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Self-reported oral health-related quality of life and caries experiences of 5-year-old children in Mandalay, Myanmar

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Abstract

Background This study aimed to examine the impact of dental caries and other potential socio-demographic factors on the oral health-related quality of life (OHRQoL) of preschool children from Myanmar. This was done using the Scale of Oral Health Outcomes for 5-year-old children (SOHO-5) as reported by both the children and their parents.

Methods A structured questionnaire was conducted to collect demographic information about the children and their caregivers, as well as socioeconomic data. The OHRQoL was assessed by interviewing the children and their parents using the Myanmar versions of SOHO-5c and SOHO-5p, respectively. Caries experience was assessed by two calibrated examiners and recorded using the dmft index. The Poisson regression model was adopted to investigate the association between OHRQoL and dental caries including socioeconomic factors.

Results A total of 454 pairs participated in the study. Among them, 64% of children and 70% of parents reported a negative impact on OHRQoL (with SOHO-5c and SOHO-5p scores exceeding 0). The mean score (SD) of the child self-report and parental version of the SOHO-5 was 1.86 (2.27) and 2.65 (3.13), respectively. Difficulties in eating and sleeping were the most commonly reported by both children and parents. The overall prevalence of dental caries was 87% (mean dmft score:5.59, SD:4.65). The final multivariate-adjusted model revealed that children with higher caries experiences were more likely to have lower OHRQoL for both child self-report (RR 4.38, 95% CI 3.16–6.14, $p < 0.001$) and parental report (RR 6.07, 95% CI 4.38–8.41, $p < 0.001$), respectively. A lower family income had a negative impact on the children's OHRQoL in child self-report (RR 1.59, 95% CI 1.26–2.04, $p < 0.001$) and parental report (RR 1.46, 95% CI 1.19–1.78, $p < 0.001$).

Conclusion Two-thirds of the study children and their parents perceived the negative impact on children's OHRQoL. Higher caries experience and lower family income were associated with poorer OHRQoL of 5-year-old Myanmar children.

Keywords Children, Dental caries, Myanmar, Oral health-related quality of life, SOHO-5

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Background

Dental caries is one of the most frequent chronic oral diseases in children globally [1]; if left untreated, it can result in pain, abscess, and both local and systemic infections [2]. Untreated caries may give rise to consequences that detrimentally affect the quality of life in children [3] such as impairment of chewing and speaking abilities, diminished school performance, psychological disturbances, e.g., disturb in sleeping, and factors related to social relations, such as avoid smiling and speaking [4, 5]. Furthermore, a negative impact on the family, e.g., parents' guilt, work absenteeism, and financial difficulties was reported among the children with untreated caries experiences [6].

Despite having decreased globally, dental caries remains prevalent in certain developing countries [7, 8]. The Republic of the Union of Myanmar, a country whose economic development is ongoing, was estimated to contain 51.4 million people in 2014 according to Myanmar Population Census records. Of this population, 30% live in urban areas, while the remaining 70% reside in rural areas [9]. In spite of the introduction of a National Health Plan (2017–2021) aimed at achieving Universal Health Coverage (UHC), oral health has been given limited emphasis in the majority of healthcare strategies [10, 11]. Due to the limited ratio of dentists to the population in Myanmar, carrying out oral health education programs and the provision of oral health services throughout the country is a challenge [12]. Moreover, although evidence-based programs prevention and management of dental caries have been implemented in certain locations [13], caries prevalence in school children remains high, which can be attributed to the lack of knowledge of oral health, the limited supply of restorative material and personnel [10, 14].

According to the National Oral Health survey (2017), the mean dmft of 6-year-old-school children was 5.7 whereas the prevalence of untreated caries was 84.1%. However, there is no information about the effect of dental caries on the oral health-related quality of life (OHRQoL) among young Myanmar children. Even though parental proxy measures are typically used to assess the OHRQoL of young children [15, 16], there's a counterargument stating that a child's actual oral health status can be effectively represented solely through parent proxy reports [17]. In recent times, the Scale of Oral Health Outcomes for 5-year-old children (SOHO-5) was developed to assess the impact of dental caries on OHRQoL of young children using both the children and parental reports [18]. The findings of recent research established the Myanmar SOHO-5 version to have a high degree of reliability and validity in a 5-year-old Myanmar population [19]. Oral health information about Myanmar preschool children is scarce [20] and updated information about the impact of dental caries on the OHRQoL of preschool children would be beneficial for the development of effective oral health preventive programmes to improve the oral health status of the children population [21].

The aim of the study was to assess the impact of dental caries and other potential factors on oral health related quality of life among 5-year-old children in Mandalay, in addition to analyzing the agreement level between parent-child pairs.

Methods

This cross-sectional study was conducted from December 2021 to February 2022 in Mandalay, Myanmar. Ethical approval was received from the Human Research Ethics Committee (HREC-DCU 2021-047) at Chulalongkorn University.

Population and sample size calculation

The study population comprised 5-year-old children and their parents living in Mandalay City. Mandalay City is the middle part of Myanmar and the second-largest city which consists of seven subdistricts. According to the Myanmar Information Management Unit (MIMU) 2019, the total number of 5-year-old school children was 21,160 in seven districts. The calculation of the sample size was performed by Poisson regression using the G*Power software to achieve a statistical power of 95% (to minimize Type II error), employing a two-sided test with a significance threshold of 0.05. The smallest detectable rate ratio (RR) for the OHRQoL was set at 1.4 when comparing children without caries (unexposed) to those with caries experience (exposed) [22]. Thus, a total of 362 participants were determined to be necessary. Considering an estimated participation rate of 80%, it was determined that at least 452 participants would need to be invited to participate in the study. This study employed a quota sampling technique, which involved selecting participants in proportion to the child population in each district (MIMU, 2019) [23]. Five-year-old children from 14 schools across 7 districts were recruited for the study. Informed consent was acquired from the parent or legal guardian of the participants prior to the implementation. The inclusion criteria were children who were 5 years old, in good health, proficient in speaking Burmese, and whose parents possessed an understanding of the Burmese language. Children with disabilities, developmental delays, uncooperative behavior, or those who refused to undergo the oral examination were excluded from the study.

Questionnaire survey

Regarding the child's OHRQoL, the parent and child were independently interviewed face-to-face using the Myanmar SOHO-5 questionnaire. The SOHO-5 questionnaire

is composed of a child self-report and a parental report for the history of the child's oral health [18]. Both reports were comprised of seven items, six of which were similar in terms of content. Scores on a three-point scale ranging from 0 to 14 were attributed to the responses given by the child report while a five-point scale of 0 to 28 was assigned to the parental report (Appendix). For both SOHO-5c and SOHO-5p, a higher score refers to a greater negative impact on the OHRQoL of children.

Furthermore, the parent's educational background and family income were also interviewed. The family income was determined by utilizing the Myanmar minimum wage of 4800 Kyat per day or 150,000 Kyat monthly in 2021 as a baseline. The participants underwent interviews conducted by three trained interviewers on the same day before the clinical examinations were performed.

Children's oral examination

An oral examination was performed while the child was in a seated position on a chair under natural light. The caries status of the children was assessed by two calibrated examiners according to World Health Organization criteria (WHO) [24] using a penlight, disposable dental mirror, and WHO-CPI probe. Training and calibration exercises were conducted on volunteers (35 children) before the study. Caries experience in primary teeth was recorded in a modified oral health assessment form using dmft index. For the recording of the teeth, the following criteria were used: decayed (dt): an unmistakable dentine carious cavity or filled lesion with recurrent caries, missing (mt): extracted due to caries, filled (ft): a permanent filling without caries. The participants' dmft score was divided into three groups, based on the scoring procedure of a previous study [25]: (1) dmft 0 (no caries experiences), (2) dmft 1–5 and (3) dmft ≥ 6.

Table 1 Characteristics of children and parents

Characteristics	Frequency	Percentage
Sex		
Female	234	51.5
Male	220	48.5
Parent interviewed		
Mother	398	87.7
Father	56	12.3
Mother's education		
Junior secondary school	120	26.4
Secondary school	168	37.0
University or Post-secondary school	166	36.6
Father's education		
Junior secondary school	113	24.9
Secondary school	159	35.0
University or Post-secondary school	182	40.1
Monthly household income in Kyat ($)		
> 300,000 ($162.01)	156	34.4
150,000–300,000 ($ 81.01–162.01)	260	57.3
< 150,000 ($ 81.01)	38	8.4
Caries experience (dmft)		
Caries free (dmft = 0)	59	13.0
Moderate caries experience (dmft 1–5)	186	41.0
High caries experience (dmft ≥ 6)	209	46.0

Data analysis

Data were analyzed by using the SPSS version 22.00 software (IBM Corp). The statistical analyses encompassed calculations of means, frequencies, and percentages. These analyses were conducted to assess the caries experiences, OHRQoL among children, and the socio-demographic status of the parents. Cohen's kappa coefficient was used to evaluate the intra- and inter-examiner reliability for caries diagnosis.

Poisson regression analysis with robust variance was constructed to correlate the total SOHO-5 scores to caries experiences and sociodemographic factors such as the child's gender, parent's education and family income. In these analyses, the outcome was treated as a count variable, consistent with the approach adopted in prior studies [22, 25], and we computed rate ratios (RR) along with corresponding 95% confidence intervals (95% CI). All variables were incorporated into the final multivariate model; nevertheless, variables that exhibited non-significance ($p > 0.05$) were subsequently excluded from the final model. The parent-child agreement for six common items was evaluated by analyzing the intra-class correlation coefficient (ICC) between the total and item scores of the child's and parents' reports [26]. The agreement level determined by the ICC was categorized as poor (< 0.20), weak (0.20–0.40), moderate (0.41–0.60), substantial (0.61–0.80), and excellent (0.81-1.0) [25, 27].

Results

A total of 509 child-parent pairs were invited to participate in the study, out of which 489 had received written consent prior to the implementation of the study, rendering a response rate of 96%. Twenty-nine children were absent, and six children refused the oral examination on the day of the examination, resulting in 454 children being enrolled in the study. There was a strong consensus in the assessment of caries, indicated by a kappa value (k) of 0.87, which reflects high inter-examiner reliability. Furthermore, when around 10% of the participants underwent a second evaluation two weeks later, the intra-examiner reliability was found to be outstanding, with a kappa value of 0.90.

Table 1 revealed the caries status and sociodemographic characteristics of the participants. In total, 87% of the subjects had caries experiences (dmft > 0), with a mean dmft index of 5.59 (with a standard deviation of 4.65). The majority of respondents for the parent version were mothers (87.7%). Table 2 showed the distribution of responses to each item in SOHO-5 reports of both

Table 2 Distribution of SOHO-5 responses to Children's and parent's reports

Child self-report						
Item	**No n (%)**	**A little n (%)**	**A lot n (%)**	**Mean (SD)**		
Difficulty in eating	180 (39.6)	176 (38.8)	98 (21.6)	0.82 (0.76)		
Difficulty in drinking	404 (89.0)	49 (10.8)	1 (0.2)	0.11 (0.32)		
Difficulty in speaking	404 (89.0)	44 (9.7)	6 (1.3)	0.12 (0.36)		
Difficulty in playing	417 (91.9)	34 (7.5)	3 (0.7)	0.09 (0.30)		
Difficulty in sleeping	289 (63.7)	131 (28.9)	34 (7.5)	0.44 (0.63)		
Avoid smiling due to pain	383 (84.4)	64 (14.1)	7 (1.5)	0.17 (0.41)		
Avoid smiling due to appearance	407 (89.6)	46 (10.1)	1 (0.2)	0.11 (0.31)		
Total score				1.86 (2.27)		
Parent's report						
Item	Not at all (%)	A little (%)	Moderate (%)	A lot (%)	A great deal (%)	Mean (SD)
Difficulty in eating	185 (40.7)	138 (30.4)	78 (17.2)	45 (9.9)	8 (1.8)	1.02 (1.06)
Difficulty in speaking	384 (84.6)	54 (11.9)	14 (3.1)	2 (0.4)	0	0.19 (0.49)
Difficulty in playing	405 (89.2)	39 (8.6)	7 (1.5)	2 (0.4)	1 (0.2)	0.14 (0.45)
Difficulty in sleeping	271 (59.7)	120 (26.4)	48 (10.6)	14 (3.1)	1 (0.2)	0.58 (0.81)
Avoid smiling due to pain	371 (81.7)	64 (14.1)	14 (3.1)	5 (1.1)	0	0.24 (0.55)
Avoid smiling due to appearance	408 (89.9)	38 (8.4)	6 (1.3)	2 (0.4)	0	0.12 (0.40)
Influence self-confidence	342 (75.3)	81 (17.8)	18 (4.0)	9 (2.0)	4 (0.9)	0.35 (0.73)
Total score						2.65 (3.12)

Table 3 Association between caries experience and sociodemographic factors with SOHO-5 score for child self-report

Covariates	**Unadjusted model**		**Adjusted model**	
	Robust RR (95% CI)	***p*-value**	**Robust RR (95% CI)**	***p*-value**
Caries experiences				
Caries free*	2.28 (1.61–3.23)	< 0.005	2.24 (1.58–3.18)	< 0.005
Moderate caries experiences (1–5)	4.59 (3.28–6.43)	< 0.001	4.38 (3.13–6.14)	< 0.001
High caries experiences (≥ 6)				
Child gender				
Female*	0.94 (0.75–1.18)	0.593	CNS	
Male				
Mother's education				
Junior secondary school*	1.05 (0.79–1.40)	0.721	CNS	
Secondary school	1.01 (0.75–1.34)	0.981		
University or Post-secondary school				
Father's education				
Junior secondary school*	0.89 (0.67–1.19)	0.450	CNS	
Secondary school	0.92 (0.70–1.22)	0.580		
University or Post-secondary school				
Monthly household income (MMK)				
> 300,000*	1.49 (1.28–1.75)	< 0.001	1.39 (1.19–1.62)	< 0.001
150,000–300,000	1.87 (1.48–2.35)	< 0.001	1.58 (1.26–1.99)	< 0.001
< 150,000				

*Reference; Robust RR: Robust rate ratio; CNS: covariate not selected for final model (p > 0.05)

children and parents. Overall, 64.1% of children experienced an impact on oral health (SOHO-5 > 0), and this finding was corroborated by parental reports of 70.5%. The highest reported score on the child self-report version was 11 out of 14, while the highest score on the parental version was 20 out of 28. The mean total score of the SOHO-5 was 1.86 ± 2.27 for the child self-report and 2.65 ± 3.13 for the parental report. Of the items analyzed within the SOHO-5, both reports demonstrated that eating difficulties represented the highest impact item on OHRQoL, followed by difficulty in sleeping.

Unadjusted and adjusted associations between caries experience, sociodemographic variables, and mean total SOHO-5 scores were shown in Tables 3 and 4. Both reports revealed that an increased SOHO-5 score ($p < 0.05$) was associated with higher caries experiences and lower family incomes. In comparison to children without caries experiences, those with moderate caries

Table 4 Association between caries experience and sociodemographic factors with SOHO-5 score for Parent report

Covariates	Unadjusted model		Adjusted model	
	Robust RR (95% CI)	*p*-value	Robust RR (95% CI)	*p*-value
Caries experiences				
Caries free*	3.16 (2.27–4.41)	< 0.001	3.13 (2.24–4.36)	< 0.001
Moderate caries experiences (1–5)	6.30 (4.55–8.72)	< 0.001	6.07 (4.38–8.41)	< 0.001
High caries experiences (≥ 6)				
Child gender				
Female*			CNS	
Male	0.92 (0.74–1.15)	0.480		
Mother's education				
Junior secondary school*				
Secondary school	1.07 (0.81–1.42)	0.623	CNS	
University or Post-secondary school	1.05 (0.80–1.40)	0.688		
Father's education				
Junior secondary school*				
Secondary school	0.96 (0.72–1.28)	0.781	CNS	
University or Post-secondary school	1.01 (0.77–1.33)	0.935		
Monthly household income (MMK)				
> 300,000*				
150,000–300,000	1.30 (1.15–1.48)	< 0.001	1.21 (1.06–1.36)	< 0.005
< 150,000	1.77 (1.47–2.13)	< 0.001	1.49 (1.24–1.80)	< 0.001

*Reference; Robust RR: Robust rate ratio; CNS: covariate not selected for final model (p > 0.05)

Table 5 Correlations between parent-child pairs for SOHO-5 total and items score

Item	Parent-child ICC (95% CI)	*p*-value
Total score	0.78 (0.75–0.82)	< 0.001
Difficulty in eating	0.70 (0.65-0.74)	< 0.001
Difficulty in speaking	0.52 (0.45–0.58)	< 0.001
Difficulty in playing	0.49 (0.42–0.56)	< 0.001
Difficulty in sleeping	0.66 (0.61–0.71)	< 0.001
Avoid smiling due to pain	0.62 (0.56–0.68)	< 0.001
Avoid smiling due to appearance	0.28 (0.20–0.37)	< 0.001

ICC: Intraclass correlation coefficient

experiences exhibited a SOHO-5 score 2.24 times higher (RR 2.24, 95% CI 1.58–3.18, p-value < 0.005), while those with high caries experiences had a score 4.38 times higher (RR 4.38, 95% CI 3.13–6.14, p-value < 0.001). Similarly, in terms of the parental report, the corresponding values were RR 3.13 (95% CI 2.24–4.36, p-value < 0.001) for moderate caries experiences and RR 6.07 (95% CI 4.38–8.41, p-value < 0.001) for high caries experiences. A decrease in family income exhibited a negative impact on the children's OHRQoL in both child self-report (RR 1.58, 95% CI 1.26–1.99, p < 0.001) and parental report (RR 1.49, 95% CI 1.24–1.80, p < 0.001). The parent-child pairs indicated an ICC of 0.78 (95% CI: 0.75–0.82) on the total score and had item ICC from 0.28 to 0.70 (Table 5).

Discussion

This is the first study reporting the association between early childhood caries and OHRQoL reported by children and their parents in Myanmar where the prevalence of untreated ECC is very high. The findings of this study highlighted a significant association between dental caries and OHRQoL among five-year-old children, as perceived by both the children themselves and their parents. Caries prevalence and dmft value in children were very high among the participants. The items 'difficulty eating' and 'difficulty in sleeping due to pain' had the highest mean scores reported by both children and parents, which is in agreement with the previous studies [25, 28, 29]. Overall, caries was found to be the primary oral clinical condition responsible for impacting all aspects assessed in the study. Children with higher caries experience have more chances of having a negative impact on their OHRQoL in this study. This result is similar to the previous studies in Hong Kong [30], Trinidad [3] and Brazil [31].

Studies conducted previously have demonstrated that parents' education level and socio-economic status are risk factors that impact a child's oral health and OHRQoL [21, 32]. The Poisson analysis of caries experiences and socio-demographic factors in our model revealed that a family income exceeding 300,000 Kyat had a positive impact on the OHRQoL of young children; this result is similar to that which was previously reported [25]. Children with low family income may be more likely to have poorer OHRQoL due to a lack of access to regular dental care, limited resources for preventive care, and a lack of prioritization for children's oral health needs. It is necessary to target these groups of children by improving access to dental care to relieve pain and infection as well as improving the parent's oral health knowledge and

encouraging positive oral health behaviors with parental involvement.

Initiating preventive measures and fundamental treatments in early childhood is crucial, as this period offers the most cost-efficient opportunity for intervention [33]. This approach should include considering sources of dietary fluoride, such as fluoridated water or milk. Moreover, it's important to implement school health programs that establish consistent toothbrushing practices and encourage healthy dietary choices. These strategies are vital in managing Early Childhood Caries (ECC) in young children [34]. Additionally, the use of silver diamine fluoride has recently emerged as a notable, non-invasive, and economical option for treating caries [35]. This treatment is particularly beneficial in reaching children in remote or underserved regions, thereby enhancing dental care accessibility. This is especially relevant for children and families living in poverty in Myanmar, where there is a high prevalence of ECC and a general lack of quality dental care. Further work is required to investigate the impact of alternative caries management on the improvement of OHRQoL in children in Myanmar.

Approximately two-thirds of the children and the parents demonstrated an adverse effect on OHRQoL (SOHO-5 score>0) of the children for at least one item. This finding also showed that children's self-reports can be reliable for their oral health information and the perceptions of parents compared with the children's perception allow a more comprehensive evaluation of the child's OHRQoL [29]. Despite the high caries prevalence in this study, the mean total SOHO-5 scores of both reports demonstrated low overall scores on OHRQoL of the children. This finding suggests that the primary concerns in Myanmar were disturbances in eating and sleeping functions. Differences in cultural beliefs and societal values related to child oral health may play a role in this aspect.

It is important to acknowledge the limitations of this study. The present study is a cross-sectional design and therefore, there was no evidence for causality between dental caries and OHRQoL of children and we cautiously generalize from the study sample to other populations. Therefore, the results could not be generalized to all Myanmar children. However, the acceptable participation rate, sufficient sample size, use of a validated instrument, and good inter and intra-examiner reliability assure the findings of this study. Nevertheless, the present findings could provide crucial information on the association of dental caries status and OHRQoL of Myanmar 5-year-old children for the public health policymakers regarding the future development of oral health promotion programs for preschool children. Future longitudinal studies are recommended to investigate the causal effect of dental caries on OHRQoL of the children and their parents using a presentative sample.

Conclusion

Two-thirds of both the children and their parents perceived a negative impact on the children's OHRQoL. Children with higher caries experience and lower family income are likely to have poorer OHRQoL. It is recommended to promote collaboration among healthcare professionals, dental associations, community organizations, and government bodies to develop a comprehensive approach aimed at enhancing the quality of life of young children.

Abbreviations

UHC	Universal Health Coverage
OHRQoL	Oral health-related quality of life
SOHO-5	Scale of Oral Health Outcomes for 5-year-old children
MIMU	Myanmar Information Management Unit
RR	Rate ratio
SOHO-5c	Scale of Oral Health Outcomes for 5-year-old children for child self-report
SOHO-5p	Scale of Oral Health Outcomes for 5-year-old children for parent self-report
WHO	The World Health Organization
CPI	Community periodontal index
dmft	Decayed, Missing, and Filled Teeth Index for primary teeth
dt	Decayed Teeth
mt	Missing Teeth
ft	Filled Teeth
CI	Confidence intervals
ICC	Intra-class correlation coefficient
MMK	Myanmar Kyat
ECC	Early childhood caries
SDF	Silver diamine fluoride

Supplementary Information

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Supplementary Material 1

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Author contributions

SNM: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing –Original draft, Review and editing, Visualization, Project administration. PD, DD, SSG: Conceptualization, Methodology, Investigation, Writing –Original draft, Review and Editing. All authors reviewed the manuscript.

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Data availability

The datasets used and/or analyzed during the current study are not publicly available due to the data protection guidelines according to the ethics approval but are available from the corresponding author on reasonable request.

Declarations

Ethical approval and consent to participate
Informed consent was acquired from the parent or legal guardian of the participants prior to the implementation. The study was approved by the Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University (HREC-DCU 2021-047).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Sharma G, Puranik MP. Approaches to arresting Dental caries: an update. J Clin Diagn Res. 2015;9(5):ZE08–11.
2. Zafar S, Harnekar SY, Siddiqi A. Early childhood caries: etiology, clinical considerations, consequences and management. Int Dent SA. 2009;11(4):24–36.
3. Naidu R, Nunn J, Donnelly-Swift E. Oral health-related quality of life and early childhood caries among preschool children in Trinidad. BMC Oral Health. 2016;16(1):1–9.
4. Bönecker M, Abanto J, Tello G, Oliveira LB. Impact of dental caries on preschool children's quality of life: an update. Brazilian oral Research. 2012;26(SPE1):103–7.
5. Mabangkhru S, Duangthip D, Chu CH, Phonghanyudh A, Jirarattanasopha V. A randomized clinical trial to arrest dentin caries in young children using silver diamine fluoride. J Dent. 2020;99:103375.
6. Thwin KM, Tun TZ, Kaneko N, Nohno K, Ogawa H. Clinical and microbial evaluation of Dental Caries Status and Associated factors among primary schoolchildren in Myanmar: a cross-sectional study. Asia Pac J Public Health. 2022:10105395221139347.
7. Çolak H, Dülgergil ÇT, Dalli M, Hamidi MM. Early childhood caries update: a review of causes, diagnoses, and treatments. J Nat Sci Biology Med. 2013;4(1):29.
8. Phantumvanit P, Makino Y, Ogawa H, Rugg-Gunn A, Moynihan P, Petersen PE, et al. WHO global consultation on public health intervention against early childhood caries. Commun Dent Oral Epidemiol. 2018;46(3):280–7.
9. UNFPA G, Myanmar. 2014 Myanmar Population and Housing Census - A Changing Population: Union Figures at a Glance, May 2015.
10. Aung EE, Maung K, Zaitsu T, Kawaguchi Y. An overview of oral health situation and challenges in Myanmar. Asian J Res Med Med Sci. 2019:1–10.
11. Oo TH, Tianviwat S, Thitasomakul S. Oral health system in Myanmar: a review. J Int Soc Prev Community Dentistry. 2021;11(3):231.
12. Swe KK, Soe AK, Aung SH, Soe HZ. Effectiveness of oral health education on 8-to 10-year-old school children in rural areas of the Magway Region, Myanmar. BMC Oral Health. 2021;21(1):1–8.
13. Nomura Y, Maung K, Kay Khine EM, Sint KM, Lin MP, Win Myint MK et al. Prevalence of dental caries in 5-and 6-year-old Myanmar children. International journal of dentistry. 2019;2019.
14. Thwin KM, Zaitsu T, Ueno M, Kawaguchi Y. Early Childhood caries and related risk factors among Myanmar Preschool Children. Int J Clin Prev Dentistry. 2016;12(4):229–36.
15. Min SN, Duangthip D, Gao SS, Detsomboonrat P. Quality of the adaptation procedures and psychometric properties of the scale of oral health outcomes for 5-year-old children (SOHO-5): a systematic review. Qual Life Res. 2023;32(6):1537–47.
16. Gao SS, Chen KJ, Duangthip D, Chu CH, Lo ECM. Translation and validation of the Chinese version of the scale of oral health outcomes for 5-year-old children. Int Dent J. 2020;70(3):201–7.
17. Chai HH, Gao SS, Chen KJ, Lo ECM, Duangthip D, Chu CH. Tools evaluating child oral health–related quality of life. Int Dent J. 2023.
18. Tsakos G, Blair YI, Yusuf H, Wright W, Watt RG, Macpherson LM. Developing a new self-reported scale of oral health outcomes for 5-year-old children (SOHO-5). Health Qual Life Outcomes. 2012;10:62.
19. Min SN, Duangthip D, Gao SS, Detsomboonrat P. Cross-cultural adaptation and psychometric properties of the Myanmar version of the scale of oral health outcomes for 5-year-old children. PLoS ONE. 2023;18(3):e0282880.
20. Myint ZCK, Zaitsu T, Oshiro A, Ueno M, Soe KK, Kawaguchi Y. Risk indicators of dental caries and gingivitis among 10 – 11-year-old students in Yangon, Myanmar. Int Dent J. 2020;70(3):167–75.
21. Scarpelli AC, Paiva SM, Viegas CM, Carvalho AC, Ferreira FM, Pordeus IA. Oral health-related quality of life among Brazilian preschool children. Community Dent Oral Epidemiol. 2013;41(4):336–44.
22. Abanto J, Carvalho TS, Mendes FM, Wanderley MT, Bönecker M, Raggio DP. Impact of oral Diseases and disorders on oral health-related quality of life of preschool children. Commun Dent Oral Epidemiol. 2011;39(2):105–14.
23. (MIMU) MIMU. Myanmar Information Management Unit Township profiles. General Administration Department, Ministry of Home Affairs; 2019.
24. WHO. Oral health surveys: basic methods. World Health Organization; 2013.
25. Abanto J, Tsakos G, Paiva SM, Carvalho TS, Raggio DP, Bönecker M. Impact of dental caries and trauma on quality of life among 5- to 6-year-old children: perceptions of parents and children. Commun Dent Oral Epidemiol. 2014;42(5):385–94.
26. Paiva CR, Alves AO, Medina PO, Zacarias RP, Hanan SA. Agreement between reports of parents and children about children's oral health-related quality of life. Volume 19. Pesquisa Brasileira em Odontopediatria e Clínica Integrada; 2020.
27. Abanto J, Tsakos G, Ardenghi TM, Paiva SM, Raggio DP, Sheiham A, et al. Responsiveness to change for the Brazilian scale of oral Health outcomes for 5-year-old children (SOHO-5). Health Qual Life Outcomes. 2013;11:1–7.
28. Dantas LR, Gomes MC, Dantas LR, Cruz-da-Silva BR, de Perazzo F, Siqueira M. The impact of dental treatment on oral health-related quality of life among preschool children. J Public Health (Germany). 2015;23(6):327–31.
29. Perazzo MF, Gomes MC, Neves ÉT, Martins CC, Paiva SM, Costa EMB, et al. Oral problems and quality of life of preschool children: self-reports of children and perception of parents/caregivers. Eur J Oral Sci. 2017;125(4):272–9.
30. Duangthip D, Gao SS, Chen KJ, Lo ECM, Chu CH. Oral health-related quality of life and caries experience of Hong Kong preschool children. Int Dent J. 2020;70(2):100–7.
31. Granville-Garcia AF, Gomes MC, Perazzo MF, Martins CC, Abreu MHNG, Paiva SM. Impact of caries severity/activity and psychological aspects of caregivers on oral health-related quality of life among 5-year-old children. Caries Res. 2018;52(6):570–9.
32. Mansoori S, Mehta A, Ansari MI. Factors associated with oral health related quality of life of children with severe-early childhood caries. J oral Biology Craniofac Res. 2019;9(3):222–5.
33. Chen KJ, Gao SS, Duangthip D, Li SKY, Lo ECM, Chu CH. Dental caries status and its associated factors among 5-year-old Hong Kong children: a cross-sectional study. BMC Oral Health. 2017;17:1–8.
34. Tinanoff N, Baez RJ, Diaz Guillory C, Donly KJ, Feldens CA, McGrath C, et al. Early childhood caries epidemiology, aetiology, risk assessment, societal burden, management, education, and policy: global perspective. Int J Pediatr Dent. 2019;29(3):238–48.
35. Gao SS, Chen KJ, Duangthip D, Wong MCM, Lo ECM, Chu CH. Arresting early childhood caries using silver and fluoride products–a randomised trial. J Dent. 2020;103:103522.

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