A proposed nomogram for prediction of dental caries in school going children of Bhopal city

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Abstract

Objective: To investigate risk factors for severe caries in children and to design a simple to-use nomogram to screen for severe caries among 6-12 years old children based on the risk level calculated in Bhopal, India.

Material and methods: A cross sectional study sample comprised of 500 children aged 6-12 years conducted in middle schools from north and south Bhopal. Oral examinations and questionnaires were given to all of the children in order to examine general information, oral influences on daily performance, dietary habits, and knowledge, attitudes, and behavior related to oral hygiene. To investigate which characteristics were substantially associated with severe caries (operationalized as DMFT ≥3).

Results: 58.2% of the children experienced caries with DMFT <2 including 149 boys and 142 girls; while the rest, 209 (41.8%) showed DMFT ≥2. The study result shows non-significant difference between gender and region while significant difference was seen with the level of education of the parents.

Keywords: nomogram, severe caries, regression analysis, oral hygiene, DMFT scores.

Introduction

Dental caries is a widespread concern that affects many countries' public health. The prevalence of dental caries varies by country, with developed countries experiencing a downward trend. In contrast, countries with less developed economies and emerging economies are reporting higher rates of caries prevalence. Urbanization, poor socioeconomic status (SES), and

changes in lifestyle have all been blamed for the rising frequency of dental caries in less developed countries.[1]

Oral diseases, including caries, are major health problems. Dental caries is multifactorial and is also influenced by biological and behavioral factors other than the abovementioned environmental factors. In most developed countries, they are the fourth most expensive to treat in terms of pain and suffering, functional limitations, and diminished quality of life. Dental caries treatment alone would exceed the complete child healthcare expenditure in many low-income nations.[1]

This article aimed to investigate risk factors for dental caries in children and to develop a simple to-use nomogram to screen for severe caries among 6-12 years old children based on the risk level calculated in Bhopal, India.

Methods

A cross-sectional survey of children aged between 6-12 years was conducted in Bhopal.

Sampling

A simple random survey sampling design was used for participant selection. The study conducted in the Bhopal city and had included 500 participants. The participants were divided into north and south division. The study includes patients in the age group of 6 to 12 years. They were further divided into boys and girls. The south division had 252(50.40%) participants which includes 129 boys and 123 girls while the North division had 248 (49.60%) participants which include 127 boys and 121 girls

Caries examination

Caries examination after parents signed informed consent forms, all 500 school children who participated in questionnaire surveys were examined on mobile dental chairs with portable lights at the schools. A tooth was classified as decayed when there was a lesion in a pit or fissure; on a smooth tooth surface with an unmistakable cavity; on undermined enamel; or on a detectably softened floor or wall. The DMFT of permanent teeth examinations mainly relied on ocular inspection with the help of Community Periodontal Index (CPI) probes as recommended by the WHO for clinical examinations. This DMFT index covers the teeth and/or tooth number that were decayed, filled or extracted as a result of caries, which we used to assess dental caries.[2]

Questionnaire

Twenty–four self-structured questions were designed. Paper printed questionnaires were completed by children individually in the classroom. If a child did not fill the questionnaires completely or did not qualify, they were excluded from the analyses.[2]

Results

A total of 500 children participated in the survey. Socio Demographic Information of the Study Participants were mentioned in the table 1. The average DMFT of the participants was 0.8±0.2. They were compared on the basis of gender, region and parents level of education. The gender and Region were compared with t test while level of education was compared with ANOVA test. The study result shows non-significant difference between

gender and region while significant difference was seen with the level of education of the parents. (Table 2)

Table 1: Socio demographic information of the study participants

Parameters		Number of Participants	Percentage
Gender	Boys	256	51.20
	Girls	244	48.80
Region	North	248	49.60
	South	252	50.40
Parents level of Education	Illetrate/low	149	29.80
	Medium	204	40.80
	High	147	29.40

Table 2: Comparison of DMFT of the participants

| Parameters		DMFT	D	M	F
Gender	Boys	0.75	0.73	0.02	0.00
	Girls	0.85	0.80	0.03	0.02
Region	North	0.82	0.80	0.02	0.00
	South	0.78	0.74	0.02	0.02
Parents level of Education*	Illiterate/low	1.2	1.2	0.00	0.00
	Medium	0.6	0.58	0.02	0.00
	High	0.7	0.66	0.02	0.02

*significant

The different risk indicators are identified and their impact on the development of dental caries was identified with the help of questionnaire prepared. They were compared at the level of DMFT greater and less than 2. It had been found that parents level of education, Daily intake of sugar, ignorance attitude towards bleeding gums, Daily tooth brushing, use of toothpaste and mouthwash had an effect on the development of dental caries. The daily food intake behavior like daily intake candies, tea, sweet milk and carbonated beverages are implicated in the development of dental caries. (Table 3)

Table 3: Description of the overall potential risk indicators for Dental Caries
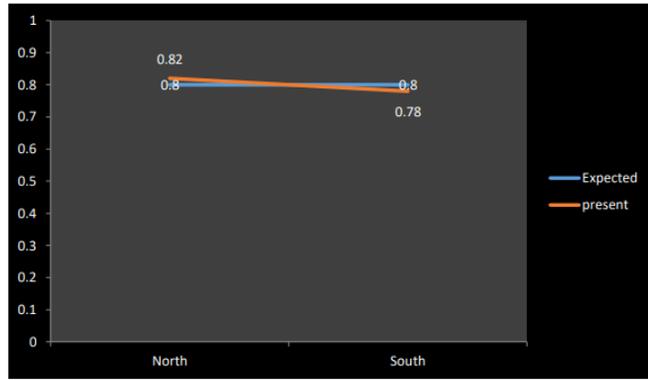
Variables		DMFT< 2	DMFT ≥ 2	P Value
Gender	Boys	149	107	0.86
	Girls	142	102	
Region	North	140	108	0.92
	South	151	101	
Parents level of Education	Illiterate/low	65	84	0.02*
	Medium	136	68	
	High	90	57	
eating sugar causes tooth decay	yes	271	129	0.001*
	No/Don't know	20	80	
bacteria/ germs can cause tooth decay	yes	193	137	0.65
	No/Don't know	98	72	
bleeding/ swollen gums are normal	yes	30	85	0.001*
	No	261	124	
Brushing	yes	290	200	0.001*
	No	1	9	
Toothpaste	yes	282	191	0.001*
	No	8	18	
Mouthwashes	yes	45	6	0.001*
	No	246	203	
fluoride/ pit & fissure sealants	Yes	149	107	0.91
	No/Don't know	142	102	
any other aids for oral hygiene	yes	19	2	0.001*
	No	272	207	
candy/chocolate/cookies/ cakes	yes	156	133	0.001*
	No	135	76	
tea/coffee/ sugary milk	yes	242	178	0.001*
	No	49	31	
carbonated beverages	yes	27	81	0.001*
	No	264	128	
eat fruits/ fresh vegetables	yes	271	194	0.66
	No	20	15	
Impact on sleeping	yes	140	108	0.78
	No	151	101	
Impact on talking	yes	145	96	0.91
	No	166	113	
Impact on eating	yes	142	98	0.89
	No	169	111	
toothache in the previous 12 months	yes	19	61	0.001*
	No	272	148	

For the development of a newer nomogram for the prediction of dental caries, the following graphs were made use of-
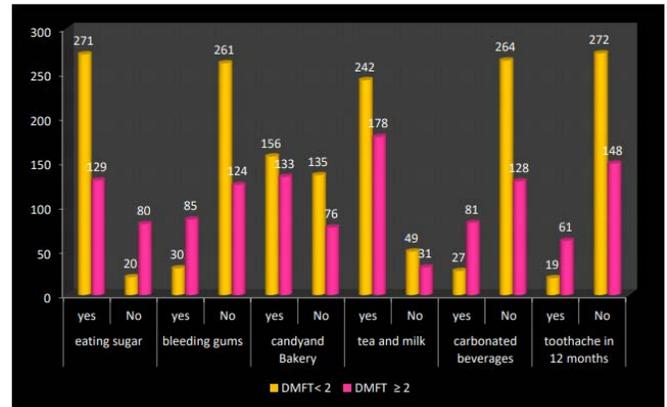
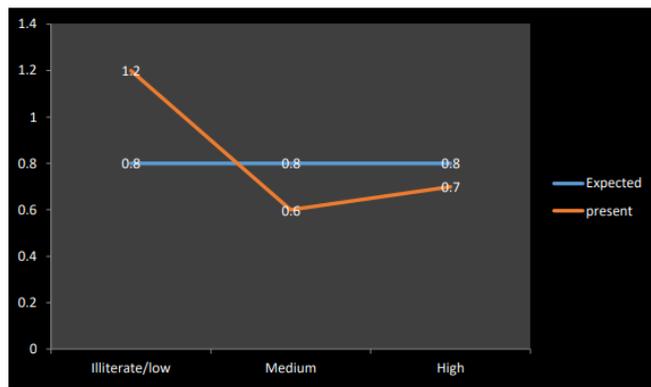Graph 1: Comparison of DMFT between different genders
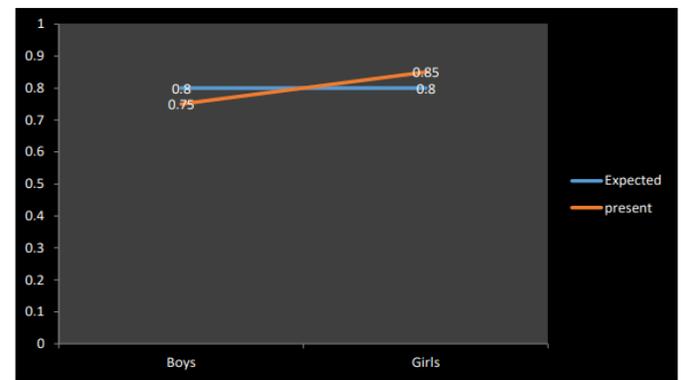
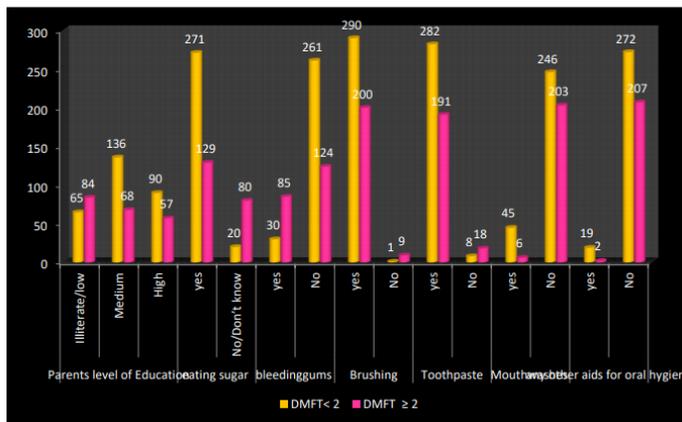Graph 2: Comparison of DMFT between different regions

Graph 3: Comparison of DMFT between different Education level of parents

Graph 4 (a): Variables increasing the risk of Dental caries

Graph 4 (b): Variables increasing the risk of Dental caries

Discussion

Although the global frequency and severity of caries differ between developing and developed nations[3,4], the first difficulty we encounter is the same: identifying persons with severe caries and implementing targeted preventative strategies.[5] Our study shows that there was not much of significant difference between gender and region, but statistical significant difference was noted with the level of education of the parents. In our study sample, 291 (58.2%) children showed caries experience with DMFT <2 including 149 boys and 142 girls; while the rest, 209 (41.8%) showed DMFT ≥2. Nine factors were found to be statistically significantly associated with DMFT: parents level of education, daily intake of sugar, ignorant attitude towards bleeding gums, daily tooth brushing, use of toothpaste, use of mouthwash, daily food intake, behaviours like daily intake of candies, tea, sweet milk and carbonated beverages are implicated in the development of dental caries.

Our study showed that 58.2% of the children experienced caries with DMFT <2 including 149 boys and 142 girls; while the rest, 209 (41.8%) showed DMFT ≥2 which is similar to the study reported by Duan et al. (2021) who showed that out of 4573 12-year-olds, 2248 (49.16%) had experience with caries (DMFT≥1), including 1048 boys and 1200 girls. Only

537 (11.74%) children had severe caries (DMFT≥3). Our study utilized 9 critical factors which were found to be statistically significant and had a DMFT ≥2, thus making us deduce the development of a new nomogram in relation to the present population/city. Further when compared with earlier studies of Duan et al[2] where they used 16 factors, our study was similar in many aspects and almost similar results were obtained statistically (DMFT≥3).

Conclusions

A nomogram is a tool that converts complex regression equations into simple, visual graphs, allowing physicians and patients to quickly calculate output probabilities without the need for medical knowledge or complicated calculations.[2] Duan et al (2021)[2] incorporated 6 significant points to draw the nomogram so as to assess the severity of dental caries. While our study shows 9 significant factors that depicts impact on the development of dental caries. So by using these 9 significant factors a new nomogram can be formulated in the future.

Limitations

- In the present study we chose 9 factors out of a total of 24 which can be considered significant for the development of dental caries in the present population.

- Since this was a pilot project, we will be deducing and formulating the newer nomogram in the larger sample and inclusion of all the 24 factors prospectively.

- Further, studies and predictive analysis have to be conducted to arrive at a 'prospective' and 'predictive' nomogram for its use in dentistry.

Acknowledgment

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