Use of DI-S and CPITN as predictors in dental caries studies in the primary dentition

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SUMMARY
The DI-S (simplified oral debris index), CPITN (Community Periodontal Index of Treatment Needs) and dmfs (dental caries experience in the primary dentition) were recorded in 395 5-year-old black children living in rural and urban areas of Southern Africa. The DI-S and CPITN were grouped, independently and together, to examine their use as simple field methods of predicting dental caries. For each grouping the sensitivity, specificity and positive and negative predictor values were calculated. A CPITN grouping of 0 or of two or more sextants with bleeding, provided the most convenient specificity, sensitivity and predictor values. It is recommended that this simple method should now be used in prospective studies of caries activity.

INTRODUCTION
Dental caries prevalence is falling in western industrialised countries, but is likely to increase in developing areas such as Africa (Glaes, 1982). If this expected increase occurs it will require considerable money and manpower to treat and to prevent the disease. Identification of people at high risk of caries could enable a concentration of resources of those who need them most.

Prediction of high risk children has been reviewed by Sullivan (1989). She has shown that many predictors have been used in various age groups with limited success. What is needed for Africa and other developing countries is a simple method that can be used in field studies. Since plaque accumulation is associated with the development of dental caries (Newbrun, 1983), a simple technique is to examine the cleanliness of the teeth. This possibility has been recently supported in a surveillance study of nursery school children in South Africa (Cooke, Williams and Cleaton-Jones, 1989). In that study nursery schools were visited every two years, from 1981, for 5 visits, so that some 5,000 children aged 3 to 5 years were examined. When the children were subdivided into high and low debris groups using the Simplified Debris Index (DI-S) (Greene and Vermillion, 1964), those in the high debris group (DI-S >1.0) consistently had twice as much caries as those in the low group (DI-S <0.2).

The DI-S is a simple, rapid measure of debris based on six index teeth. A drawback is that the index shows an amount of debris on teeth at a specific moment in time, which may not be indicative of the usual cleanliness of those teeth. Another measure which is likely to indirectly show oral cleanliness over a longer period is the gingival state. Inflammation results from plaque accumulation and many indices have been developed to measure this. The Community Periodontal Index of Treatment Needs (CPITN) was introduced in 1982 (Ainamo et al., 1982) and is now endorsed by the World Health Organisation (1984). If used as an index of periodontal health in conjunction with the current caries indices, increased comparisons may be made of dental health of communities, particularly with regard to longitudinal studies (World Health Organisation, 1987). Although initially introduced for adults (Cutress, 1986), the index has been found to be useful among teenagers (Ainamo, Parviainen and Murtomaa, 1984). The index is simple to use and might be a useful predictor of caries risk in the primary dentition.

The objective of this study was to compare the DI-S and CPITN as possible predictor models of dental caries in the primary dentition of rural and urban African children.

MATERIALS AND METHODS
The data used in this study were collected in two field studies in Namibia and KwaZulu during April 1988. Prior to the study
The protocol was approved by the University of the Witwatersrand Committee for Research on Human Subjects (Clearance 1/1/86).

The population sample consisted of 395 black children, aged 5 years on their last birthday, who were present at school or kindergarten on the day of examination. The KwaZulu communities studied were rural Ngqutu and urban KwaMashu (Durban) and those in Namibia were rural Grootfontein and urban Katatura (Windhoek). All had similar fluoride levels of <0.15ppm in the drinking water.

The children were examined in natural light in the supine position on folding chairs using plane mirrors, curved disposable probes and the CPITN probe recommended by Emslie (1980). Dental caries was diagnosed clinically without radiographs according to WHO (1987) criteria, the DI-S was recorded as described by Greene and Vermillion (1964) using the index primary teeth described in earlier studies (Cleaton-Jones et al., 1984). Calibration for dental caries diagnosis was undertaken using extracted teeth mounted in plaster of paris (Cleaton-Jones et al., 1989) and kappa values for the examiners were established at levels all greater than 0.80. Re-examination of some 10 per cent of the children in the field showed that the diagnostic reproducibility was maintained. Calibration for the DI-S was by discussion between the examiners before and during the study.

The CPITN was modified for the primary dentition through the substitution of the following index primary teeth for the recommended permanent teeth - the second primary molars in the posterior sextants (55; 65; 75; 85) and a central primary incisor (51; 71) in the anterior sextants. Substitute teeth were selected for missing teeth using the following rules based on criteria recommended for the permanent dentition (Ainamo et al., 1982):

(a) if in a posterior sextant, one of the two index teeth was absent, then the examination was based on the remaining index tooth.
(b) if in the anterior maxillary sextant 51 was absent then 61 was substituted; if both 51 and 61 were absent the worst score from the remaining incisors was recorded. Similarly in the mandible, 51 was substituted if 71 was missing and so on.
(c) if all teeth in a sextant were missing or only one functional tooth remained in an anterior sextant, the sextant was not recorded.

For purposes of calibration the examiners practised using the CPITN probe on the gingival sulcus of their own teeth and on their fingernails, pressed gently but sufficient to produce blanching and not pain. This is equivalent to 20 grams pressure or less (Cutress, 1986). A good practical field method to check intra- and inter-examiner variation with the CPITN index has not yet been defined. In trial runs bleeding points from an initial examination could still be seen in a recall examination, thereby introducing bias. To overcome this problem during the study, frequent joint examinations to maintain diagnostic consistency were undertaken.

The data were analysed in the University of the Witwatersrand's mainframe computer using SAS (1985). Determination of the protocol was approved by the University of the Witwatersrand Committee for Research on Human Subjects (Clearance 1/1/86).

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DISCUSSION

Barker and Rose (1976) have explained that in disease screening a high sensitivity is important, when false negative errors are serious to such an extent that someone might be denied treatment for cancer, for example. High specificity is necessary when false positive errors are undesirable in terms of anxiety and discomfort to subjects or because they lead to further expensive investigations. Raising the specificity of a test will make it less sensitive so the balance between the two is a matter for judgement. For dental caries specificity is more important than sensitivity, since the consequence of a false negative result is unlikely to be serious.

In conditions where prevalences are low, such as dental caries in this study, the positive and negative predictive values of the test must also be considered. For dental caries positive predictor values are more important than negative.

Examination of Table IV shows that the predictor with the best combination of sensitivity, specificity and predictor values is CPITN alone, using the number of sextants with bleeding present. Of the possible combinations those children with no sextants showing bleeding or with 2 or more sextants showing bleeding seems most useful.

In comparison with the single variable gingival state of Sullivan and Schröder's study (1989), particularly in their 5-6 year old period, the CPITN grouping turned out to have high specificity and predictive values.

It clearly is difficult to predict dental caries, and a single variable is less effective than a combination of gingival state and microbiology (Sullivan and Schröder, 1989). Nevertheless, in a third world developing population the CPITN could be a useful measure of high risk children. Longitudinal studies with pre-school children are needed to confirm this.

The present study has been undertaken on cross-sectional data, associating current oral hygiene and gingival state with a disease (caries) developed in the past. What is now needed is classification of children into high and low risk groups using CPITN combined with prospective follow-up examinations. We hope that clinicians will undertake such studies.

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REFERENCES


Official Announcement

SCALE OF BENEFITS WITH VAT INCLUDED

The following matters have come to our attention in the schedule of Scale of Benefits items provided by RAMS with the 8% they will allow for VAT added, which we recently circulated to members:

1. On page 1 Code 8261 was included but this procedure was eliminated from the schedule with effect from 1 January 1991.
2. On page 3 Codes 9186, 9187 and 9188 were included but these procedures were eliminated from the schedule with effect from 1 January 1991.
3. On pages 3 and 4 the Codes commencing with 9301 through to 9662 refer to fees for dental technicians services.