **Summary of dental caries results in Soweto and Bophuthutswana (Cleaton-Jones and Hargreaves, 1988)**

Region	Environment	n	Caries - free	DMFT	DMFS	All children corrected for erupted teeth DMFT/28 teeth	DMFS/128 surfaces	Children with caries only n	DMFT	DMFS
Bophuthatswana	rural	209	81	0,4	0,6	1,5	1,7	40	2,1	3,1
Soweto	urban	203	48	1,7	2,6	3,2	4,6	106	3,3	5,0

children without caries, then the values within each group are closer (Table II) except that the higher fluoride group scores remain low. When correction is made for the number of erupted teeth and erupted surfaces (Dummer, 1987) then the Namibian urban children have the highest DMFT/28 and DMFS/128 scores. Statistical analysis of the scores showed the same significant differences as for the numbers of children with caries.

In Table III a breakdown of the percentage of each tooth type that was carious is presented for each group for maxillary and mandibular teeth. In both jaws few incisor and canine teeth were carious, the highest prevalence being 3,3 per cent in rural Namibians in a low fluoride area. Premolars were more frequently carious in the mandible, approximately twice the prevalence that was seen in the maxilla, and Namibian children in low fluoride areas had the most carious premolars. First molars were the teeth most frequently carious, particularly in the mandible. Of all the low fluoride groups the KwaZulu rural group had the least affected first molars. Second molars were found to be carious most frequently in the Namibian rural children. For all tooth types, children in the higher fluoride rural area of Namibia had a low caries prevalence.

DISCUSSION

This investigation has shown that in low fluoride rural areas there were significantly more children with dental caries in Namibia than in KwaZulu but that the numbers in urban areas in the two regions are similar. Although significantly more children had caries in urban compared to rural areas within KwaZulu, no significant difference was found in a similar comparison in Namibia. As would be expected few children in the area with 1,56ppm F in the drinking water had caries. Differences between the low fluoride areas were less marked when DMFT and DMFS scores corrected for numbers of affected children or numbers of erupted teeth were examined. An interesting phenomenon, although not statistically significant, is that DMFT and DMFS scores and their corrected values are higher in rural Namibian children living in low fluoride areas than in their urban counterparts. This is the reverse of what is present in KwaZulu which is the general pattern worldwide. Low scores were seen in the higher fluoride area.

Dental caries studies were carried out during 1986 in similar age groups in rural Bophuthatswana and urban Soweto (both low fluoride areas); pertinent results are listed in Table IV. The number of caries-free children in rural Bophutatswana was significantly lower ($p<0,001$) than in rural KwaZulu and rural Namibia (low fluoride area) but did not differ significantly from the higher fluoride area of Namibia. When urban areas were compared significantly less children in Soweto had dental caries than in Namibia ($p<0,010$ but the prevalences in Soweto and KwaZulu were similar. The mean DMFT and DMFS as well as their corrected scores reflect the same trend.

Comparisons between the caries prevalences in the different areas studied in the present investigation or in an earlier study (Cleaton-Jones and Hargreaves, 1988) suggest the following.

Within Namibia, DMFT and DMFS scores in rural and urban low fluoride areas were similar; the usual differential of a lower prevalence in rural areas was not present. These findings in the urban or rural areas give a reasonable estimate of each other. Within KwaZulu the expected lower scores in rural areas was confirmed indicating that studies in each area are necessary. Cross comparisons between scores in urban areas showed a similarity between KwaZulu and Soweto indicating that generalization may be made between them. Rural Bophutatswana however, had lower scores than rural KwaZulu and approached that of the higher fluoride area of Namibia. The reasons for this are not known. Scores in urban areas in Namibia, Soweto and KwaZulu were similar.

The main tooth groups involved in the caries measurements were the first and second molars with as many as 45 per cent being involved by age 11 years in the low fluoride area of rural Namibia. This suggests that a fissure sealant programme could be considered when planning possible preventive programmes. In the higher fluoride rural region of Namibia the prevalence of affected first molar teeth (still the main tooth type involved) was less than 15 per cent various by the age of 11 years. It is not recommended that a sealant programme be considered in this community.

These are important considerations when planning dental health needs and preventive dentistry programmes for the school children in urban or rural communities in different regions of Southern Africa. The findings from urban communities presented in this study, could be used as reasonable predictors for the needs of urban 11-year-old black children. On the other hand the rural communities vary widely and baseline surveys of the type described by WHO (1986) are recommended before considering dental requirements for different rural communities in Southern Africa. Recently a study in Zimbabwe (Chironga and Manji, 1989) has shown two things. Firstly, in their study of black 12 year-olds in Zimbabwe there was little difference in caries between rural (mean DMFT 1,1) and urban (mean DMFT 0,5, mean DMFS 0,9) children. When they compared their results to studies in similar populations in Kenya and Tanzania, results were comparable. This supports the general observations in the present investigation.

The correction of DMFT and DMFS data for the number of erupted teeth and surfaces suggested by Dummer et al (1987) is we believe a useful method which allows comparisons of individuals and even populations with varying times of eruption.

ACKNOWLEDGEMENTS

Grateful thanks are expressed to all who participated in the surveys, particularly Mr. A de Klerk of the Namibian Education Services and Drs. A. Khan and A. Tuleram of KwaZulu Dental Services. Also thanks to Dr. S.R. Grobler of the University of Stellenbosch Oral and Dental Research Institute for the fluoride analyses, and Mrs. H. Ball for her wordprocessing skills.

REFERENCES

Cleaton-Jones, P. & Hargreaves, J.A. (1988) Dental caries of 11 to 12 year-old South African children and WHO guidelines for the year 2000. *Journal of the Dental Association of South Africa*, **43**, 357-359.

Cleaton-Jones, P., Hargreaves, J.A., Fatti, L.P., Chandler, H.D. Grossman, E.S. (1989) Dental caries diagnosis calibration for clinical field studies. *Caries Research*, **23**, 195-199

Chironga, L. & Manji, F. (1989) Dental caries in 12-year-old urban and rural children in Zimbabwe. *Community Dentistry and Oral Epidemiology*, **17**, 31-33.

Dummer, P.M.H., Addy, M., Hicks, R. & Kingdon, A. (1987) The effect of social class on the prevalence of caries, plaque, gingivitis and pocketing in 11-12-year-old children in South Wales. *Journal of Dentistry*, **15**, 185-190.

Manji, F. (1983) The prevalence of dental caries in children of African and Asian origin in Nairobi, Kenya. *Odontostomatologie Tropicale*, **6** 27-33.

Manji, F., Mosha, H. & Frencken, J. (1983) The pattern of dental caries in 12-year-old urban children in East Africa. *Community Dentistry and Oral Epidemiology*, **14**, 99-103.

Mosha, H.J., Fejerskov, O., Langebael, J., Thylstrup, A., Baelum, V. & Manji, F. (1988)Caries experience in urban Tanzanian children 1973-84. *Scandinavian Journal of Dental Research*, **96**, 385-389.

Olujugba, O.E. & Lennon, M.A. (1987) Dental caries experience in 5- and 12-year-old school children in Ondo State, Nigeria in 1977 and 1983. *Community Dental Health*, **4**, 129-135.

SAS Institute Inc (1985) *SAS User's Guide:* Basics, Version 5, 1290pp. Cary, N.C.: SAS Institute Inc.

Steyn, N.P. Albertse, E.C. Van Wyk Kotze, T.V., Van Wyk, C.W. & Van Eck, M. (1987) Sugar consumption and dental caries in twelve-year-old children of all ethnic groups residing in Cape Town. *Journal of the Dental Association of South Africa*, **42**, 43-49.

World Health Organisation (1979) *A guide to oral health epidemiological investigations.* pp6-8. Geneva: World Health Organisation.

World Health Organisation (1986) *Oral health surveys: basic methods.* 3rd ed., pp. 4-11. Geneva: World Health Organisation.