



A Study on Assessing the Chance of Dental Caries Level using Early Childhood Oral Health Impact Scale in 5-year-old Children in Kandy District, Sri Lanka

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ABSTRACT

Aim: The aim of this preliminary study was to assess the chance of dental caries level using early childhood oral health impact scale (ECOHIS) in a group of 5-year-old children in Sri Lanka.

Materials and methods: A sample of school children aged 5+ years was taken for the study from Denuwara educational zone in Kandy District in Sri Lanka using probability proportional to size sampling method in 2010. Dental caries and oral health impact of the children were recorded. The mean decayed, missing, and filled teeth (DMFT) was 0.01 ± 0.3 , while mean dmft was 3.7 ± 0.29 . The mean decayed teeth (d) was 3.0 ± 0.23 , the mean extracted teeth (m) was 0.46 ± 0.08 , and the mean filled teeth (f) was 0.21 ± 0.05 . Twenty four percent of them were caries free (95% confidence interval 0.17, 0.32). Ordinal logistic regression models were fitted by considering dmft levels as the response variables, and oral health impact as the predictor variable. Since Pearson test p-value and deviance test p-value are 0.99 ($p > 0.05$) and 0.986 ($p > 0.05$) respectively, the null hypothesis is not rejected as the model fitted the data adequately.

Conclusion: This model could be used to predict the chance of dental caries level with the score of ECOHIS. Therefore, ECOHIS can be taken as a reliable indicator to assess the level of dental caries.

Keywords: Dental caries, Goodness of fit test, Prediction of dental caries.

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INTRODUCTION

Generally, oral diseases have been viewed separately from those of the rest of the body. However, in recent years, authorities have recognized oral health as an integral part of the overall health of a person.¹ Moreover, the oral cavity has multiple functions in relation to daily life, such as mastication, communication, and esthetics.

Among all the oral diseases, dental caries is a significant oral health problem, which makes the oral health poor among children and adults influencing the general health. This may lead to a variety of complications ranging from mild pain to severe pain and to den-toalveolar abscess in untreated status. Besides all these complaints, its physical inconvenience and its greater potentiality to impair the quality of life of the bearer and the family unit are documented.²⁻⁴ The impairment of the quality of life could be reflected by reducing food intake and thereby causing low growth in children and worsening the nutritional status.⁵ Pain might also have a negative impact on the ability to engage in social relations and children might not get the full benefit of their education when they are suffering from pain and discomfort. While poor dental status among children has a negative effect on speech development and their carrier development, this might ultimately damage the social life of the young individual, especially resulting in a negative effect on the family unit.⁶ The early childhood oral health impact scale (ECOHIS) is such an instrument² specifically developed and designed to assess oral health-related quality of life of such young individuals, and has shown high degrees of success in identifying the actual problem in recent past. It has been used in different parts of world after translation and validation into their own language including Sri Lanka.⁷⁻⁹

More than treating a young patient with oral diseases, examining them in a calm and quiet environment is a unique challenge for dentists to provide comprehensive oral care. A child's behavior can never become an excuse for imperfect care in the mouth. In spite of all the technical and material-

tic advances, the science still seems to provide limited option for its uncooperative young clients. Lengthy behavioral management of oral diseases of children in dentistry has been limited to an art rather than a science. In fact, it is no wonder that today there are more dentists who are afraid of children than children who are afraid of dentists.¹⁰ Many researchers have made effort to find different pharmacodynamic profiles to manage young patients with oral health problems. Besides, examination of young clients for caries has become a major challenge to the paedodontist as frightening scenarios frequently arise during examinations depending on the level of co operation of children. As a result, there are a number of research papers published on the use of caries risk assessment tools as prediction instruments to identify the relative occurrence or absence of caries in the setup of minimally invasive clinical management.¹¹⁻¹³ Further, Abernathy et al¹⁴ used the discriminate function and logistic regression analysis to predict the caries risk and showed that both statistical methods are equal in specificity and sensitivity. However, it further says that the logistic regression is a relatively new technique in this area of application, i.e., not limited by requiring predictor variable to be normally distributed.^{14,15}

Thus, our aim of the preliminary study was to evaluate the level of oral disease, especially dental caries, and to assess the chance of the dental caries status with the score of the ECOHIS in a group of 5+ years Sri Lankan schoolchildren using multivariable logistic regression.

MATERIALS AND METHODS

Ethics Approval and Consent to Participate

The study was approved by Research and Ethical Review Committee of the Faculty of Dental Sciences, University of Peradeniya, Sri Lanka, under the ethical clearance certificate No: FDS-RERC/2009/13/Herath 2. The permission to conduct the study in schools was obtained from the Zonal Education Authority, Kandy, Sri Lanka. Following an explanation of the study objectives, verbal and written consent were obtained from the school, schoolchildren enrolled in the study, and their parents or guardians.

Consent for Publication

Informed written consent to publish the data received from the participants was obtained in the same consent form which was used to get the consent for the participation. The current study does not contain any form of images and videos. Basic personal data were used only to identify the participant.

Participants

The study population of schoolchildren at the age of 5+ years was drawn from schools in Kandy district in Central Province of Sri Lanka.

Children with congenital diseases affecting dentition and mentally retarded children were excluded from the study. Oral health education was given prior to the clinical oral examination. All the children received elaborated oral health instructions and routine dental treatment when necessary from the Teaching Hospital (Dental), Faculty of Dental Science, University of Peradeniya, Sri Lanka.

Sample and the Data Collection

The data for the present manuscript were obtained from a large study which was conducted to assess the effectiveness of a school-based fluoride mouth rinse program in Sri Lanka.

Denuwara education zone was randomly selected from six education zones in Kandy District. According to the categorization of schools as popular, unpopular, and rural in Sri Lanka, two schools were randomly selected from each category. All the children at the age of 5+ years were invited to participate in the study. The required number of schoolchildren in the sample was achieved by sampling with probability proportion to size of each category of schools.

After exempting the data of 47 children based on exclusion criteria, the data of 150 children were analyzed.

The data were collected in 2010 in randomly selected six schools in Kandy District. Clinical examination for dental caries was performed by a single examiner, a specialist in dental surgery, who was trained and calibrated for the entire study. Intraexaminer variability was tested using kappa statistics and it became 0.849 (95% confidence interval [CI] 0.760, 0.937 with standard error ± 0.045).

The examination was done within the school premises under natural light using autoclave sterilized dental mirrors and explorers, and no radiographs were taken. Caries was diagnosed using criteria set by the World Health Organization (WHO)⁶ and quantified using decayed (d/D), missing (m/M) and filled (f/F) teeth index (dmft/DMFT). Dental caries in terms of prevalence and severity was measured based on the dmft/DMFT indices.

Children's age and gender together with the ECOHIS questionnaire were recorded from parents on the day of oral health examination by a trained interviewer.

Oral health impact of the children was recorded using a pretested, interviewer-administered questionnaire (ECOHIS) which consists of 13 questions.² As reported in the literature, because of the infrequent nature of oral health problems and the young age of children being considered, the parent was asked to consider the child's entire life span when responding to the questions in our study.² Response categories for the ECOHIS were coded:

1 = never; 2 = hardly ever; 3 = occasionally; 4 = often; 5 = very often; 6 = don't know.

From these responses, each question had the frequency score of 0 mark for never; 1 mark for hardly ever, 2 marks for occasionally, and 3 marks for often and very often codes. Content and consensual validity of the translated modified scale was obtained by the opinion of the experts in the field. "Don't know" responses were considered as never, which scored 0. However, those who were with >2 missing responses on child section and >1 missing response on the family section were excluded from the analysis.

Statistical Analysis

Intraexaminer variability was tested using kappa statistics. Dental caries in terms of prevalence was measured based on the dmft/DMFT indices. Levels of dmft were grouped according to the WHO recommendation.¹⁶ Zero dmft was taken as the no risk group, 1 to 4 dmft level was taken as the moderate risk group, and >4 in dmft was taken as a severe risk group for caries. Statistical analysis was carried out using MINITAB 16 statistical software.

There were three categories in dmft by considering dmft levels as the response variables, and oral health impact as the predictor variable; ordinal logistic regression models were developed to predict the chance of having dental caries in dmft for a given oral health impact score using ECOHIS. Applied ordinal logistic regression models are given below:

$$\text{logit}(p_1) \equiv \ln \left(\frac{p_1}{1-p_1} \right) = \alpha_1 + \beta x$$

$$\text{logit}(p_1 + p_2) \equiv \ln \left(\frac{p_1 + p_2}{1-p_1 - p_2} \right) = \alpha_2 + \beta x$$

$$p_1 + p_2 + p_3 = 1$$

where α and β are constants; x is an independent variable (ECOHIS).

p_1 – P (a child falls in dmft level 0)

p_2 – P (a child falls in dmft levels 1 to 4)

p_3 – P (a child falls in dmft level >4)

The goodness of fit of the statistical model was carried using both Pearson and deviance goodness-of-fit tests. Measures of goodness of fit typically summarize the discrepancy between observed values and the values expected under the model in question. If the p-value is greater than the selected α -level, the test does not reject the null hypothesis that the model fits the data adequately.

RESULTS

The total study sample was 150 schoolchildren aged 5+ years, which consisted of 80 (53%) boys and 70 (47%) girls.

The mean DMFT was 0.01 ± 0.3 , while mean dmft was 3.7 ± 0.29 . The mean number of decayed teeth was 3.0 ± 0.23 , while the mean number of extracted teeth was 0.46 ± 0.08 and mean number of filled teeth was 0.21 ± 0.05 .

The dmft levels of children were analyzed and 24% of them were caries free (95% CI 0.17, 0.32) and categorized under no caries group. They scored 0 for ECOHIS. Forty percent of children were in moderate caries group (95% CI 0.32, 0.48), while 36% had more than four caries teeth and belonged to the severe caries group (95% CI 0.28, 0.44) (Table 1).

The ECOHIS scores range from 0 to 39, and in this sample, the highest score was 14 and the lowest was 0.

The fitted ordinal logistic regression models are given below.

$$\text{logit}(p_1) \equiv \ln \left(\frac{p_1}{1-p_1} \right) = -0.598215 \pm 0.432746(\text{ECOHIS})$$

$$\text{logit}(p_1 + p_2) \equiv \ln \left(\frac{p_1 + p_2}{1-p_1 - p_2} \right) = 1.44033 + -0.432746(\text{ECOHIS})$$

Since the Pearson test p-value is 0.99 ($p > 0.05$) and deviance test p-value is 0.918 ($p > 0.05$), the model fitted the data adequately. Therefore, by using the above model, the chance of dental caries level was predicted and is given in Table 2.

DISCUSSION

The study group of children shows high levels of caries (76%).^{16,17} Out of them, 40% of them were in the moderate group, in which the affected number of teeth ranged from 1 to 4 while 36% of them were with >4 affected or caries teeth.

Table 1: Children distribution according to the teeth affected

Group	Total of dmft	No. of patients and 95% CI
No caries	0	36 (24%), (0.17, 0.32)
Moderate caries	1-4	60 (40%), (0.32, 0.48)
Severe caries	>4	54 (36%), (0.28, 0.44)

Table 2: Chance of predictability of level of dental caries using ECOHIS scale

ECOHIS score	p_1 (dmft level 0)	p_2 (dmft levels 1 to 4)	p_3 (dmft level >4)
2*	0.19	0.47	0.36
5*	0.06	0.27	0.67
10*	0.0001	0.05	0.9499

*Randomly selected values to represent low, middle, and high scores for ECOHIS

Although the National Oral Health Survey (NOHS) reported that the 1983/84, 1994/95, and 2002/2003 surveys showed an overall declination in prevalence of dental caries in all age groups (6, 12, and 35–44 years), our results show a high prevalence of dental caries (76%) among 5-year-old children.^{18,19} The NOHS¹⁹ further reported that prevalence of dental caries in the 5-year-old group was 65.31%, with regional variations, such as 74.2% in Galle (southern province), 67.5% in Kandy (central province), and 77.5% in Kalutara (western province).

Since Pearson test p -value was 0.99 ($p > 0.05$) and deviance test p -value was 0.918 ($p > 0.05$), this indicates that the null hypothesis is not rejected as the model fitted the data adequately. Therefore, it confirms that the fitted model is significant. Hence, this model could be used to predict the probability to be in a group which was designed based on the number of teeth with dental caries, using the score of ECOHIS. For example, when a given score of ECOHIS is increased, it reflects the number of cavities present/number of teeth affected in a child's mouth. Further, a child who scored 2 for ECOHIS would have a 36% chance to be in the severe caries group and a child who scores 10 would have a 94.99% chance to be in the severe caries group. Therefore, ECOHIS score can be considered as a reliable indicator to predict the chance of having levels of dental caries in a child aged 5+ years.

There are a number of research papers published on prediction instruments using caries risk assessment which were done with different statistical methods like generalized linear or logistic regression analysis to support the final explanatory model for caries presence and an odds ratio to quantify the relative occurrence or absence of caries over time.^{13–15} However, most of these caries prediction attempts are not noninvasive but minimally invasive and individual level studies.^{13,20} The caries prediction model that was generated from our preliminary study is a totally noninvasive population level study as reported by others.^{14,15} Further, several recent reviews^{13,21} have highlighted the importance of having minimally invasive dentistry caries management strategies that should be incorporated to estimate caries activity at each visit. These reviews^{13,21,22} have also highlighted the current lack of such methods validated for reliable and precise estimation of caries activity. In fact, the model we used to assess the chance of level of caries can be used at the individual level as well as population level to assist dental professionals in implementing effective treatment and preventive strategies, in order to reduce the prevalence of dental caries in Sri Lanka. Since this is a preliminary study, further studies are needed to ensure the reliability and reproducibility of this model to assess the chance of level of caries using ECOHIS in the same population and others.

CONCLUSION

This study shows that there is a significant relationship between ECOHIS score and the status of caries level of a child. Early childhood oral health impact scale can be used as a reliable indicator to assess the probability of having dental caries in a child at an age of 5+ years. This shows that answering 13 questions by either caregivers or the parents can assess the level of dental caries of a child aged 5+ years.

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