Causes and Severity of Neglected Dental Caries in Rural Sri Lankan Primary School Children

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ABSTRACT

Untreated dental caries is one of the most prevalent childhood morbidities worldwide, yet the clinical consequences of neglected dental caries are underreported in the literature. This study aimed to quantify and describe the clinical manifestations of untreated dental caries in children, arising from neglected oral health. Additionally, it sought to investigate the parental and health system factors associated with the neglect of dental caries in children. This cross-sectional survey was conducted among 5–7-year-old children residing in the Monaragala district of Sri Lanka. Children with dental caries (dmft > 0) were included in the analysis, with a total sample size of 284. Sociodemographic data of the children and their parents were collected using a self-administered questionnaire. Dental caries was assessed and recorded using the WHO Basic Methods, while the clinical consequences of untreated caries were evaluated using the pufa index. The mean dmft, mean pufa score, and mean pufa ratio for the study population were 4.52 ± 0.3, 1.05 ± 1.5, and 22.5% ± 2.8, respectively. Clinical consequences of untreated dental caries were observed in 47.5% of the children. Pufa scores were significantly associated with the father's age ($p = 0.01$), father's occupational category ($p < 0.001$), and the child's health-seeking behavior ($p < 0.001$). A substantial proportion of children in the study exhibited clinical signs and symptoms of neglected dental caries, despite the availability of free healthcare services in Sri Lanka. Strengthening awareness of children's oral health needs is strongly recommended. Furthermore, the development and implementation of preventive oral health programs targeting preschool-aged children, particularly those from socioeconomically disadvantaged populations, is imperative.

Keywords: neglected dental caries, untreated dental caries, clinical manifestations, pufa index

INTRODUCTION

Dental neglect is defined by the American Academy of Pediatric Dentistry (AAPD) as the failure of caregivers to provide the essential care required for proper oral function, including seeking timely dental treatment to prevent pain and infection (Lourenço et al., 2013; Bradbury-Jones et al., 2013; Kellogg et al., 2005; Harris, 2009). When left untreated, dental caries frequently leads to oral infections and pain, progressing to complications such as pulpal involvement, abscesses, sinus tract formation, and ulcerations. This problem of untreated dental caries has been documented across countries, irrespective of their economic status (Kumari & Perera, 2018; Mons et al., 2010).

Children suffering from dental neglect face a wide range of adverse outcomes, including dental pain, difficulty eating, infections, disrupted sleep, poor oral function, unattractive appearance, low body weight, diminished school performance, low self-esteem, and an overall poor quality of life (Bhatia et al., 2014;

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Lourenço et al., 2013). These consequences can have long-lasting physical, emotional, and social impacts on the child.

Although dental neglect can occur in any family, it is strongly associated with social determinants such as poverty, unemployment, homelessness, family isolation, illness, overcrowded or inadequate housing, and substance abuse. These factors contribute to gaps in addressing oral health needs, particularly in vulnerable populations (Bradbury-Jones et al., 2013; Jordan et al., 2012; Kellogg et al., 2015; Mezzich et al., 2007).

The present study aims to quantify and describe the clinical manifestations of neglected dental caries in children. It also seeks to identify parental and health system factors contributing to this condition, providing a basis for targeted interventions to improve the oral health and well-being of affected children.

MATERIALS AND METHODS

This cross-sectional observational study was conducted among Grade 1 primary school children in the Monaragala District, Sri Lanka, from August to December 2016. A cluster sampling method, with probability proportional to size, was utilized to select the study sample. A total of 284 children with dental caries were included in the analysis. Prior to the study, examiner training and calibration were carried out under the supervision of consultants in restorative dentistry and community dentistry to ensure accuracy and consistency in data collection.

A pretest was conducted with 25 primary school children from a rural school in the Galle District to assess the feasibility of the study. The children included in the pretest were not part of the main study sample. Children with more than one dental caries lesion and whose parents or caregivers provided voluntary consent were included in the study. Children with special needs or those who declined to participate were excluded. The study adhered to the principles outlined in the Declaration of Helsinki, and ethical approval was obtained from the Ethics Review Committee of the Faculty of Medicine, University of Colombo.

Demographic and sociodemographic data of participants were collected using a structured questionnaire. Clinical examinations were conducted in classrooms using a semi-supine position with the aid of artificial lighting and a school dental chair. Dental caries was assessed and documented following the WHO criteria using a Community Periodontal Index (CPI) probe and dental mirror. Tooth surfaces were dried using cotton rolls and tongue blades prior to diagnosis.

The clinical consequences of untreated dental caries were evaluated using the pufa index, which served as a measure of oral health neglect. Although some children exhibited caries in permanent dentition, these were minimal and excluded from the calculations. Children with caries in permanent teeth were referred for appropriate treatment.

Pufa Index:

The pufa index (Praveen et al., 2014) was used to assess the clinical consequences of untreated carries, including pulp involvement, ulceration of oral mucosa due to root fragments, fistula, or abscess formation. The index is recorded separately from the dmft/DMFT scores. Lesions not associated with visible pulpal involvement due to caries were excluded. Assessments were performed visually without the use of instruments, and only one score was assigned per tooth. In cases of uncertainty regarding the extent of odontogenic infection, the basic score (P/p for pulp involvement) was assigned. Both primary and permanent teeth were scored if odontogenic infection was present in both.

The scoring criteria for the pufa index are as follows:

- **P/p**: Visible pulp chamber opening or destruction of coronal tooth structure, leaving roots or root fragments, without probing.

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- **U/u**: Ulceration caused by trauma from sharp tooth fragments.
- **F/f**: Presence of a pus-releasing sinus tract related to a tooth with pulpal involvement.
- **A/a**: Presence of a pus-containing swelling or abscess related to a tooth with pulpal involvement.

The pufa score for an individual was calculated cumulatively, similar to the dmft/DMFT scoring system. The total pufa score ranges from 0 to 20 for primary teeth and 0 to 32 for permanent teeth. The prevalence of pufa/PUFA was expressed as the percentage of individuals with a score of 1 or more, with the population prevalence computed as a mean value.

Data Analysis

Data were analyzed using SPSS software (version 26). The frequency distribution of clinical consequences of untreated dental caries was determined. Children were categorized into two groups: those with no clinical manifestations of untreated caries (pufa score = 0) and those with clinical manifestations (pufa score > 0). The chi-square test was applied to compare groups based on parental factors and health service-related variables.

RESULTS

Socio-demographic Characteristics of Parents

The majority of the Grade 1 schoolchildren in the study were 6 years old (80.29%) and male (53.87%). Among mothers, 67.1% were aged 30 years or below, while the remaining 32.9% were aged between 31 and 50 years. Most mothers (87.6%) had completed education at or above the General Certificate of Education (Ordinary Level) [G.C.E. (O/L)], whereas 80.1% of fathers had an education level below the G.C.E. (O/L).

A significant proportion of mothers (78.2%) were unemployed, and among employed mothers, only 9.8% had permanent jobs. Fathers were predominantly employed (90.5%), with 61.5% being self-employed, likely engaged in farming on their lands. This contributed to 64% of families not having a permanent source of income.

Most children (68.3%) did not have access to a school dental clinic, and for the majority (71%), a government hospital dental clinic was the nearest oral healthcare facility. Nearly one-third of the children (31.3%) had never received oral healthcare services. Table 1 summarizes the socio-demographic characteristics of the study sample.

Table 1: Socio-demographic characteristics of the study sample

Variable	Number	Percentage
Age of children (N=284)		
5 years	37	13.03
6 years	228	80.29
7 years	19	6.68
Gender (N=284)		
Male	153	53.87
Female	131	46.13
Age of the mother (N=283)		
30 or below 30	190	67.1
31-50	93	32.9
Mother's educational state (N=283)		
Up to G.C.E. (O/L)	35	12.4
G.C.E. (O/L) and above.	248	87.6

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Variable	Number	Percentage
Age of the father (N=282)		
30 or below	128	45.4
31-50	154	54.6
Father's educational state (N=281)		
Up to G.C.E. (O/L)	225	80.1
G.C.E. (O/L) and above.	56	30.9
Mothers occupational state (N=284)		
Yes	222	78.2
No	62	21.8
Occupational category of Mother (N=284)		
Permanent	28	9.8
Self-employing	22	7.7
Temporary/no/other	234	82.3
Father's occupational state (N=284)		
Yes	257	90.5
No	27	9.5
Occupational category pf father (N=283)		
Permanent	82	28.9
Self-employing	174	61.5
Temporary/no/other	27	9.6
Income status of the family (283)		
Permanent	102	36.0
Not Permanent	181	64.0
Availability of School Dental clinic in child's school (N=284)		
Yes	90	31.7
No	194	68.3
Nearest oral health care facility (N=283)		
Government hospital dental clinic	201	71.0
School dental clinic	73	25.8
Private dental clinic	8	2.8
Other	1	0.4
Oral health seeking behaviour (N=284)		
Ever received	195	68.7
Never received	89	31.3

Distribution of Neglected Dental Caries

The mean number of untreated teeth in the study population was 1.14, with a mean decayed, missing, and filled teeth (dmft) score of 4.52. The mean pufa score was 1.05, and on average, 22.5% of teeth with dental caries showed clinical consequences of neglected caries. Table 2 summarizes the clinical measures related to untreated dental caries and its consequences.

The most frequently observed clinical manifestation of neglected dental caries was pulpal involvement (p), affecting 20.1% of children. Additionally, 12 children exhibited abscesses related to untreated teeth, including one child with two abscesses, underscoring the severity of dental neglect in this population.

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Table 2: Clinical measures related to untreated dental caries and its consequences

Variable	Mean	SD
Untreated teeth	1.14	0.3
dmft score	4.52	3.0
pufa score	1.05	1.5
Pufa ratio (%)	22.5	2.8

Table 3: Distribution of clinical manifestations (pufa components) among the study sample

Number of teeth	p (pulpal)	u (ulceration)	f (fistula)	a (abscess)
0	180 (63.4%)	248 (87.3%)	256 (90.1%)	270 (95.1%)
1	57 (20.1%)	27 (9.5%)	22 (7.7%)	12 (4.2%)
2	29 (10.2%)	8 (2.8%)	2 (0.7%)	2 (0.7%)
3	8 (2.8%)	1 (0.4%)	1 (0.4%)	0
4	5 (1.8%)	0	1 (0.4%)	0
5	4 (1.4%)	0	0	0
6	1 (0.4%)	0	0	0

Factors Associated with Clinical Manifestations of Neglected Dental Caries

The association between various socio-demographic characteristics, oral healthcare service-related factors, and the presence of clinical consequences of untreated caries (pufa score > 0) was evaluated.

Significant associations were observed with the father's occupational category ($p < 0.001$), father's age ($p = 0.01$), and children's health-seeking behavior ($p < 0.001$). Specifically, children whose fathers were self-employed or engaged in temporary work and those who had never received oral healthcare were more likely to exhibit clinical manifestations of neglected dental caries. No significant differences were found concerning children's age, gender, mother's age, educational levels of parents, family income, or the availability of a school dental clinic Table 4 summarizes these findings.

Table 4: Factors associated with clinical manifestations of neglected caries in children

Variable	pufa score 0		pufa score>0		Chi-square	Significance
	No	%	No	%		P value
Age in year (N= 284)						
5	16	43.2	21	56.8		
6	121	53.1	107	46.9	2.200	0.339
7	12	63.2	7	36.8		
Gender (N=284)						
Male	84	54.9	69	45.1	0.790	0.374
Female	65	49.6	66	50.4		
Mothers age (N=283)						
Below 30	97	49.2	93	50.8	0.359	0.613
30-50	51	54.8	42	45.2		
Fathers age (N=282)						
Below 30	57	44.5	71	55.5	5.940	**0.010**
30-50	91	59.0	63	41.0		

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Variable	pufa score 0		pufa score>0		Chi-square	Significance
	No	%	No	%		P value
Income (N= 283)						
Below 25 000	52	51.0	50	49.0	0.111	0.797
25 000 & above	96	53.0	85	47.0		
Father's educational state (N=281)						
Below G.C.E.(O/L)	115	51.1	110	49.9	0.654	0.419
G.C.E. (O/L) or above	32	57.1	24	42.9		
Mother's education (N=283)						
Below G.C.E.(O/L)	131	52.8	117	42.2	0.222	0.637
Above G.C.E. (O/L) or above	17	48.6	18	51.4		
Mothers occupational state (N=284)						
Yes	30	48.4	32	51.6	0.529	0.467
No	119		103			
Father's occupational state (N=284)						
Yes	137	53.3	120	46.7	0.770	0.422
No	12	44.4	15	54.6		
Father's occupation category (N=283)						
Permanent	83		91			
Self-employing	25		2		21.460	**0.000**
Temporary /no/other	40		42			
Mother's occupational category (N=284)						
permanent	11	39.3	17	60.7	2.311	0.336
Self -employing	11	50.0	11	50		
Temporary/no/other	127	54.3	107	45.7		
Closest health care institute (N=283)						
Government hospital	113	56.2	88	43.8		
Private dental clinic	30	41.1	43	58.9	6.147	0.081
SDC	5	62.5	3	37.5		
other	1	100.0.	0	0		
Health seeking behaviour (N=284)						
Ever received care	87	44.6	108	55.4	15.370	**0.000**
Never received care	62	69.7	27	29.3		
Availability of school dental clinic (N=284						
Yes	50	55.5	40	44.5	0.505	0.477
No	99	51.0	95	49		

DISCUSSION

This study highlights a high prevalence of symptoms associated with oral health negligence among children living in a remote rural setting in Sri Lanka, as reflected in the clinical manifestations of neglected dental caries. Despite the significant burden of untreated dental caries, certain factors, such as the availability of oral healthcare services, mothers' age, education, and occupation, did not show a significant association with the presence of clinical manifestations of dental negligence.

The findings align with the literature suggesting that failure or delay in seeking dental treatment is a key characteristic of oral health negligence (Bhatia et al., 2014). This study also found a significant difference in

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the clinical presentations of neglected dental caries based on children's health-seeking behaviors, reinforcing the role of timely oral healthcare access in mitigating the severity of dental neglect.

Interestingly, the availability of school dental clinics was not significantly associated with the presence of neglected caries. This could be attributed to the advanced stage of dental caries in these children, which may exceed the treatment capabilities of school dental therapists who typically do not provide pulp treatments. Nevertheless, school dental clinics likely play a critical role in identifying and appropriately referring children for specialized care.

Parental Factors and Their Influence

Fathers' education and occupation were found to significantly affect the occurrence of neglected caries in children. In rural settings such as this, fathers often serve as the primary breadwinners and decision-makers in the family, while mothers, most of whom are unemployed, have a less dominant role. Literature reports that dental negligence in children is more prevalent in families residing in suburban or rural areas and among less-educated parents (Gurunathan & Shanmugaavel, 2016; Kumari et al., 2022).

Contrary to some studies, this investigation did not find a significant association between parental education and dental negligence. This may be due to the homogeneity of the population, as most parents in the study had low educational levels. Furthermore, living in a rural, resource-limited setting could contribute to the observed 47.5% prevalence of clinical manifestations of oral health negligence in this study population.

The significant association observed between fathers' occupational category and age with the presence of neglected caries supports previous findings linking parental factors to dental health outcomes in children (Anwar et al., 2022). These findings emphasize the importance of addressing socioeconomic determinants in mitigating oral health disparities.

Recommendations and Interventions

The findings of this study underscore the need for targeted interventions to reduce the prevalence and severity of neglected dental caries in children. The following measures are recommended:

Parental Education and Awareness:

Educating parents about daily oral health practices, proper feeding habits, and the importance of early and regular dental visits is crucial. Studies, such as those by Ramazani (2016), emphasize that enhancing parental knowledge and awareness can play a pivotal role in preventing dental neglect.

School-Based Programs:

Schools can serve as an effective platform for early detection of dental issues and education. Programs led by dental professionals, coupled with referrals to appropriate care facilities, can help bridge the gap in oral healthcare access.

Revisiting Dental Education Curricula:

Dental curricula should incorporate comprehensive training on recognizing and managing child dental neglect. Shifting from traditional lecture-based methods to interactive, case-based learning could enhance dental graduates' competencies in identifying and addressing dental neglect.

Interprofessional Collaboration:

Collaboration between dental teams and physicians can optimize the prevention, identification, and management of child dental neglect. Physicians, as primary healthcare providers for pediatric populations,

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should be trained to recognize signs of dental neglect and collaborate with dental professionals for timely intervention.

Public Health Integration:

Public health initiatives should prioritize community awareness campaigns and implement clear guidelines for identifying and managing dental neglect. Nurses and social workers should be equipped with tools and training to support follow-up care and engage with affected families.

Addressing Structural Barriers:

Structural barriers, such as lack of access to specialized dental care and permanent sources of income, should be addressed through government policies and resource allocation. Efforts to establish community-based dental clinics and provide affordable or free dental care for underserved populations are essential.

CONCLUSION

Neglected dental caries in children is a multifaceted issue influenced by parental, behavioral, and systemic factors. Addressing these disparities requires a holistic approach involving parents, schools, healthcare providers, and policymakers. By implementing evidence-based strategies and fostering interprofessional collaboration, the burden of dental neglect can be reduced, leading to improved oral health outcomes for vulnerable populations.

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