

Oral health status and absence from school among 12 year olds

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Objective: To assess dental caries, periodontal status, malocclusion and absenteeism from school among 12-year-olds in Bhopal district, Central India. **Materials and Methods:** Two-stage random sample of 1238 school children. Decayed missing filled teeth (DMFT), Significant caries index (SiC), community periodontal index (CPI) and dental aesthetic index (DAI) were used to record dental caries, periodontal status and malocclusion. Information on absence from school in the previous year due to pain/discomfort in the teeth or mouth was collected via interviews. Generalized structural equation modelling (GSEM) examined the direct and indirect predictors of absence from school. **Results:** A total of 39.1%, 17.3% and 23.9% of children had dental caries, calculus and gingival bleeding respectively. Mean DMFT and SiC scores were 1.82 ± 1.36 and 3.15 ± 1.47 . 5,127 school hours were missed due to oral health problems per 1,000 children. None of the studied variables predicted absence from school. Utilization of dental care was associated directly with gender and malocclusion ($p < 0.001$). Periodontal status was associated with male gender, nuclear families, tobacco consumption, and malocclusion ($p < 0.001$). Higher DMFT was associated with male gender, malocclusion and experience of pain/discomfort ($p < 0.001$). **Conclusions:** Poor oral health and a high prevalence of untreated dental caries were noted. Despite a considerable number of missed school hours reported due to dental conditions, none of the studied variables predicted absence from school.

Keywords: health promotion, oral health, school health, school absence, access to health care

The World Health Organization (WHO) recognizes oral diseases as a significant public health concern due to their high prevalence and high treatment costs, often requiring high out of pocket payments (Peres *et al.*, 2019; Petersen *et al.*, 2020). The prevalence of oral disease continues to increase in most low- and middle-income nations, largely due to increased urbanization and changes in living conditions. The Global Burden of Disease Study, 2017 estimates that oral diseases affect close to 3.5 billion people worldwide and that 2.3 billion people suffer from dental caries in permanent dentition, predominantly the children (Kassebaum *et al.*, 2017).

Oral diseases among children may lead to negative self-image, lack of self-confidence and consequently, low quality of life (Peres *et al.*, 2019; Petersen *et al.*, 2020). Dental caries becomes complex over time if left untreated due to its progressive and cumulative nature. Similarly, periodontal diseases if left untreated can become painful, irreversible with complications lasting a lifetime (Bashirian *et al.*, 2018). Pain in the teeth or mouth may also affect the child's concentration and engagement in school, limiting not just their play and growth but also depriving them the full benefits of education (Jürgensen and Petersen, 2013).

Children have considerable needs for oral health promotion, prevention and oral health care services, especially in developing countries (Peres *et al.*, 2019; Jürgensen and Petersen, 2013; Bashirian *et al.*, 2018). Effective measures for protecting and promoting oral health among children must be equitable, sustainable and reach large populations. The schools present an

environment favourable for education and reinforcements for a considerable period of time and permit health professionals and teachers to participate in preventive health actions. However, an organized effort to achieve this goal is lacking in many countries including India, specifically for oral health.

Bhopal School Oral Health Program (BSOHP) is probably the first comprehensive school oral health program initiated in India and includes dental screening, oral health education, reinforcements by the trained teachers, and provision of preventive and restorative services. Children with oral diseases are more prone to experiencing dental pain and missing school. Missed school hours have the potential to negatively impact children's quality of life by depriving them of learning. Scant information is available about the oral health status among school children from this region. No available information exists about the school hours missed due to dental reasons for any Indian population. Therefore, the program included conducting a oral health survey among 12 year old children to assess dental caries, periodontal status, malocclusion, absenteeism from school due to dental conditions and associated risk factors among 12-year-olds in Bhopal district, Central India.

Material and Methods

The target population for the cross-sectional study was 12-year-old school children of Bhopal district. Sixty-two schools in the district offer secondary education as notified by the state education department, with approximately

11,500 students in the target age group enrolled. Two-stage sampling first involved the random selection of 20 schools, five each from the four blocks in Bhopal district. The second stage selected all target aged children from the selected schools. A minimum sample of 1112 children was required for a disease prevalence of 50% and precision at 5%. A representative sample of 1238 school children were selected and participated in the study. Children from the age range of 12 ± 1 studying in grade 7th grade were included.

Information on the demographic characteristics of study participants, oral health behaviours, including visits to health personnel for dental needs, pain/discomfort from mouth or teeth in past one year, number of school days missed in past one year due to oral health problems was collected by examiner administered interviews. The dental team comprised of four trained examiners and assisted by two recording clerks.

Clinical examination was conducted according to WHO (1997) guidelines in the classrooms with a plane mouth mirror and a CPI probe. The decayed missing and filled teeth (DMFT) index was used to record dental caries and treatment experience. The Community Periodontal Index (CPI) and Dental Aesthetic Index (DAI) were used to assess the periodontal status and malocclusion and Significant Caries Index (SiC) scores were calculated with to focus on children with the most severe disease.

Ethical clearance was granted by the Institutional Ethics Committee (Project ID: EF0028). This work is reported in compliance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines (von Elm *et al.*, 2007). Informed written consent from the parents and assent from the children was taken before participation. A two-day training session for standardization and calibration was conducted within the Department of Dentistry, AIIMS, Bhopal. Duplicate examinations were conducted on approximately 10% of the participants. The kappa statistics for both inter and intra-examiner agreements were in range of 0.88–0.94.

Generalized structural equation modelling (GSEM) was adopted to examine the relationship between a set of exogenous variables and absence from school due to oral health problems (MSD) via the five endogenous variables (Figure 1): utilisation of dental services (DUP), CPI, DMFT, pain/discomfort from teeth and MSD. Two conceptual frameworks were initially considered and evaluated for better fit: the first (Figure 1) and a similar second framework with an additional direct impact of the exogenous variables. The Akaike Information Criteria (AIC) value was reported for comparison between two different frameworks and the

framework with lower AIC is presented in Figure 1. The lower the AIC score the better the model fit. Generalised Structural equation modelling was performed using Stata v.15 (College Station, TX, USA) and path coefficients along with the 95% confidence interval were reported. $P < 0.05$ was considered significant.

Results

The sample comprised 1238 participants of whom 58.3% were female. Low literacy was noted among the parents, with no formal level of education among 51.7% and 44% of participants' mothers and fathers respectively. Monthly family income levels of <100 US \$ was noted among 8.6% participants. Approximately, 32% lived in a joint family system with three generations of the family residing together. (Table 1)

Nearly all participants used a toothbrush to clean their teeth (Table 2). Approximately, 18% of male and 8% of females consumed some form of tobacco. Experience of pain/discomfort and missed school in past one year due to oral health problems was noted among 35.1% and 22.1% children respectively. The number of school days missed due to oral health problems were 1058 and the numbers of school hours missed were 5,127 hours per 1,000 children.

Calculus and bleeding gums was noted among 17.3% and 23.9% students. Dental caries, missing teeth and filled teeth were noted among 39.1%, 6.5% and 2.6% students respectively. Gender differences for dental caries ($p < 0.001$) and filled teeth ($p < 0.02$) were noted. Mean DMFT was 1.82 ± 1.36 . SIC scores for male and female students were 3.59 ± 1.63 and 2.71 ± 1.32 respectively ($p < 0.001$). Most (75.2%) children had DAI scores under 26 requiring no or minor treatment (Table 3).

The indirect effect of each exogenous variable on the endogenous variable are presented in Table 4. None of the indirect pathways were shown to have significant impact on absence from school. Direct impacts of DMFT and CPI were evaluated and DMFT was found to have significant impact on the discomfort ($p < 0.001$). Gender was found to have significant direct effects on DUP ($p < 0.001$), CPI ($p < 0.001$), and DMFT ($p < 0.001$). Tobacco and type of family were also noted to have a significant direct impact on CPI ($p < 0.001$). DUP and DAI were noted to have a significant direct impact on DMFT ($p < 0.001$). None of the exogenous variables were shown to have significant indirect effect on the CPI, however, DAI was found to have significant indirect ($p < 0.023$) effect on the DMFT.

Two frameworks were evaluated for better fit and the framework without direct effect of other exogenous

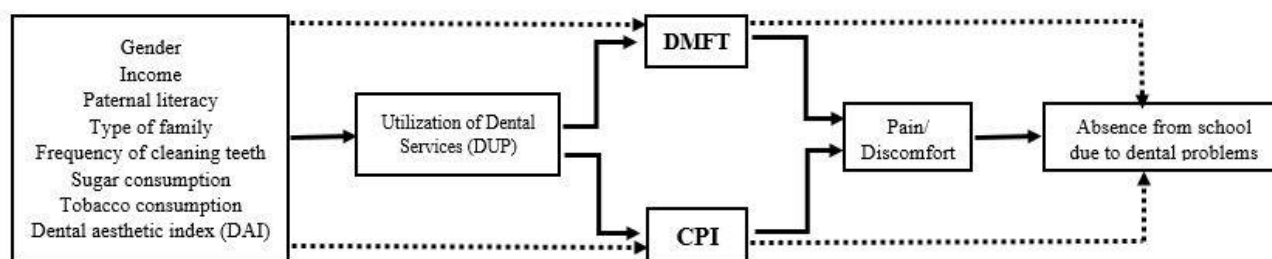


Figure 1. Conceptualized framework for factors affecting absence from school due to dental conditions.

Table 1. Demographic characteristics of 1238 12-year-olds.

<i>Socio-demographic variables</i>	<i>Gender</i>	
	<i>Males (n = 516)</i> (%)	<i>Females (n = 722)</i> (%)
Mother's literacy status		
Illiterate	53.9	50.2
Junior to middle school (1 st to 7 th Grade)	15.8	21.4
Completed high school (10 th Grade)	26.6	25
Graduation and higher	3.7	3.4
Father's literacy status		
Illiterate	46.9	42
Junior to middle school (1 st to 7 th Grade)	16.5	16.2
Completed high school (10 th Grade)	30	37.9
Graduation and higher	6.6	3.9
Family Income levels (Rs) *		
<7500 pm (~100 US \$)	9.3	8.2
7,500 to 15,000 pm (~ 100 to 200 US \$)	80.2	79.2
> 15,000 pm (~ 300 US \$)	10.5	12.6
Type of Family		
Nuclear	67.6	67.1
Joint	32.4	32.9

Table 2. Oral health behaviours among 1238 12-year-olds.

<i>Oral health related behaviour variables</i>		<i>Male (%)</i> (n=516)	<i>Female (%)</i> (n=722)	<i>Total (%)</i> (n=1238)
Mode of cleaning teeth	Finger	3.3	3.3	3.3
	Toothbrush	95.7	96.1	96
	Datun	1	0.6	0.7
Frequency of cleaning teeth	Once daily	77.5	78	77.8
	≥ 2 times a day	22.5	22	22.2
Material used for cleaning teeth	Toothpaste	95.5	95.6	95.6
	Toothpowder	2.9	2.9	2.9
	Others	1.6	1.5	1.5
Frequency of between meal sugar consumption	Never	9.3	5.3	6.9
	Once a day	31.2	33	32.2
	Two times a day	35.8	31.7	33.4
	≥ 3 times a day	23.7	30	27.5
Tobacco related habits	Absent	81.8	92	87.7
	Present	18.2	8	12.3
Utilization of dental care	Never visited	63.7	58.3	60.4
	Previous visit (within 1 year)	8.5	7.5	7.9
	Previous visit (beyond 1 year)	27.7	34.4	31.6
Pain/discomfort from mouth or teeth in past one year	Yes	35.4	34.7	35.1
	No	64.6	65.3	64.9
School missed in past one year due to oral health problems	Yes	22.4	21.7	22.1
	No	77.6	78.3	77.9

Table 3. Oral health status among 1238 study participants.

<i>Clinical variables</i>		<i>Males (%)</i> (516)	<i>Female (%)</i> (722)	<i>p</i> <i>value</i>	<i>Total (%)</i>
Periodontal Status (Highest CPI score)	Healthy	46.3	67.7	0.001	58.8
	Bleeding	33.3	17.2		23.9
	Calculus	20.4	15.1		17.3
Mean No. of Sextants	CPI = 0	2.46 ± 1.31	2.79 ± 1.62	0.001	2.62 ± 1.28
	CPI = 1	2.01 ± 1.57	1.87 ± 1.41		1.60 ± 1.46
	CPI = 2	2.82 ± 1.23	2.61 ± 1.07		2.71 ± 1.15
Decayed teeth (DT) N (%)	Absent	52.9	66.5	0.001	60.8
	Present	47.1	33.5		39.1
Missing teeth (MT) N (%)	Absent	93.4	93.6	0.81	93.5
	Present	6.6	6.4		6.5
Filled teeth (FT) N (%)	Absent	95.5	98.8	0.02	97.4
	Present	4.5	1.2		2.6
Mean DMFT		2.01 ± 1.50	1.69 ± 1.24	0.001	1.82 ± 1.36
Range DMFT N (%)	0	52.9	66.5	0.001	60.8
	1-2	22.6	14.1		17.7
	≥ 3	24.5	19.4		21.5
Significant Caries Index (SIC)		3.59 ± 1.63	2.71 ± 1.32	0.001	3.15± 1.47
Dental Aesthetic Index Scores					
< 25 (no abnormality/minor malocclusion)		76	74.6	0.58	75.2
26–30 (definite malocclusion)		16.7	17.7		17.2
31–35 (severe malocclusion)		5.2	5.4		5.3
36 and above (very severe/ handicapping malocclusion)		2.1	2.3		2.3

Table 4. Demographic and oral health characteristics and their direct and indirect effects for the final model of absence from school.

			<i>PC (95% CI)</i>	<i>p</i> <i>value</i>
MSD	Indirect Effects	DMFT	0.02 (-0.01, 0.04)	0.30
		CPI	-0.00 (-0.03, 0.02)	0.74
		DUPn	0.01 (-0.01, 0.02)	0.31
	Direct Effects	Discomfort	-0.08 (-0.22, 0.07)	0.29
Discomfort	Direct Effects	DMFT	-0.20 (-0.29, -0.11)	0.00
		CPI	0.05 (-0.23, 0.33)	0.72
DMFT	Indirect Effects	Gender	-0.28 (-0.42, -0.14)	0.00
		DAI	0.14 (0.02, 0.27)	0.02
	Direct Effect	DUP	0.39 (0.24, 0.54)	0.00
CPI	Indirect Effects	Gender	0.84 (0.57, 1.11)	0.00
		Tobacco	1.66 (1.22, 2.10)	0.00
		Type of Family	0.45 (0.19, 0.71)	0.00
	Direct Effects	DUPn	-0.15 (-0.38, 0.07)	0.18
DUP	Direct Effects	Gender	-0.65 (-0.89, -0.41)	0.00
		Dental Aesthetic Index (DAI)	0.34 (0.07, 0.61)	0.01

variables like gender, frequency of cleaning, parental literacy, tobacco and sugar consumption on CPI and DMFT was found to have higher AIC value as compared to the one with direct effects (AIC: 12433 versus 12271 respectively). Path coefficients along with the standard error with 95% confidence interval from the conceptualized framework are reported in Figure 2.

Discussion

Identification and monitoring of oral health status of a population is essential to identify the impact of public health policies and programs. High prevalence of dental caries, poor periodontal health, and many missed school hours due to dental problems were noted. High tobacco consumption and extremely low utilization of dental care were also observed.

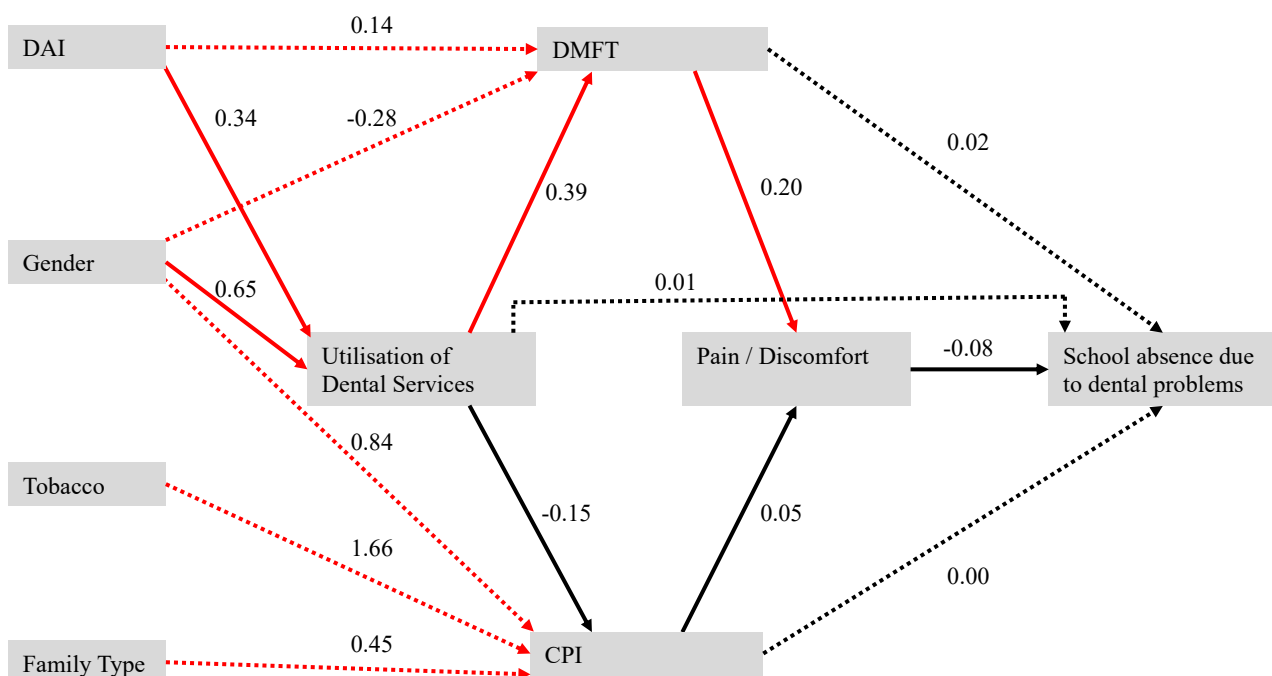
Dental problems were associated with absence from school. School hours missed due to dental reasons in the present study was 5127 hours per 1,000 children which was much greater than that of 1923 hours per 1,000 children as reported among 9-13 years old school children in Thailand, 2003 (Pongpichit *et al.*, 2008). Data was extracted from North Carolina Child Health Assessment and Monitoring Program (CHAMP), 2008 and it was observed that children with poor oral health were nearly three times more likely to miss school because of dental pain than their peers (Jackson *et al.*, 2011).

The problem of missed school hours missed is important because it affects academic learning. Female gender and malocclusion (DAI) were significantly associated with dental care utilization and utilization of dental services

was associated with a higher DMFT. DMFT score was associated with pain/discomfort in the past year. Pain/discomfort from mouth was noted among 35.1% of children and absence from school due to oral conditions was noted among 22.1% of participants. However, pain/discomfort from the teeth was not associated with absence from school due to oral conditions. The reason for the above finding could be that many school children attend school despite being in pain/discomfort.

The other aim of the study was to assess dental caries and periodontal disease. The prevalence of dental caries among 12-year-olds in this study was 39.1% which was twice as high as in Germany and higher than that reported in England (Splieth *et al.*, 2019; Children Dental Health Survey, 2013). The prevalence of dental caries in the study region as reported in National Oral Health Survey, 2003 was 69%, which has reduced to 39.1% in the present study (Bali *et al.*, 2004). The single attributable reason for this change could be the wider availability and use of fluoridated toothpastes. Other reasons include increased awareness about oral health and the significance of oral health, a significant increase in oral health workforce and available services, and the economic growth in the last two decades.

Tobacco is a leading preventable cause of deaths worldwide yet its use among youth is increasing in epidemic proportions across the world. A study conducted among 35 European countries in 2015 reported 21% of adolescents using tobacco regularly (ESPAD Report, 2015). The great majority of tobacco users begin using tobacco products before they reach the age of 18. The tobacco epidemic in India is unique because of the wide



Solid lines = Direct pathways
Dotted lines = Indirect pathways
Red lines = Pathways significant at $p < 0.05$

Figure 2. Structural Equation Model of predictors of absence from school due to dental problems.

variety of tobacco products easily available both for smoking and smokeless use. High tobacco consumption was noted among 12.3% study participants in the present study similar to studies which reveal the rising tobacco consumption among children and adolescence in India (Mistry *et al.*, 2018; Goyal *et al.*, 2020)

Education and health are essential interdependent basic human rights and critical for social and economic development. A school that is not health promoting is no longer justifiable and acceptable as stated by the Director General, UNESCO (WHO, 2021). Screening at schools alone is ineffective without provision or referral to care for those identified in need. A total of approximately 25,000 school children from all the surveyed schools were screened and appropriate referrals made for treatment. Most of the disease burden consisted of untreated dental caries.

The WHO's Health Promoting Schools initiatives offers recommendations for suitable school health activities as well as the integration of oral health interventions into existing school health programs. To integrate and practice positive oral hygiene behaviour as a daily routine is a way of imparting necessary skills to children. These children may also be the ones bringing about positive changes in hygiene behaviour of their families and communities. Periodic oral screenings by the trained teachers should be encouraged by the school and based on prevention and long-term oral hygiene practices. The school curriculum should be planned to include oral hygiene instructions. Provision and consumption of sugary drinks and tobacco use should be banned within school premises. Access to oral health services for the school children through a public health program needs to be a priority. Even though the observed trends suggest an improvement in oral health yet there is an immense scope for further progress and improvements.

Conclusion

Poor oral health and a high prevalence of untreated dental caries were noted with a considerable number of missed school hours due to dental-related conditions. However, none of the studied variables were found to predict absence from school. High tobacco consumption and extremely low utilization of dental care were also noted.

Conflict of Interest

None to be declared

Funding

None

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