



Socio-economic and health determinants of untreated dental caries burden of a group of children in rural Sri Lanka

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Abstract

Introduction/Background: Dental caries is a result of complex interactions between an array of biological, social and environmental factors. Since dental diseases are the 4th most expensive disease to be treated, poor people may not have financial security to access for treatments of dental caries of their children unless free oral health care services are provided.

The low socio-economic status is categorized as a risk factor for dental caries along with equally important life-style-related factors such as high refined sugar consumption and poor oral hygiene.

Methodology: A descriptive cross-sectional study was conducted to explore the relationship between prevalence and the severity of untreated dental caries with selected socio-economic and health service factors. A multi stage cluster sampling technique was employed to select 479 Grade I school children attending to Government schools of Wellawaya MOH area.

A self-administered questionnaire was used to collect socio-demographic information. Dental caries was recorded using dmft index and severity of untreated dental caries was recorded using pufa index. Data analysis was done using SPSS version 20. The relationship of prevalence and severity of untreated dental caries with socio-economic and health service factors was assessed using Chi-square test.

Results: There was a significant differences of untreated dental caries prevalence among children by different levels of father's education ($p = 0.027$) and levels of family income ($p = 0.018$).

There was a significant difference of severity of untreated dental caries among children by different levels of father's occupation ($p = 0.001$) and family income ($p = 0.013$).

Conclusion: Prevalence of untreated dental caries was significantly associated with father's educational attainment. Severity of untreated dental caries of children was significantly associated with father's occupational status. Moreover, prevalence and severity of untreated dental caries of children were significantly associated with family income there by demonstrating oral health inequality patterned by their socio-economic status.

Keywords: Untreated, dental caries, socio-economic factors

Introduction

Dental caries, periodontal diseases and tooth loss are the major three oral diseases in humans, and combined prevalence of them has been reported as 45% and it was the most prevalent NCD during last three decades (World Health Organization, 2020) [17]. Globally 3.5 billion people have been affected by this chronic disease and specially, children are a vulnerable group. Thus, 520 million children suffer from dental caries in their deciduous dentition worldwide (IHME, 2019; Peres *et al.*, 2019) [9, 12].

Socio-economic status is a determinant of dental caries and low socio-economic status has been considered to be a risk factor for dental caries in high income countries than low & middle-income countries.

Further, it was evident in recent past that middle socioeconomic status could offer a mild protective effect in acquiring dental caries (Yousaf *et al.*, 2022) ^[18].

Oral health status of children is crucial in determining their physical, social and psychological well-being while dental caries is one of the main reason for deteriorating their oral health status, which is entangled in complex daily habits determined by psychosocial, economic and environmental factors (Watt, 2007) ^[16]. However, despite the global declining trend of dental caries, a social gradient is observed in oral health of children (Christensen *et al.*, 2010) ^[4]. Therefore, preventive efforts of dental caries should not narrowly be focused on individual and biological factors.

The national guidelines of the United Kingdom in pediatric dentistry have categorized low socioeconomic status as a risk factor for dental caries along with equally important high sugar consumption and poor oral hygiene (O'Sullivan & Milosevic, 2008) ^[11]. Studies have shown that children who live in poverty have five times more untreated dental caries compared to those who do not live in poverty (California Pan-Ethnic Health Network, 2016) ^[2].

Household food insecurity can be considered as an indicator of low family income and according to a study conducted in 2015, it was observed that being in a food-insecure household was associated with greater frequency of untreated dental caries among low income school children (Santin *et al.*, 2016) ^[14]. Thus, according to literature, Children with low family income are at more risk of developing dental caries and having untreated dental caries (Gokhale & Nuvvula, 2016) ^[7].

Parents are the primary care givers for children and, the level of education of parents plays a significant role in preventing and controlling dental diseases. It was observed that mean number of decayed teeth is decreasing with the highest level of parental educational attainment (Canadian Academy of Health Sciences, 2014) ^[3]. Another important factor which determines the level of untreated dental caries of children is the occupation of parents. As it influences the family income, time availability to access oral health care, and maintaining oral hygiene of children, occupational status of parents would be associated with untreated dental caries burden of children. It has reported in literature that children in low socioeconomic status and those who having both parents in the workforce are more prone to getting dental caries (Gokhale & Nuvvula, 2016) ^[7]. This could be due to low access of oral health care services caused by unavailability of time for parents.

Oral health care services availability affects obtaining dental treatment for the dental caries in children. Majority of dental caries is seen untreated due to unavailable, unaffordable, or inappropriate oral health care services (World Health Organization, 2014).

An observational study conducted by Sayegh *et al.* in 2002 ^[15] in Jordan among 3–5-year-old children revealed the significant association between dental caries in children and the father's education. (OR1.5, 95%CI 1.1-2.1). In the same study it was demonstrated that there was an association between per capita household income and untreated dental decay of children (Sayegh *et al.*, 2002) ^[15]. According to the third US national health and nutrition examination survey the prevalence of untreated dental caries among 2–5-year-old children was 18.7%. Further, it reported if household income was stratified the prevalence of dental caries increased to 29.7% in the most deprived group (Dye *et al.*, 2012).

Another study has been conducted in India on dental neglect among children in Chennai, gives some important information about association between socio-economic factors and untreated dental caries. A total of 478 children and parent pairs were selected and it was considered as a random sample representing Chennai population. Education level of parent's was categorized as secondary, higher secondary, graduate and post graduate. This study demonstrated a significant association between Mean DMFT of children and parents' education level ($P=0.017$). In the same study, the association between service utilization and Mean DMFT and mean pufa of children was investigated. Children who had utilized oral health care services within preceding year showed the lowest mean DMFT (0.67) and lowest mean pufa (0.3), children those who had utilized oral health services within last 2 years showed a Mean DMFT of 1.33 and it was the highest among this study group and they showed the lowest mean pufa (0.14) value in the study group (Gurunathan & Shanmugaavel, 2016) ^[8].

A study conducted in China has also demonstrated that association between early preventive dental visits and untreated dental caries among children below 7 years old. They have found a lower dental caries rate and untreated dental caries in children who utilized early preventive dental care compare to children who underutilized early preventive dental care (Qu *et al.*, 2022).

In the scarcity of Sri Lankan literature, this study was conducted to explore the association between untreated dental caries and selected socio-economic and health service factors among 5-7 years old school children living in one of the poverty-stricken districts of Sri Lanka.

Methodology

A cross-sectional study was conducted among Grade 1 School children in Wellawaya Medical Officer of Health (MOH) area of the Monaragala district. Monaragala district consists of 97.7% of rural and 2.3% of estate population. This study setting was selected since dental caries is polarized to socio-economically disadvantaged populations. Data collection was done within the period of 10th August to 31st December, 2016.

Multi-stage cluster sampling technique was employed to select required study sample from all 32 government schools in the Wellawaya MOH area. Sample was comprised of 202 female students and 198 male students. A Grade 1 child with a Care giver (Mother/father/other relative) was considered as the study unit. A self-administered questionnaire was used to collect data on socio economic and demographic variables of the study participants. Intra oral examination was performed to record untreated dental caries by the principal investigator. Children were examined in the school dental clinic seated on a dental chair. In schools where a school dental clinic was not available a class room was utilized to examine children. In those instances, a mobile dental chair and a spot light was used to facilitate intra oral examination. Dental probe was not used to explore dental caries since it could be triggered a dental pain, if pulp exposed tooth was probed unintentionally. Therefore, only the sterile mouth mirrors were used to identify dental caries and children were examined before the mid-day meal as much as possible. However, if they had consumed a meal after teeth brushing in the morning they were advised to brush their teeth before the examination. Dental caries was recorded according to WHO basic methods (dmft index) while severity of untreated dental caries was

recorded using “pufa” index. Principal investigator who did the intra-oral examination was trained to record severity of untreated dental caries according to pufa index. Adequate measures taken to reduce intra-examiner variability.

Information regarding the parental educational attainment, occupation, average income of the family, and availability of oral health care services were collected using a self-administered questionnaire (table 1.1). Data analysis was performed using SPSS version 20 and since dental caries recorded in permanent teeth was negligible, analysis was limited to the deciduous dentition. Descriptive variables were operationalized to facilitate analysis and frequency distribution was done for all the variables. The chi-square test of statistical significance was used to compare the group differences among children by socio-economic variables considered in this study. Significance was set as the cut-off P value of ≤ 0.05 .

Availability of oral health care services was assessed based on the distance to all three types of dental clinics from their residence in kilometers. Three types of dental clinics which children can receive care were School Dental Clinics (SDC), Government Hospital Dental Clinic (HDC) and Private Dental Clinics (PDC).

Ethical clearance was taken from the Ethics Review Committee of the Faculty of Medicine, University of Colombo. Voluntary participation was allowed and written informed consent was obtained from the parents or care givers of children. Moreover, administrative clearance was obtained from the relevant health and education authorities prior the commencement of the study.

Results

A total of 401 children were included in the study sample and the response rate was 93.9%. Moreover, 50.9% of the sample comprised of males. The ages of children ranged from 05 to 07 years with a Mean age of 5.9 years. Majority was Sinhalese.

The level of education of parents of children in the study sample showed a considerable variation. About 1.6 % mothers and 2.3% of fathers had no formal education. The majority of fathers and mothers have passed G.C.E. O/L (54.3% fathers & 58% mothers). Moreover, 18.4% fathers and 18% mothers have passed G.C.E. (A/L). Only 3.8% fathers & 6.2% mothers were diploma or degree holders.

Occupational status among mothers and fathers showed a marked difference. Majority of fathers (60.7%) were engaged

in self-employment and the majority of mothers (83.2%) were un-employed. Only 4.3% of fathers and 7.3% of mothers were doing managerial jobs. Another 10 % of fathers and 7.5% of mothers worked as skilled and unskilled labors. Majority (33.5%) of children in this rural MOH area had family income 10 000-15 000 LKR while 26.2% children had 25 000-35 000 LKR. Another 19.5% had the family income between 15 000-25 000 LKR and only 20.6% had family income above 35 000LKR. Income levels were amalgamated to two categories during further analysis: category 1 – monthly income Rs.15 000 or below while category, 2 – monthly income above Rs.15000. There was a significant differences of untreated dental caries prevalence among children by different levels of father’s education ($P= 0.027$) and two levels of monthly family income ($P =0.018$) (Table1.1). Severity of untreated dental caries was assessed according to pufa index (presence of pulpal symptoms). There were significant differences of severity of untreated dental caries, among children by different levels of father’s occupation ($P<0.001$) and family income ($P=0.013$). (Table1.2)

Availability of oral health care services was assessed according to the distance to different oral health care facility. The availability of a SDC within the school of children was also considered as availability of school dental services. Among the children who had a SDC within their school only 40.7% children had untreated dental caries and 59.3% children had no untreated dental caries. However, there was no significant difference of prevalence of untreated dental caries among children by availability of SDC within their school (table 1.3). Among children who had a SDC within 10 KM of their residence, 39.2% had untreated dental caries and 60.8% children had no untreated dental caries. However, this difference was not statistically significant (Table 1.3). Among children who had a hospital dental clinic within 10 KM of their residence, 37.3% had untreated dental caries and 62.7% of children were free of untreated dental caries. However, there was no significant difference of untreated dental caries prevalence among children by availability of hospital dental services nearby (table 1.3). Among children who had a private dental clinic within 10 KM of their residence, 37.4% had untreated dental caries and 62.6% of children were free of untreated dental caries. However, there was no significant difference of untreated dental caries prevalence or the severity among children by availability of private oral health care services nearby (table 1.3).

Table 1: Differences in prevalence of untreated dental caries according to selected socio-demographic factors of children

Variable	Presence of untreated dental caries		Chi-square(df) P value	
	Yes Number (%)	No Number (%)		
Level of education of father				
Below G.C.E.A/L	110(35.8%)	197(64.2%)	4.896(1)	0.027
Passed G.C.E.A/L & above	43(48.9%)	45(51.1%)		
Total**	153(38.7%)	242(61.3%)		
Level of education of mother				
Below G.C.E.A/L	112(37.1%)	190(62.9%)	2.111(1)	0.146
PASSED G.C.E.A/L &above	44(45.4%)	53(54.6%)		
Total**	156(39.1%)	243(60.9%)		
Monthly income of the family				
<15000 Rs	68(33.2%)	137(66.8%)	5.719(1)	0.018
>15 000Rs	86(44.8%)	107(55.2%)		
Total**	154(38.7%)	244(61.3%)		
Occupation of the father				
Unemployed	7(41.2%)	10(58.8%)	2.417(3)	0.491

Skilled & un skilled labor	87(36.1%)	154(63.9%)		
Self-employment	45(45%)	55(55.0%)		
Managerial	16(40%)	24(60.0%)		
Total**	155(38.9%)	243(61.1%)		
Occupation of the mother				
Un employee	130(39.3%)	201(60.7%)	6.547(3)	0.088
Skilled & un skilled labor	6(20%)	24(80.0%)		
Self-employment	3(37.5%)	5(62.5%)		
Managerial	15(51.7%)	14(48.3%)		
Total**	154(38.7%)	244(61.3%)		

Table 2: Differences in severity of untreated dental caries according to selected socio-demographic factors of children

Variable	Presence of untreated dental caries with pulpal symptoms(pufa ≥1)		Chi square (df)	P value
	Yes Number (%)	No Number (%)		
Level of education of father				
Below G.C.E.(A/L)	106(35.1%)	196(64.9%)	2.743(1)	0.098
PASSED G.C.E.(A/L) &above	22(25.6%)	64(74.4%)		
Total**	128(33.0%)	260(70.0%)		
Level of education of mother				
Below G.C.E.(A/L)	97(32.7%)	200(67.3%)	0.034(1)	0.853
PASSED G.C.E.A/L and above	32(33.7%)	63(66.3%)		
Total**	129(31.2%)	263(68.8%)		
Monthly income of the family				
<15000 Rs	78(38.6%)	124(61.4%)	6.145(1)	0.013
>15 000Rs	51(26.8%)	139(73.2%)		
Total**	129(32.9%)	263(67.1%)		
Occupation of the father				
Unemployed	9(52.9%)	8(47.1%)	18.41(3)	<0.001
Skilled &un skilled labor	85(36.3 %)	149(63.7%)		
Self-employment	33(33.3%)	67(66.7%)		
Managerial	2(05.0%)	38(95.0%)		
Total**	129(33.2%)	262(66.8%)		
Occupation of the mother				
Unemployed	103(31.6%)	223(68.4%)	2.924(3)	0.404
Skilled &un skilled labor	13(43.3%)	17(56.7%)		
Self-employment	4(50.0%)	4(50.0%)		
Managerial	8(29.6%)	19(70.4%)		
Total**	128(32.8%)	263(67.2%)		

Table 3: Differences in untreated dental caries prevalence among children by availability of oral health care services

Variable	Presence of untreated dental caries		Chi- square(df)	P value
	Yes Number (%)	No Number (%)		
Availability of SDC in school				
Yes	55(40.7%)	80(59.3%)	0.308 (1)	0.579
No	100(37.9%)	164(62.1%)		
Total**	155(38.9%)	244(61.1%)		
Distance to SDC				
Within 10 KM	143(39.2%)	222(60.8%)	0.056 (1)	0.814
Away from 10 KM	13(37.1%)	22(62.9%)		
Total**	156(39.0%)	244(61.0%)		
Distance to HDC				
Within 10 KM	119(37.3%)	200(62.7%)	2.150 (1)	0.143
Away from 10 KM	37(46.2%)	43(53.8%)		
Total**	156(39.1%)	243(60.9%)		
Distance to PDC				
Within 10 KM	120(37.4%)	201(62.6%)	2.027(1)	0.155
Away from 10 KM	36(46.2%)	42(53.8%)		
Total **	156(39.1%)	243(60.9%)		

Discussion

According to Sri Lanka Demographic and Health survey of 2006-07, Monaragala district had the biggest contribution for the lowest quintiles and the smallest contribution to the highest quintiles of wealth index which is the socio-economic indicator used as a proxy measure of the long-term standard of living of house hold. Further, Proportion of male

and female household population completed secondary education was 20.4% and 20.2% respectively (Department of census and statistics (DCS) and Ministry of healthcare and nutrition (MOH), 2009). Therefore, this was an ideal setting to investigate the effects of socio-economic status on the untreated dental caries burden of children as the diseases is disproportionately concentrated among poor.

There was a significant differences of untreated dental caries prevalence among children by different levels of father's education ($p=0.027$) and by the level of average monthly income of the family ($p=0.018$) (Table 1). The severity of untreated dental caries of children demonstrated significant difference by fathers' occupation ($P<0.001$) and family income ($P=0.013$) (Table2).

Educational level of the mother is an important factor to avoid or to reduce risk factors of dental caries related to the diet and oral hygiene practices of children. However, at present, father is also a care giver for the children in Sri Lankan socio- cultural context as most of the other countries and it is worthwhile to investigate educational level of both father and the mother. It was found, a significant difference of the prevalence of untreated dental caries by different levels of father's education ($p=0.027$). It is in agreement with the study findings exist in literature demonstrating higher prevalence of untreated dental caries among children having parents with lower education compare to children who are having parents with higher education.

However, the prevalence of untreated dental caries was higher among children whose fathers received education G.C.E. (A/L) and above compared to children whose father's received education below G.C.E. (A/L). This could be due to father's level of education not being translated to the practices that are conducive to oral health of children in the family. Further, despite the level of education, the level of oral health literacy to translate knowledge into oral health promoting behaviors for children could be low among this rural parent. However, there was no significant difference of untreated dental caries among children by the different levels of mother's education. This may be due to the father being the dominant decision maker of the family especially in rural communities. A study has been conducted among Brazilian pre- school children in 2010, also demonstrated that there was a significant association of ECC and the father's educational status and mother's educational status (Santin *et al.*, 2016) ^[14]. Similarly, a study conducted in Chennai, India also demonstrated the significant association between the mean dmft of children and education level of parents (Gurunathan & Shanmugaavel, 2016) ^[8]. However, there is a scarcity of studies conducted to explore the association between untreated dental caries in children and the parental education. Occupation of the parents plays an important role in relation to the oral health status of the children. Receiving regular oral health care especially for young children is dependent on the ability of parents to spend enough time, during clinic functioning hours of public health services to receive oral health care facility. Financial accessibility should be available, if private oral health care facility is to be utilized. However, odontogenic infections in children are the result of failure to receive timely, adequate oral health care for dental caries. Since these factors are directly related to parent's occupation present study was focused on the relationship between the occupation of parents and the prevalence and the severity of untreated dental caries among children. Present study demonstrated a significant difference in the severity of untreated dental caries among children by the different types of occupation of father ($P<0.001$). Similar study conducted among Australian preschool children which was

demonstrated a significant association between parental occupation and the prevalence of dental caries and dmft score (Armfield, 2007). However, in present study the prevalence and the severity of untreated dental caries among children did not show a significant difference by mother's occupation (table 1, table 2). In present study the majority of mothers were unemployed which could have contributed to lack of significant differences. This finding was in accordance with the study conducted in 2007 among 2–5-year-old children in China which assessed the association between the parent's occupation and prevalence of ECC and dmft (Du *et al.*, 2007). According to literature socio- economic status of the family is a major contributory factor for the development of dental caries and many researches have used the monthly income of the family as a parameter of socio -economic status (John *et al.*, 2015). Present study also assessed the relationship between the monthly income of the family and the prevalence and the severity of untreated dental caries among children. Present study demonstrated significant differences of the prevalence of untreated dental caries ($p=0.018$) and the severity of untreated dental caries among children ($p=0.013$) according to levels of monthly family income (Table 1, Table 2). This was more or less consistent with the finding of the U.S. National Health and Nutrition Examination survey 2009- 2010 which showed a significant association between untreated dental caries and poverty level in 3 -5-year-old children (Dye *et al.*, 2012). Studies conducted by Du *et al.*, 2007 in China and Armfield, 2007 ^[1], in Australia also demonstrated the significant association between ECC and income of the family among pre - school children (Armfield, 2007; Du *et al.*, 2007) ^[1].

Treatment for the dental caries is more expensive compared to most of other morbidities in children and inequality of oral health outcome is largely influenced by the access to oral health care (Canadian Academy of Health Sciences, 2014) ^[3]. Thus, the availability of oral health care services may affect the prevalence of untreated dental caries especially in poverty-stricken areas. Therefore, present study investigated whether prevalence and severity of untreated dental caries differed by availability of oral health care services. Availability of oral health care services was considered in terms of the distance to different oral healthcare facilities. However, there was no significant difference of prevalence and the severity of untreated dental caries among children by availability of oral health care services though, this should be interpreted cautiously due to limitations of present study (table 3). Considering the real availability of oral health services this study may not have taken an appropriate measure to ensure service availability. Specially in rural areas human resources for healthcare is limited and though the clinic is available within reasonable distance there may be no dental surgeons or school dental therapist in all working days and working hours. Other important factor is physical resources to provide continuous care including dental materials needed to restore teeth. It is possible to unavailable facilities to provide treatments for dental caries of children. However, a cohort study conducted in Southern Brazil has revealed that availability of public dental care reduces the untreated dental caries in children as it increased the accessibility (Moraes *et al.*, 2021) ^[10]. In this rural Sri Lankan

group of children oral health care utilization might be affected by many factors which are not investigated in this study, demonstrating no association between untreated dental caries and availability of oral health care. However, it is worth to investigate further, the availability of oral health care services and its impact on untreated dental caries of children.

Conclusion

As emerged from the findings of this study, father's educational attainment and monthly household income significantly influenced untreated dental caries burden of this group of rural children. Availability of public oral health services including school dental services which offer services free of charge at the point of service delivery, probably did not make this health service factor- a significant determinant of untreated dental caries burden of children. As the majority of mothers were housewives who did not gainfully employed maternal socioeconomic factors may have not significantly influenced the untreated caries status of children. Further, it is worthy to investigate the psychosocial and economic impact of untreated dental caries in these primary school children in order to gain the attention of decision makers to take necessary actions to overcome the problems related to untreated severe forms of dental caries.

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