Original Article

Impact of Oral Health Status, Oral Health Related Quality of Life and Social Determinants of Health on the Academic performance of 12 and 15 Year Old Children in Bangalore – A Descriptive study

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ABSTRACT
Oral health problems in children have a detrimental impact on their daily performance and quality of life causing missed school days and poor academic performance. The present study was conducted to measure the impact of Oral Health Status, Oral Health Related Quality Of Life and Social Determinants of Health on the Academic Performance of 12 and 15 year old school children in Bangalore, Karnataka. A cross–sectional study employing a multi-stage cluster random sampling strategy was conducted among 860 children aged 12 and 15 years. The assessment was carried out in 3 sections including oral health status examination by calibrated examiners, Oral Health Related Quality of life assessment using COHIP questionnaire for children and Social Determinants of Health assessment by using a parental questionnaire. The children's previous year academic grades were obtained from the school authorities. Mother's education and missed school days due to oral problems were significantly associated with the Academic Performance of both 12 and 15 year old children. The ordinal regression model, established that with every 1 day decrease in the missed school days due to oral problems or 1 higher education qualification of mother, the Academic Performance of children increased to the next higher grade. The study revealed that oral Health Status independent of the social determinants of health influenced the Academic Performance of children. This initiates the need to influence policy makers and stakeholders to inculcate solitary or integrated oral health interventions in schools, thus aiming at effective oral health promotion.
Keywords: *"Academic Performance", "Bangalore", "Oral Health Related Quality of Life", "Oral Health Status" , "Social determinants of Health" "School Children".*

INTRODUCTION

Oral diseases, being universal in nature affect all individuals globally, irrespective of age or gender.

Despite huge oral health promotion activities, oral problems still persist , particularly among the under-privileged groups in developed and

developing countries[1]. In India, a National Oral health Survey in 2002-03, revealed a mean DMFT of 1.7 and 2.3 among 12 and 15 year old children respectively with a twofold increase in adults[2].

Poor oral health in children affects their mental, emotional and psychological well-being, thus hampering their growth and quality of life. In addition, poor oral health can root to distraction during lectures or missed school days, thus impeding their academic performance. Children with oral problems lose more than 51 million school hours annually and are 12 times more likely to have restricted-activity days than their counterparts[3].

However, academic performance of children is also influenced by various other factors like their learning capability, academic training quality in schools, school environment, quality of life and socio-demographic determinants. Thus, a comprehensive assessment of oral health and other factors on academic performance is essential.

Oral health can be assessed through a normative approach by analyzing the oral health status or quality of life measures which incorporates concepts of functional, psychological and social well-being of the individual. Using Oral Health Related Quality Of Life (OHRQoL) measures alongside traditional clinical Oral Health Status assessment, a comprehensive outlook of the oral diseases impact on the several dimensions of subjective wellbeing becomes possible.[4]

Limited research globally have linked the influence of Oral Health Status, OHRQoL and Social Determinants on Academic Performance of children[3,5–7], whereas in India, studies persist which examine the influence of either oral health on academic performance or social determinants of health on academic performance, thus not signifying the independent influence of the variables on academic performance[8]. In India, the academic performance is an upshot of variables like social determinants (income, socio-economic status), overall health status and quality of life, which determines their success in future.

Hence the present descriptive study aims to assess the independent influence of Oral Health Status, OHRQoL and Social Determinants on the Academic Performance of 12 and 15 year old school children in Bangalore.

METHODOLOGY

A descriptive study was conducted in Bangalore, Karnataka in 2014-2015 with a sample of 860 school children aged 12 and 15 years. Ethical clearance was obtained from the Institutional Review Board [IRB N0: 045/Vol-1/2013).

Selection of Study Participants

A multi-stage cluster random sampling was followed (Figure I). Children from government schools which had both higher primary and secondary school administration, aged 12 years (studying in standard 6th or 7th and born between 1st August 2002 to 31stJuly 2003) and 15 years (studying in standard 9th or 10th and born between 1stAugust 1999 to 31stJuly 2000), providing written informed consent and present during the assessment were included. The sample size was estimated using the formula N= $\underline{Z^2 x\ PQ\ XD}\ /\Delta^2$ where Z= 1.96 for 95 % Confidence level, P =Proportion of children aged 12 and 15 year old with good oral health $(0.5)^9$, Q=1-P, Δ=0. 05(5% margin of error) and D= Design effect of 2^{10}.

Development and validation of the tools

The study was conducted using a translated version of the Child oral Health Impact Profile -19 item generic questionnaire[11] for the OHRQoL assessment (5 domains namely Oral Health–well being, Functional well-being, Social/ Emotional well-being, Social environment and Self image) and 9 item self-administered questionnaire on Social Determinants of Health. Both question-aires were in Kannada language. A bilingual professor translated the questionnaire from English to Kannada, while another independent bilingual professor translated the Kannada questionnaire back to English language. The differences were noted, and sorted out by involving both the translators. The Oral Health Status Assessment was conducted using an Oral health assessment form comprising of 2 indices: Dentition Status and Treatment Needs Index and Gingival index. All the tools were validated for

face and content validity by a team of 6 Public Health Dentists

Data Collection Phase

Oral health examination by conducted by 03 calibrated examiners following the WHO guidelines, during which the study participants were identified. The OHRQoL questionnaire was later administered to the children. Consecutively, they were given the Social Determinants of Health questionnaire and instructed to get them completed by their parents and carry it to school the next day. Schools in Karnataka, during 1 academic year consist of 2 semesters with 2 formative assessments and 1 summative assessment per semester. Considering all 6 assessments, a final grade is assigned to the student. The final grade of the students from the previous academic year was obtained from the school authorities using a data extraction form.

Statistical Analysis

The data was analysed using SPSS version 16. The Social determinants and academic performance details were expressed in as number and percentage. The age-wise comparison of Oral Health Status, OHRQoL and Academic Performance was assessed using Man-Whitney U test. The gender-wise comparison of the OHRQoL and Academic Performance was assessed using chi-square test. The association of various independent variables on the academic performance was assessed using ordinal regression model. $p < 0.05$ was considered significant.

RESULTS

Among 860 school children, the data of 731 (85%) children were analysed according to the per protocol analysis[12] and 15% data were excluded from the final analysis due to incomplete questionnaires returned and failure to obtain the questionnaires even after repeated reminders.

Social determinants of the participants

The distribution of participants was as follows: 12 year old - 289 (39.5%), 15 year old- 442 (60.5%), females- 326 (44.6) and males – 405 (55.4%). The sample comprised of a preponderance of Hindus (85%), with majority of the parents being illiterate

(30%) pursuing unskilled occupation in the private firm (54-56%). Although 26.81% individuals were unaware of their monthly family income, a majority of 26.95% individuals obtained an income of 9,249-13,873 (Table 1).

Oral health status

The overall DMFT score was marginally higher among the 15 year old (0.99) than the 12 year old (0.98), however the age-wise analysis revealed no significant difference in the oral health status (Table 2). The gender wise analysis revealed a significant higher filled score in males as compared to females among 15 year old (Table 3).

Oral Health Related Quality Of Life of children

OHRQoL was assessed on a five point likert scale (Almost all time, fairly often, sometimes, almost never, never). A significant age-wise [(15 year – 60.14, 12 year-53.92)] and gender-wise difference in the OHRQoL scores was observed indicating a better OHRQoL among 15 year old (Table 4) and females aged 15 years (Table 5).

Academic performance of school children

The academic performance of children was categorized grade wise as A^+, A, B^+, B and C.

Majority of the students obtained "A" grade with a significantly higher academic grade amongst the 15 year old (Table 6) but no significant gender wise difference.

Influence of various variables on the Academic Performance of children

Among the various factors, the number of missed school days due to oral problems determining the OHRQoL (Table 7) and mothers education among the social determinants (Table 9), was significantly associated with the Academic Performance of children i.e. with every 1 day decrease in the missed school days or 1 higher educational qualification of the mother, the Academic Performance would significantly increase by 1 grade.

Table I: Social determinants affecting the health of the study participants

Sl.	Characteristic		n (%)
	Religion wise Distribution of participants		
	Hindu	Male	285 (38.99%)
		Female	339 (46.37%)
	Muslim	Male	8 (1.1%)
		Female	10 (1.36%)
	Christian	Male	33 (4.51%)
		Female	56 (7.66%)
	Total		731 (100.0)
	Parents educational qualification	Mother	Father
	Professional or honors	0	1 (0.13)
	Graduate or post graduate	1 (0.13)	3 (0.41)
	Post high school diploma	22 (3.01)	39 (5.34)
	High school certificate	211 (28.86)	195 (26.68)
	Middle school certificate	143 (19.56)	128 (17.51)
	Primary school or literate	130 (17.78)	148 (20.25)
	Illiterate	224 (30.64)	217 (29.69)
	Total	731(100.0)	731(100.0)
	Parents occupational status	Mother	Father
	Professional	0	3 (0.41)
	Semiprofessional	2 (0.27)	3 (0.41)
	Clerical, shop owner, farmer	198 (27.09)	133 (18.19)
	Skilled worker	14 (1.92)	23 (3.15)
	Semi – skilled worker	64 (8.76)	85 (11.62)
	Unskilled	396 (54.17)	410 (56.09)
	Unemployed	157 (21.48)	74 (10.12)
	Total	731 (100.00)	731 (100.00)

Table II: Comparison of Oral Health Status indicators between the 2 age groups

Sl	Parameter	Age Group	N	Mean	Std Dev	SE of Mean	MD	Z	P-Value
	DMFT Score	12 yrs	289	0.98	1.48	0.087	-0.004	-0.597	0.55
		15 yrs	442	0.99	1.61	0.076			
	Decay Score	12 yrs	289	0.88	1.39	0.082	0.006	-0.594	0.55
		15 yrs	442	0.87	1.47	0.070			
	Missing Score	12 yrs	289	0.06	0.32	0.019	0.001	0.918	0.92
		15 yrs	442	0.05	0.32	0.015			
	Filled Score	12 yrs	289	0.05	0.33	0.020	0.007	0.619	0.62
		15 yrs	442	0.05	0.24	0.011			
	GI	12 yrs	289	1.34	1.93	0.114	0.108	-0.582	0.56
		15 yrs	442	1.23	1.94	0.092			

Table III: Gender wise Comparison of oral health indicators in 15 year old children

Sl	Parameter	Age Group	N	Mean	Std Dev	SE of Mean	MD	Z	P-Value
	DMFT Score	Male	201	0.89	1.48	0.105	-0.176	-0.787	0.43
		Female	241	1.07	1.70	0.110			
	Decay Score	Male	201	0.84	1.41	0.099	-0.060	-0.025	0.98
		Female	241	1.90	1.53	0.098			
	Missing Score	Male	201	0.03	0.21	0.015	-0.036	-0.676	0.49
		Female	241	0.07	0.39	0.025			
	Filled Score	Male	201	0.12	0.12	0.009	-0.056	-2.357	0.018*
		Female	241	0.07	0.30	0.019			
	GI	Male	201	1.32	1.93	0.136	0.176	-1.521	0.12
		Female	241	1.15	1.95	0.125			
		Female	241	7.03	3.52	0.226			

*denotes significant difference

Table IV: Comparison of OHRQoL between the two age groups

Age Group	N	Mean	Std Dev	Z	P-Value
12 yrs	289	53.92	13.14	-6.828	<0.000*
15 yrs	442	60.14	12.53		

*denotes significant association

Table V: Gender wise Comparison of OHRQoL scores

Age Group	Gender	N	Mean	Std Dev	Z	P-Value
12 yrs	Male	125	53.14	13.06	-0.902	0.367
	Female	164	54.52	13.21		
15 yrs	Male	201	57.49	14.24	-3.454	<0.001*
	Female	241	62.34	10.42		

*denotes significant difference

Table VI: Age wise Academic Performance of children

Grades obtained	Age group	n (%)	Mean	Std Dev	Z	P-Value
12 years (n=289)	A+	70 (24.2%)	2.43	1.180	-2.704	0.007*
	A	104 (36.0%)				
	B+	52 (18%)				
	B	47(16.3%)				
	C	16 (5.5%)				
15 years N=(442)	A+	79 (17.9%)	2.66	1.174		
	A	137 (31%)				
	B+	115 (26%)				
	B	79 (17.9%)				
	C	32 (7.2%)				
Total		731 (100.0)				

*denotes significant difference

Table VII: Influence of OHRQoL on the Academic Performance of children

Sl	OHRQoL		β	SE of β	Odds Ratio	P-Value	95% CI for β	
							Lower	Upper
	Pain	12 yr	0.179	0.106	1.196	0.091	-0.029	0.387
		15 yr	-0.172	0.096	0.842	0.074	-0.361	0.017
	Discoloration	12 yr	0.068	0.087	1.071	0.430	-0.101	0.238
		15 yr	-0.036	0.072	0.965	0.616	-0.177	0.105
	Crooked/spacing	12 yr	0.086	0.066	1.090	0.191	-0.043	0.214
		15 yr	-0.046	0.064	0.955	0.468	-0.171	0.078
	Halitosis	12 yr	0.088	0.095	1.092	0.353	-0.098	0.274
		15 yr	-0.107	0.104	0.899	0.305	-0.311	0.097
	Bleeding gums	12 yr	0.130	0.089	1.139	0.145	-0.045	0.306
		15 yr	-0.016	0.084	0.984	0.850	-0.181	0.149
	Eating problem	12 yr	-0.018	0.106	0.982	0.865	-0.225	0.189
		15 yr	-0.049	0.093	0.952	0.595	-0.232	0.133
	Disturbed Sleep	12 yr	-0.033	0.119	0.968	0.783	-0.266	0.200
		15 yr	-0.082	0.108	0.921	0.448	-0.294	0.130
	Word pronunciation	12 yr	-0.103	0.100	0.903	0.305	-0.298	0.093
		15 yr	0.021	0.092	1.021	0.819	-0.159	0.202
	Teeth clean	12 yr	0.051	0.108	1.052	0.635	-0.160	0.263

Sl	OHRQoL		β	SE of β	Odds Ratio	P-Value	95% CI for β	
		15 yr	0.118	0.110	1.125	0.282	-0.097	0.333
	Sad feeling	12 yr	-0.046	0.108	0.955	0.674	-0.258	0.167
		15 yr	0.160	0.102	1.173	0.116	-0.039	0.359
	Tensed	12 yr	-0.241	0.105	0.786	0.022	-0.447	-0.035
		15 yr	0.007	0.106	1.007	0.944	-0.201	0.216
	Refrainment while speaking	12 yr	0.091	0.113	1.095	0.422	-0.131	0.313
		15 yr	0.068	0.116	1.071	0.556	-0.160	0.296
	Been bullied	12 yr	-0.076	0.116	0.926	0.508	-0.303	0.150
		15 yr	0.123	0.115	1.131	0.287	-0.103	0.349
	Felt ugly	12 yr	0.029	0.110	1.029	0.794	-0.186	0.243
		15 yr	0.081	0.106	1.084	0.446	-0.127	0.289
	Perturbed by others thought	12 yr	-0.018	0.112	0.982	0.873	-0.238	0.202
		15 yr	-0.164	0.110	0.849	0.138	-0.380	0.053
	Missed school	12 yr	-0.356	0.120	0.700	0.003*	-0.592	-0.121
		15 yr	-0.032	0.120	0.969	0.012*	-0.467	-0.114
	Talk aloud	12 yr	0.050	0.113	1.052	0.656	-0.171	0.272
		15 yr	-0.260	0.124	0.771	0.136	-0.503	-0.017
	Self confidence	12 yr	-0.134	0.074	0.875	0.069	-0.278	0.010
		15 yr	0.026	0.064	1.027	0.683	-0.100	0.152
	Felt beautiful	12 yr	0.076	0.069	1.079	0.271	-0.060	0.212
		15 yr	0.020	0.066	1.020	0.767	-0.110	0.149

*denotes a significantly influencing variable

Table VIII: Influence of Oral health status on the Academic Performance of children

Sl	Oral health Status		β	SE of β	Odds Ratio	P-Value	95% CI for β	
							Lower Bound	Upper Bound
	Decay	12 yr	0.622	1.866	1.862	0.739	-3.035	4.278
		15 yr	-2.164	193.423	0.115	0.991	-381.266	376.938
	Missing	12 yr	0.845	1.896	2.327	0.656	-2.872	4.561
		15 yr	-2.727	193.423	0.065	0.989	-381.829	376.375
	Filled	12 yr	1.275	1.896	3.579	0.501	-2.440	4.990
		15 yr	-3.271	193.423	0.038	0.987	-382.374	375.831
	DMFT Score	12 yr	-0.281	1.865	0.755	0.880	-3.936	3.374
		15 yr	2.979	193.423	19.664	0.988	-376.123	382.080
	GI	12 yr	0.090	0.062	1.094	0.145	-0.031	0.211
		15 yr	0.063	0.048	1.065	0.189	-0.031	0.156

*denotes a significantly influencing variable

Table IX: Influence of Social determinants on the Academic Performance of children

Sl	Social determinants		β	SE of β	Odds Ratio	P-Value	95% CI for β	
							Lower Bound	Upper Bound
	Age	12 yr	0.176	1.105	1.185	0.092	-0.025	0.384
		15 yr	0.130	0.084	1.134	0.143	-0.042	0.301
	Fathers education	12 yr	-0.241	0.105	0.784	0.133	-0.443	-0.030
		15 yr	-0.134	0.074	0.873	0.062	-0.273	0.015
	Mothers education	12 yr	0.759	0.442	2.664	0.027*	0.117	1.890
		15 yr	0.887	0.553	2.038	0.007[*]	0.157	1.821
	Fathers occupation	12 yr	0.064	0.113	1.069	0.552	-0.160	0.296
		15 yr	0.076	0.169	0.962	0.503	-0.152	0.075
	Mothers occupation	12 yr	0.081	0.106	1.082	0.441	-0.123	0.285
		15 yr	0.038	0.151	1.039	0.800	-0.257	0.334
	Family income	12 yr	0.808	0.514	2.240	0.110	-0.205	1.814
		15 yr	0.040	0.064	1.035	0.762	-0.112	0.151

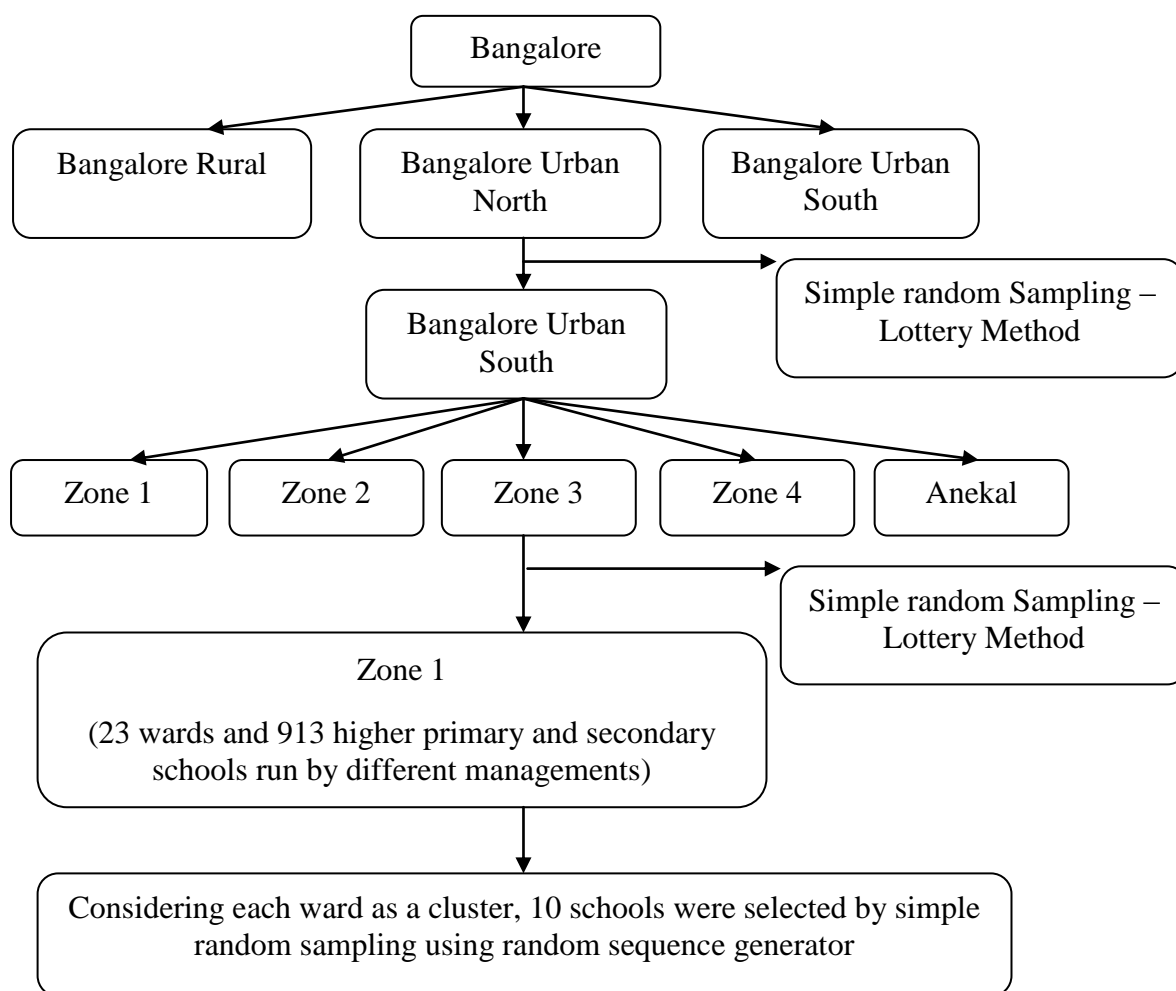*denotes a significantly influencing variable

Figure I: Sampling Strategy employed in the study

DISCUSSION

Poor oral health can have a detrimental effect on children's daily life, hampering their quality of life and academic performance. Poor academic performance in children is one of the various factors responsible for school drop outs. Primary

school level dropout was 9% for India as whole ranging from 1.8 to 15.5 %. 18% children dropped out of school before completing middle school[13]. The current study was conducted among 12 and 15 year old children as it is the recommended age for global monitoring of caries for international comparisons and monitoring of disease trends[14].

The present study revealed that the OHRQoL of 15 year old children (60.14) was better than 12 year old (53.92). In addition, 15 year old females had a significantly better OHRQoL than males. Similar studies which assessed the factors associated with school absence in children instituted that the OHRQol was lower in 12 year old with no gender differences[15]. This may be because younger children have a lower threshold to pain or abnormal symptoms[16]. In the present study, the DMFT experience among 15 year old was marginally higher (0.99) than the 12 year old (0.98) with untreated decay being higher in 12 year old (0.88) than the 15 year old (0.87). But, a retrospective analysis of the caries experience in 5, 12 and 15 year old Indian children showed that the mean caries experience was higher among 15 year old (2.46) than the 12 year old (1.48). This may be due to the fact that the oral health status of the younger children is usually monitored by the parents and hence decreased caries experience.

The present study revealed that 36% of 12year old children and 31% of 15 year old children scored an academic grade of "A" which is considered as "Excellent" according to the grading criteria. These findings are supported by the Sarva Siksha Abhiyan document of Karnataka, which affirms that Student Learning Study conducted by Educational Initiatives reveal that Karnataka clearly show an overall better performance than the national average[17]. The improved standards in educational delivery by introduction of formative assessment encourage students possessing lower grades to enhance their performance subsequently. Of the various social determinants of health, mothers' education seemed to have a significant impact on the academic performance of children. Studies assessing the influence of various factors on school performance showed that primary education of parents was significantly associated with academic performance[3,7]. Educated parents are more verbally responsive to their young children and tend to use teaching strategies that mimic formal instructional techniques, such as asking questions and offering feedback rather than issuing directives. However, the Oral Health Status assessment revealed no significant impact on academic performance in terms of dental caries experience (Table 8). The results are in contradiction with studies which proved that the caries experience in children was significantly associated with their academic performance[6,20]. This is because, in the present study caries experience was assessed using DMFT index which appraises both initial and advanced caries lesion similarly and thus the differentiation between the severe lesions which cause pain and discomfort in children leading to missed school days was not viable. The OHRQoL assessment revealed that, the number of missed school days due to oral problems was significantly associated with the Academic Performance of both12 and 15 year old children. Similar results were obtained in a study assessing dental care with school absence[20]. Oral problems cause pain, discomfort in children leading to missed school days which cause a disconnection in the knowledge attainment, thus hampering their Academic Performance.

The study has a good internal validity as the design and conduct of the present study has been conducted rigorously with minimal bias as per the STROBES Statement. To minimize the influence of variables, Ordinal regression was done by adjusting for the confounders. The study population may be considered similar to the target population in terms of their entry level requirements to the school i.e. minimum age limit – 6 yrs and Socio-economic Status. Thus, the findings of the present study can be extrapolated to all higher primary and secondary school students in Bangalore.

However, the study has few limitations. The data was obtained through a questionnaire and so there may be an influence of social desirability bias.

Even after repeated reminders to the students, personally and through the school teachers, all the parental questionnaires could not be obtained. Thus the Per Protocol analysis or Compliers only analysis was used which induces selection bias.

The findings suggest that the normative oral health status measurement is not comprehensive in its entity, thus resonating the need for incorporation of a more standardized measurement incorporating both the normative needs and OHRQoL assessment. In addition, through experience, the need for a more sensitive index to help identify missed school days due to oral problems is needed. Longitudinal longer follow-up study initiatives to study the influence of various factors on the Academic Performance of school children should be undertaken. Further research utilizing children of various age groups especially in rural areas, assessing the missed school days in children due to oral problems and analyzing its impact on the Academic Performance should also be initiated.

The present study reflects that academic performance of children is impacted by their oral health and social determinants of health. It can convince the curriculum developers / policy makers to recognize the importance of oral health integration into existing curricula by fortifying health promoting school strategies and implementing measures for training teachers and parents to detect the oral lesions at the early stage, thus targeting at oral health promotion.

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