

Material Deprivation And School Absenteeism As Indicators Of Dental Caries Experience In 12-Year School Children Of Government Schools In Bengaluru City, India.

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Abstract

Background: Children's oral health status is being increasingly addressed in recent years, but oral health of materially deprived and underprivileged children and its association with school absenteeism continues to be a neglected issue. This study aimed to investigate whether measures of material deprivation and school absenteeism could be used as indicators of dental caries experience among underprivileged schoolchildren.

Methods: A cross-sectional study was done on a sample of 403, 12-year-old schoolchildren attending government schools in South Zone I of Bengaluru City using a multistage clustered simple random sampling method. Data was collected on school absenteeism and its reasons while Material Deprivation among their parents was assessed using UNDP Multidimensional Poverty Index (MPI). Clinical examinations were carried out using the World Health Organization Oral Health Assessment Form- 2013. Linear regression and mediation analysis was used between school absenteeism and 'poor households' with dental caries experience with the level of significance at 5%.

Results: The data analysis showed that the total caries experience of the study sample was 2.31 ± 1.33 with nearly 120 school days missed due to dental reasons, 650 days due to medical and 250 days due to social reasons. A significantly strong positive correlation was found between the caries experience and poor households and, caries experience and school absenteeism supporting mediation.

Conclusion: The present study suggests both material deprivation and school absenteeism as good indicators of dental caries experience of the 12-year- old government school children.

Keywords: Absenteeism, children/adolescent, dental caries, material deprivation, oral health, UNDP MPI index.

Introduction:

Poverty is a flat development that exists in all societies, varying in magnitude and depth among different countries, and encompasses the lack of resources, unsatisfied housing conditions, poor education and/ or ill health that impacts generations. The association between poverty and health is complicated in terms of causative relationships. Oral health is the basic element of general health and the occurrence of dental caries, the most common disease of childhood, is significantly influenced by socioeconomic inequities. It is particularly high in children from families with low income, lower household educational attainment, racial/ethnic minority status, lack of private dental insurance and higher

levels of deprivation based on small area measures¹ and these inequities have worsened over time.² Material deprivation is the most generally researched social variable and a homogenous marker of childhood caries. It refers to the scarcity of "material standards of diet, clothing, housing, household facilities, working, environmental and location conditions and facilities that are orderly available in their society".³ Working-class parents tend to earn lower financial gain that can result in their children experiencing material deprivation, bad diet, ill-health, and lack of resources.⁴ Absenteeism refers to excusable or inexcusable absences from the primary/secondary school system and dental reasons for school absenteeism have been widely explored in literature. More than 51 million school hours are

lost annually because of illness related to dental problems.^{5,6}

Traditionally used clinical oral health status measures pay comparatively less attention to the social dimensions of oral disease.⁷ While literature shows the link between high caries risk and accumulated levels of material deprivation using both conventional measures of socioeconomic status and area-based measures of deprivation⁸ only few studies have used UNDP's Multidimensional Poverty Index⁹ which measures the deprivation in terms of multi-dimensional aspects of poverty. Socio-dental indicators like school absenteeism and material deprivation can assess the interference of oral diseases with daily living¹⁰ and traditional social role functioning.¹¹

These social factors that potentially impact the prevalence of dental caries have not been explored extensively⁸ and to explore this relationship among Indian school children, the current study was undertaken. It aimed to understand whether measures of material deprivation and school absenteeism could be used as indicators of dental caries experience. Current multidimensional measures of poverty continue to follow the traditional income poverty approach of using household rather than the individual as the unit of analysis. The first international measure of its kind, UNDP's Multidimensional Poverty Index offers an essential complement to income poverty indices as it measures deprivations directly. Hence, this study utilized UNDP's Multidimensional Poverty Index to provide a realistic measure of material deprivation in a community such as Indian school children.

Methodology:

This cross-sectional study was conducted in Bengaluru city, India for a period of 8 months from September 2015 to April 2016. Ethical clearance was obtained from the Institutional Ethical Committee of V.S. Dental College and Hospital, Bengaluru. A 403, 12-year-old school children who were selected from 20 randomly selected Government schools in South Zone-I of Bengaluru city, Karnataka, India using multistage, simple random cluster sampling method and their parents, residing in the same place participated in this study.

Sampling method:

Bengaluru city has four zones- North, South, East and West, each of which was further divided into four clusters as I, II, III, and IV. Each cluster consisted of 100-150 government schools. In the first stage of sampling, the South zone was selected followed by the I cluster in the second stage and 20

schools in this region in the third stage. A simple random sampling method using the lottery method was employed in all stages. The selected schools were taken as the place of study and continued till the desired sample of 403 children was recruited. School children aged 12 years attending the same school for at least one academic year, residing in South Zone-1 of Bengaluru city and gave written assent in addition to parents and teachers' consent were included in the study while students newly admitted to the school in the previous academic year were excluded.

Sample Size Estimation:

UM Das, et.al., 2009¹² reported the prevalence of dental caries among 12–15-year-old children to be 49.25%. Assuming a 5% alpha error and an increase of 5% to account for contingencies, a minimum of 403 participants were required.

Examination and Data Collection:

Oral examination of the study participants was carried out by the investigator in a room within the school premises. WHO Oral Health Assessment form- 2013¹³ was used to assess dental caries prevalence among school children. The remaining students in the selected schools were later screened and referred to V S Dental College and Hospital for further treatment if required. These students, however, were not included in the study.

Following the oral examination, the investigator visited the homes of the study participants during evening times or weekends to collect data regarding material deprivation in the study participants' households and to confirm their child's absenteeism from the school. using UNDP Multidimensional Poverty Index (MPI). Information on 10 indicators of MPI was collected encompassing three dimensions- education, nutrition and living standard with respective weights. This index, based on the dimension weights set the Poverty cut-off 'k' at 3, thereby indicating that the household must be deprived in at least the equivalent of 30% (0.333). Households were classified into 'poor households' - $k > 0.333$ and 'not poor households' - $k < 0.333$. A pilot study was conducted to assess the feasibility of the study, calibration of the examiner ($\chi = 0.80$) and test-retest reliability ($\chi = 0.84$), which were found to be good. A structured, pre-validated questionnaire containing questions on socio-demographic factors, number of school days missed and reasons for absenteeism were administered by the investigator in person with each student at the school premises.

Statistical Analysis:

Data analysis was carried out using SPSS software version 21.0 (SPSS Inc., Chicago, IL, USA).

Descriptive statistics were done for the number of school days missed, caries experience and the Multidimensional Poverty Index variables using frequencies and percentages. Spearman's correlation coefficient was used to test the correlation between school absenteeism, 'poor households' and caries experience. MPI variables were assessed for variance in caries experience among the study population by using a linear regression model and multivariate analysis was used to assess the variance in dental caries experience with school absenteeism and 'poor households'. Mediation analysis was used between school absenteeism and 'poor households' with dental caries experience. A two-sided p-value of <0.05 was considered statistically significant.

Results:

A total of 403 subjects participated in the study of which 208 (51.6%) were boys and 195 (48.4%) were girls. Table 1 describes the sociodemographic variables of the study population. Among the study subjects, caries prevalence was high (Figure 1), and 38 (9.4%) students missed school due to dental reasons of whom, 33 (8.2%) students missed school due to trauma (Avulsion/Luxation), 22 (5.5%) students due to jaw swellings and 9 (2.2%) students due to toothache whereas only 3 (0.74%) students missed school because of a dental visit as shown in Table 2.

Table 3 shows the MPI characteristics of the study participants, while its association with dental caries and school absenteeism is shown in Table 4. Parents' education and BMI (underweight) of the first sibling were found to significantly influence children's caries experience. While caries experience was also influenced by school absenteeism, the presence of dental caries and poor households significantly influenced the number of school days missed ($p<0.05$).

Evidence of mediation between poor households and school absenteeism as mediators for caries experience is shown in Table 5, where the adjusted effect size measure (R^2) of the 'poor households' on caries experience rose from 50% to 68% on the addition of school absenteeism ($p<0.001$). A statistically significant strong positive correlation was found between 'poor households', caries experience and school absenteeism ($p=0.01$) (Table 6).

Table I. Demographics of the study participants and their parents (N=403)

Sociodemographic Variables	
<i>Sex of the child</i>	<i>Frequency (%)</i>
Male	208 (51.6%)
Female	195 (48.4%)
Total	403(100%)
<i>Mean age of the parents</i>	<i>Mean(SD)</i>
Mother	36.5 (3.5)
Father	40.8 (3.45)
Socioeconomic Status	
<i>Education</i>	<i>Frequency (%)</i>
Illiterate	203 (50%)
Primary school certificate	152(38.1%)
Middle school certificate	24 (5.9%)
High school certificate	16 (4%)
Intermediate/post high school	8(2%)
Graduate/postgraduate	00
<i>Occupation</i>	<i>Frequency (%)</i>
Unemployed	00(0%)
Unskilled worker	160 (39.7%)
Semi-skilled worker	108(26.7%)
Skilled worker	65 (16.3)
Clerical/shop owner	50 (12.4)
Semi profession	20 (4.9%)
Profession	00 (0%)
<i>Monthly income (INR)</i>	<i>Frequency (%)</i>
1601-4809	178 (44.1%)
4810-8009	90 (22.3%)
8010-12019	59 (14.7%)
12020-16019	41 (10.2%)
16020-32049	35 (8.7%)
<i>Socioeconomic status scale</i>	<i>Frequency (%)</i>
Upper middle	70 (17.6%)
Middle/lower middle	100 (24.8%)
Lower/upper lower	180 (44.5%)
Lower	53 (13.1%)

Table II: Distribution of study participants based on number of school days missed and reasons of school absenteeism.

School Absenteeism	Mean (SD)
<i>No. of school days missed</i>	5.02 (4.4)
Days missed (Dental reason)	0.42 (0.99)
Days missed (Medical reason)	3.03 (3.55)
Days missed (Social reason)	1.50 (2.39)
<i>Reason for school absenteeism</i>	<i>Frequency (%)</i>
Dental	38 (9.4%)
Medical	167 (41.5%)
Social	70 (17.4%)
Dental + Medical	26 (6.5%)
Dental + Social	07 (1.7%)
Medical + Social	86 (21.3%)
All	09 (2.2%)
<i>Specific reasons for school absenteeism</i>	<i>Frequency (%)</i>
Dental reason	
No dental problems	321 (79.7%)
Toothache	09 (2.2%)
Swelling due to infection	22 (5.5%)
Fever due to dental problems	15 (3.7%)
Trauma (Avulsion/Luxation)	33 (8.2%)
Dental visit	3 (0.7%)
Medical Reason	
No medical problems	114 (28.3%)
Headache	13 (3.2%)
Fever	212 (52.6%)
Any other	64 (15.9%)
Social Reason	
No school absenteeism	233 (57.8%)
Lack of interest	52 (13%)
Lack of confidence	01 (0.2%)
Excess of homework	17 (4.2%)
Family function	100 (24.8%)

Table III. Distribution of study participants according to UNDP Multidimensional Poverty Index:

UNDP MULTIDIMENSIONAL POVERTY INDEX						
EDUCATIONAL DIMENSION						
[Frequency (%)]						
A. Years of schooling		Did not attend		Class I-V		Class VI-X
Mother		235 (58.3%)		144 (38%)		14 (3.4%)
Father		203 (50.4%)		176 (43.6%)		24 (5.9%)
B. Child school enrolment		Yes			No	
Any child not attending school: year 1-8		0 (0%)			403 (100%)	
HEALTH DIMENSION						
[Frequency (%)]						
A. Nutrition		Normal	Under-weight	Over-weight	Obese	Refused
Households BMI	Males	312 (77.4%)	0 (0%)	80 (19.8%)	12 (2.9%)	0 (0%)
	Females	330 (81.8%)	0 (0%)	60 (14.8%)	13 (3.2%)	0 (0%)
Siblings' BMI	1 st sibling	180 (58.1%)	130 (41.9%)	0 (0%)	0 (0%)	0 (0%)
	2 nd sibling	150 (61.8%)	93 (38.2%)	0 (0%)	0 (0%)	0 (0%)
B. Child mortality		Yes			No	
Child death in the family		0 (0%)			403 (100%)	
LIVING STANDARD DIMENSION						
[Frequency (%)]						
A. Electricity		Yes			No	
Electricity available		317 (78%)			86(21%)	
B. Sanitation		Yes				
Flush to septic tank		24 (5.9%)				
Flush to pit		48 (11.9%)				
Flush to somewhere else		71(17.6%)				
Flush to unknown place		60(14.8%)				
No facilities/bush/field		136(33.7%)				
Others		1(0.2%)				
Common Toilets		63(15.6%)				
Total		403 (100%)				
Water Source						
i. Drinking water		Yes				
Piped into dwelling		104 (26.3%)				
Unprotected dug well		73 (17.8%)				
Protected dug well		60 (14.6%)				
Protected spring		44 (10.7%)				
Unprotected spring		30 (7.3%)				
Tanker-truck		18 (4.4%)				
Cart with small tank		06 (1.5%)				
River/dam/lake/pond/canal		68 (16.6%)				
Total		403 (100%)				
ii. Non-Drinking Water		Yes				
Piped into dwelling		104 (26.3%)				
Unprotected dug well		73 (17.8%)				
Protected dug well		60 (14.6%)				
Protected spring		44 (10.7%)				
Unprotected spring		30 (7.3%)				
Tanker-truck		18 (4.4%)				
Cart with small tank		06 (1.5%)				
River/dam/lake/pond/canal		68 (16.6%)				
Total		403 (100%)				
iii. Distance to water source		Yes			No	
Water on premises		348 (84.4%)			55 (15.6%)	
C. House floor		Yes				
Earth/sand		130 (32.2%)				
Dung		111 (27.5%)				
Palm/bamboo		38 (9.42%)				
Vinyl/asphalt strips		30 (7.4%)				
Ceramic tiles		37 (9.2%)				
Cement		57 (14.1%)				
Total		403 (100%)				
D. Cooking Fuel		Yes				
LPG		100 (24.4%)				
Kerosene		29 (7.6%)				
Coal/lignite		40 (8.4%)				
Charcoal		46 (11.2%)				
Wood		124 (30.5%)				
Straw/shrub/grass		49 (12.5%)				
Agricultural crop		15 (5.4%)				
Total		403 (100%)				
E. Assets		Yes			No	
Radio		129(33.2%)			274(66.8%)	
Refrigerator		00(0%)			403(100%)	
Television		142(36.3%)			261(63.7%)	
Non mobile telephone		80(19.7%)			323(80.3%)	
Mobile telephone		129(33.2%)			274(66.8%)	
Bicycle		305(75%)			98(25%)	
Motor bike/ Scooter		53(12.9%)			350(87.1%)	
Car		0(0%)			403(100%)	
Truck		0(0%)			403(100%)	

Table IV. Linear regression model between dental caries experience and independent variables:

Model	Unstandardized coefficients		Standardized coefficients	T statistic	p value
	B	Std. error	Beta		
<i>Independent Variables</i>					
(Constant)	1.132	.355		3.187	.002
Education					
Father	0.038	0.032	0.068	1.179	0.023*
Mother	0.010	0.033	0.016	0.291	0.041*
BMI of siblings					
1 st sibling	-0.029	0.039	-0.043	-0.739	0.046*
2 nd sibling	-0.010	0.044	-0.013	-0.235	0.814
BMI of household members					
Men	0.002	0.139	0.018	0.014	0.989
Women	-.003	.139	-.024	-.019	.985
<i>UNDP MPI Variables</i>					
House floor	-0.001	0.002	-0.028	-0.520	0.603
Sanitation	0.002	0.002	0.070	0.952	0.342
Common toilets	-0.015	0.038	-0.021	-0.380	0.704
Cooking fuel	-0.006	0.007	-0.044	-0.852	0.395
Non-drinking water	0.001	0.001	0.042	0.794	0.428
Water availability of premises	0.001	0.000	0.008	0.146	0.884
Electricity	0.043	0.064	0.051	0.662	0.508
Radio	0.057	0.077	0.052	0.737	0.462
Television	0.068	0.040	0.096	1.675	0.095
Mobile telephone	-0.061	0.054	-0.085	-1.122	0.263
Bicycle	-0.051	0.052	-0.064	-0.989	0.323
Motorbike/scooter	0.080	0.061	0.078	1.301	0.194
Car	-0.251	0.146	-0.121	-1.719	0.086
<i>MPI Index</i>					
(Constant)	0.838	0.053		15.757	0.000
Poor Households [†]	-0.039	0.154	-0.013	-0.254	0.800
(Constant)	.583	.190		3.067	.002
Poor Households [‡]	2.234	.820	.148	2.726	0.007*
<i>School Absenteeism[†]</i>					
(Constant)	0.838	0.053		15.757	0.000
No. of school days missed	0.008	0.004	0.103	2.067	0.039*
<i>Dental Caries[‡]</i>					
(Constant)	0.583	0.190		3.067	0.002
Caries experience	0.891	0.081	0.599	11.061	<0.001*

[†] Dependent Variable: Child caries experience,

[‡] Dependent Variable: No. of school days missed,

*Significant at p<0.05

Table V. Mediation analysis between school absenteeism and 'poor households' with dental caries experience:

Model [†]	Unstandardized coefficients		Standardized coefficients Beta	T statistic	Adjusted R ²	P value
	B	Std. error				
(Constant)	0.259	0.107		2.415		0.016
Poor households	5.021	0.383	0.493	13.099	0.500	<0.001*
Poor households + No. of school days missed	0.280	0.025	0.417	11.061	0.658	<0.001*

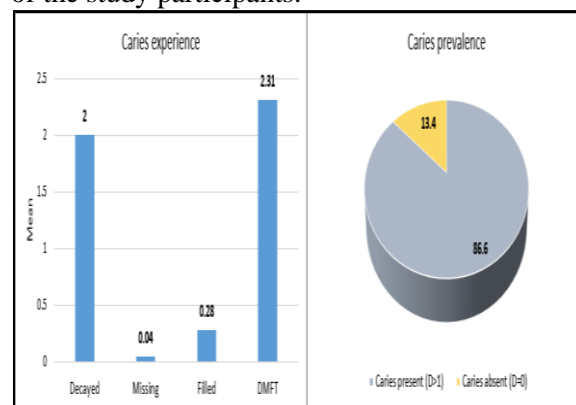
[†]Dependent Variable: Child caries experience,

*p<0.05

Table VI. Correlation between households and school absenteeism with caries experience of the study participants:

Variables (N=182)	Poor Households (ρ)	Caries Experience (ρ)	School Absenteeism (ρ)
Poor households	1	0.786*	0.650*
Caries experience	0.786*	1	0.708*
School absenteeism	0.650*	0.708**	1

^ρ Spearman's rho, * Significant at p<0.05

Figure I. Caries experience and caries prevalence of the study participants:

Discussion:

The gap in oral health inequalities is widening and severe tooth decay is strongly associated with child poverty. Several investigators have confirmed that the measures of socioeconomic inequalities are sensitive to inequalities in oral health and, due to their spatial component, are likely to prove useful in the planning processes.¹¹ Dental professionals and oral health policy planners require more up-to-date and accurate information about the patterns of disease among children of lower socioeconomic households to predict possible disease trends and plan appropriate treatment modalities and oral health policies.

UNDP Multidimensional Poverty Index is a composite indicator used in the evaluation of socioeconomic status. According to our knowledge, there are no studies assessing poverty and material deprivation, using the UNDP Multidimensional Poverty Index, as an indicator of dental caries experience with school absenteeism. Hence, the present study was undertaken to investigate whether measures of material deprivation and school absenteeism could be used as indicators of dental caries experience in 12-year-old schoolchildren attending government schools of South Zone- I, Bengaluru city.

None of the participants had attended preschools during their childhood. In this study, school absenteeism was recorded based on the total

number of school days missed from the last year and the results showed that nearly 120 days were missed by the school children due to dental reasons, nearly 650 days were missed due to medical and 250 days due to social reasons. This amounted to, on average, nearly three and a half missed school hours due to dental reasons, six missed school hours due to medical and five missed school hours due to social reasons, which are similar to the observations made by Pongpichit B et al., 2008 in Thailand.¹⁴ Literature suggests that the improvement of children's oral health may be a vehicle to improve their educational experience indirectly by reducing the missed school hours.¹⁵ The finding that medical reasons accounted for higher absenteeism than dental reasons may be explained by the fact that while children stayed at home when ill, they were likely to go to school when they experienced dental problems, unless painful. The number of children visiting a dentist is negligibly lower (1.4%). This shows the lack of oral health knowledge among them and awareness among their parents. Such families tend to incur oral problems that may result in reduced activity and/or dental treatments that involve lengthy and/or multiple appointments.¹⁶

The health dimension of the UNDP Multidimensional Poverty Index was assessed using BMI as an indicator of nutritional status. Accordingly, the BMI (underweight) of the first siblings of school children in this study was significantly associated with caries experience as reported in the literature.¹⁷ Thus, multidimensional poverty could have influenced BMI which was shown to be associated with dental caries experience.

The total caries experience of the schoolchildren was 2.31 ± 1.33 with decay component being higher (2 ± 1.31) followed by filled component (0.28 ± 0.66) and missing component (0.04 ± 0.26). Similar findings have been recorded in the literature,¹⁸ while higher caries experiences have been recorded in Peru and the United Kingdom.^{19,20} A significant strong positive correlation was found between school absenteeism and caries experience, like the findings reported by Krisdapong B, et al., 2013¹⁷ where severe tooth decay was the main dental factor related to school absence but not significantly associated. In contrast, the results from the study done by Pongpichit et al., 2008¹⁴ showed that the level of school absence for dental-related conditions and care was low per child but could be categorized as 'considerable' cumulatively.

A significant strong positive correlation was found between the 'poor households' with the caries experience as observed in the literature.⁸ This could be due to material deprivation having a greater impact on oral health among these children. Material living conditions, where these children live, could affect their participation in roles, relationships, functions, rights, and responsibilities implied by membership of the society, which in turn might affect their oral health. While this relationship is supported by the significant unadjusted association of poverty with dental caries and the 8% decrease in the odds ratio for the association between poverty and dental caries,¹⁹ contrasting results have shown that the deprivation index was not statistically significant with caries experience.²¹

Low parental educational levels may lead to reduced income, unemployment, and poor occupational status; these conditions influence health behaviours and self-rated oral health.¹ Specifically addressing children, previous studies have suggested that oral health outcomes are influenced by the mothers' educational levels.²² Low education of parents is significantly mediated with greater severity of dental caries in low socioeconomic children²³⁻²⁵ as observed in this study.

This study provides new information from a public health perspective. We used a representative sample of South Bengaluru school children from the lower socioeconomic status, obtained by a random selection process. This prevented Berksonian bias that might have occurred if the sample had been collected in an institutional or a clinical setting, for example. Moreover, such studies are relevant to the planning of public health programs and contribute to the definition of groups with a higher level of need. Further research in this field is needed to help acquire precise data and information vital for directing policy changes in public institutions in India.

This study is not without limitations. Oral health behaviours which may have an impact on dental caries experience were not assessed. The study was conducted among government school children and deprived households with poor levels of health care services living in a metropolitan city, which might have limited the representativeness of the population in the sample. Further studies should include deprived people in several districts and villages throughout the state to provide a reliable and holistic picture of oral health in the country. We would like to recommend that future studies

can, apart from dental caries, take into consideration other oral health conditions that affect the overall health of the child and lead to school absenteeism; to address the overall oral health of the children and its reasons for school absenteeism among multidimensionally poor individuals.

Conclusion:

The present study was a sincere attempt to understand the oral health status of the low socioeconomic children in Bengaluru city South zone-1 measured by the UNDP Multidimensional Poverty Index. Children living in poor households had a higher chance of experiencing dental caries. Material deprivation and school absenteeism were concluded to be good indicators of the dental caries experience among 12-year-old government school children. As India aspires to become a developed country soon its achievement in the social arena will be seen with equal interest as its economic and scientific advancement. Hence, health professionals have a major responsibility in ensuring a healthy nation.

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