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Dental caries experience among primary school pupils in Honiara City, Solomon Islands

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Abstract

Objectives: The objective of this study was to describe dental caries experience among primary school children in Honiara, Solomon Islands. This was carried out to inform the development of an oral health strategic plan for the Dental Services Department, Ministry of Health and Medical Services, Solomon Islands.

Methods: This cross-sectional oral health survey examined 547 primary school pupils (81.8% response rate) in 19 randomly selected public, church owned and private primary schools in Honiara city, Solomon Islands. Systematic sampling was employed to sample and recruit the participants. The World Health Organization (WHO) oral health assessment form and approach was used to record the caries experience of the primary school pupils.

Results: A total of 547 primary school pupils were examined, of whom 40% were 6-year-olds and 60% were 12-year-olds. Caries experience among the 6-year-olds was very high, with a mean dmft of 4.8 (SD 4.1), and only 16.9% caries-free. Among the 12-year-olds, the mean DMFT was 1.3 (SD 2.0), with 50.9% caries-free. Considerable variation in caries prevalence and experience was observed among schools.

Conclusion: Dental caries experience among primary school pupils in Honiara, Solomon Islands mirrors the typical Pacific pattern of high deciduous dentition disease experience but lower rates in the permanent dentition, with marked variation among neighborhood schools.

Introduction

Oral diseases rank among the most prevalent non-communicable disease globally, affecting over 3.5 billion people. Untreated caries in permanent and deciduous teeth is present in 2 billion people and 514 million children respectively (WHO, 2022). Dental caries, in particular, can result in health and economic burdens, causing pain, sepsis and affecting quality of life (QOL) for both children and adults. In many cases, the problem is not treated adequately, mainly because of insufficient resources to meet the need or the limited resources are not easily accessible to the people who need it the most (Goodwin *et al.*, 2022; Inomae *et al.*, 2022).

Early childhood caries (ECC) is characterized as a severe form of dental decay precipitated by cariogenic bacteria in the plaque biofilm, along with the presence of sugars and acids in a bottle containing milk or juice that remains in prolonged contact with a child's primary teeth; such a combination leads to the rapid demineralization of the hard tissue structure (Darby and Walsh, 2010). According to the American Academy of Paediatric Dentistry (AAPD), the presence of 1 or more decayed teeth, missing teeth (due to caries) or filled tooth surface in the primary dentition of a child aged younger than 6 years old is considered to be ECC. ECC remains a persistent dental public health problem in both developing and developed countries; its principal complications of pain and infection lead to problems such as absence from school, compromised eating habits and lower self-esteem (AAPS, 2016). These affect the child's well-being and oral-health-related quality of life (OHRQoL). It is now evident that the occurrence of oral diseases shows variation by geographical location and access to oral health care services (Vukovic *et al.*, 2021), along with the quality of the care provided (Bahannan *et al.*, 2018; Kabi and Eltawil, 2017).

The severity of accumulated lifetime caries experience is usually represented by the mean decayed (d), missing (m), filled surfaces (dmfs) and decayed (D), missing (M), filled teeth (DMFT) scores (Haskim *et al.*, 2013). The World Health Organization (2013) has suggested ordinal categories of population dental caries experience as Very Low (dmft/DMFT 0.0 to 1.1), Low (1.2 to 2.6), Medium (2.7 to 4.4), High (4.5 to 6.6) and Very High (> 6.7).

Investigations of dental caries experience among 6-year-olds and 12-year-olds among children living in the Solomon Islands children has been undertaken sporadically since 1965. For 6-year-olds, mean dmft scores were reported to be 1.2 in 1971 and 2.8 in 2007. Among the 12-year-olds, the mean DMFT was 1.7 in 1965, 2.7 in 1994, 2.3 in 1999, 2.2 in 2003, and 0.6 in 2007 (Vane, 2007). While most of the studies were conducted in Honiara, the 2007 study was broadened to include three of the ten Solomon Islands provinces (namely, Honiara, Makira/Ulawa and Central Islands). Vane in his 2007 study also reported specifically on Honiara primary school pupils which revealed that the dmft of the 6-year-olds was 3.4 (SD 3.8) and the DMFT of the 12-year-olds was 1.0 (SD 1.8). The most recent analyses have used routinely-collected health services data which are available in annual reports from local dental clinics. For example, the 2020 annual report from Mataniko Dental Clinic (MDC) in Central Honiara revealed that 87.0% of pediatric patients (0-15 years old) had presented with caries-related problems, and that 42.1% of the restorations and

44.9% of the dental extractions which were provided had resulted from dental caries. The 2021 MDC annual report revealed a similar pattern, with 74.8% (n=3138) of pediatric patients presenting with dental caries; 40.6% of them underwent restoration due to caries and 34.2% had had dental extraction as a result of carious teeth.

Currently, data on caries experience among schoolchildren in Honiara and the Solomon Islands are scarce. Honiara city dental services health data suggest that dental caries rates remain high, and that a systematic approach to tackling the problem is warranted. Accordingly, the aim of this study was to describe dental caries experience among Honiara primary school children in order to inform the development of an oral health strategic plan for child oral health in Honiara, Solomon Islands.

Methods

A cross-sectional oral health survey was conducted in 19 selected public, church owned and private primary schools in Honiara City, Solomon Islands. Ethics approval to conduct the study was obtained from the Solomon Islands Health Research & Ethics Review Board (No. HRE010/23), the Honiara city council education authority, school administrations and the parents/guardians of the randomly selected students.

A systematic sampling technique was used to recruit the 6-year-olds and 12-year-olds primary school pupils for this study. The profiling phase of the exercise indicated that the total number of students attending the 19 selected schools was 7,434. An online sample size calculator was used to determine the required sample size, which was determined to be 669 for the 19 selected primary schools. The sample consisted of 17 6-year-olds and 18 12-year-olds per school, selected randomly by the teachers from those who had been assigned odd numbers in the class listing.

A one-day calibration training exercise for all examiners and recorders was held one week prior to data collection. Dentists and oral health therapists used visual tactile examination under natural light to examine the randomly selected 6-year-olds and 12-year-olds attending the 19 selected public, church-owned and private schools. Consent forms were issued to the

Table 1. Dental caries experience among 6-year-olds, by demographic characteristics (brackets contain column % unless otherwise indicated)

	Number		Caries-free[a]		Mean dmft (SD)	
Sex						
Female	105	(47.9)	18	(17.1)	4.6	(3.6)
Male	114	(52.1)	19	(16.7)	4.9	(4.5)
Race						
Melanesian	197	(90.0)	5	(22.7)	3.0	(3.0)[b]
Others	22	(10.0)	32	(16.2)	5.0	(4.1)
Level						
ECE	76	(34.7)	13	(17.1)	4.4	(3.4)
PPY	90	(41.1)	20	(22.2)	4.6	(4.3)
Class 1	53	(24.2)	4	(7.5)	5.6	(4.4)
School						
White River	16	(7.3)	2	(12.5)	5.3	(4.7)
Red Cross Special	4	(1.8)	1	(25.0)	7.0	(8.8)
St Johns Primary	20	(9.1)	6	(30.0)	4.1	(4.0)
Advance Christian Academy	10	(4.6)	1	(10.0)	4.1	(3.9)
Mbokonavera Primary	10	(4.6)	2	(20.0)	5.4	(4.7)
Honiara Christian Academy	16	(7.3)	3	(18.8)	3.8	(3.8)
Coronation Primary	10	(4.6)	4	(40.0)	3.7	(4.0)
Chung Wah	6	(2.7)	0	(0.0)	4.7	(3.7)
Koloale Primary	8	(3.6)	1	(12.5)	3.4	(2.7)
St Nicolas Primary	14	(6.4)	0	(0.0)	7.1	(4.7)
Mbua Valley Primary	1	(0.5)	0	(0.0)	5.0	(—)
Florence Young Primary	6	(2.7)	2	(33.3)	3.5	(2.9)
Naha SDA Primary	10	(4.6)	0	(0.0)	5.6	(4.8)
Vura Primary	13	(5.9)	3	(23.1)	3.7	(2.6)
Zion Christian Academy	13	(5.9)	0	(0.0)	6.2	(3.3)
Ilia Primary	20	(9.1)	3	(15.0)	5.5	(4.1)
Woodford International	10	(4.6)	4	(40.0)	3.3	(3.5)
Perch Primary	13	(5.9)	1	(7.7)	4.5	(3.6)
Harvest Academy	19	(8.7)	4	(21.1)	4.8	(4.4)
All combined	219	(100.0)	37	(16.9)	4.8	(4.1)

[a] Row percent
[b] P<0.05

selected primary school pupils to ensure parental or guardian awareness and approval for the forthcoming examination. Pupils returning a signed consent from their parents or guardians were examined. A modified WHO oral health assessment form (World Health Organization, 2013) was used for the dental charting.

The data obtained were entered in Microsoft Excel 2016 then exported into SPSS version 28 for analysis. Following the computation of descriptive statistics, cross-tabulations and Chi-square statistics were used for comparisons of categorical variables, while analysis of variance (and nonparametric tests as appropriate) were used to compare means.

Results

Overall, 547 (81.8%) pupils from the 19 selected primary schools in Honiara City participated in the oral examination for their caries experience determination. Of those, 219 (40.0%) were 6-year-olds, and 328 (60.0%) were 12-year-olds.

Table 1 represents data on the 6-year-old children examined. Just over half were male, and Melanesians comprised the great majority with 90%. Caries experience was high, with more than four out of five 6-year-olds having the condition. There was no sex difference in mean dmft score, but non-Melanesians had greater caries experience. There was considerable variation in caries experience by school.

Data on the 12-year-olds are presented in Table 2. Just over half the sample was female, and most were Melanesian. Approximately half of the 12-year-olds had caries experience, and mean DMFT scores were higher among females. While there was no apparent ethnic difference in caries experience, there was considerable variation among schools.

Discussion

This study investigated the dental caries status of 6-year-old and 12-year-old primary school pupils in Honiara City, Solomon Islands. As expected, caries experience among the former was high, while it was considerably lower among the 12-year-olds. Irrespective of dentition, there was considerable variation in caries experience by school.

The study has a number of strengths and weaknesses which should be considered before discussing the

Table 2. Dental caries experience among 12-year-olds, by demographic characteristics (brackets contain column % unless otherwise indicated)

	Number		Caries-free[a]		Mean DMFT (SD)	
Sex						
Female	182	(55.5)	93	(51.1)	1.5	(2.3)
Male	146	(44.5)	75	(50.7)	1.0	(1.4)
Race						
Melanesian	306	(93.3)	9	(40.9)	1.2	(1.6)
Others	22	(6.7)	158	(51.6)	1.3	(2.0)
Level						
Class 1	2	(0.6)	1	(50)	2.0	(2.8)
Class 5	184	(56.1)	93	(50.5)	1.4	(2.0)
Class 6	142	(43.3)	73	(51.4)	1.1	(1.9)
School						
White River	17	(5.2)	11	(64.7)	1.2	(1.9)
Red Cross Special	5	(1.5)	2	(40.0)	1.2	(1.6)
St Johns Primary	18	(5.5)	9	(50.0)	1.1	(1.5)
Advance Christian Academy	20	(6.1)	9	(45.0)	1.4	(1.7)
Mbokonavera	25	(7.2)	18	(72.0)	0.5	(1.0)
Honiara Christian Academy	0	(0.0)	0	(0.0)	0.0	(0.0)
Coronation Primary	21	(6.4)	14	(66.7)	0.8	(1.6)
Chung Wah	16	(4.9)	6	(37.5)	1.4	(1.4)
Koloale Primary	22	(6.7)	10	(45.5)	1.5	(2.3)
St Nicolas Primary	12	(3.7)	7	(58.3)	0.7	(1.0)
Mbua Valley Primary	21	(6.4)	12	(57.1)	1.1	(1.9)
Florence Young	34	(10.4)	20	(58.8)	1.1	(1.7)
Naha SDA Primary	18	(5.5)	8	(44.4)	2.2	(3.0)
Vura Primary	21	(6.4)	13	(61.9)	0.5	(0.7)
Zion Christian Academy	32	(9.8)	9	(28.1)	2.3	(2.6)
Ilia Primary	23	(7.0)	8	(34.8)	1.1	(1.1)
Woodford International	2	(0.6)	1	(50.0)	1.0	(1.4)
Perch Primary	11	(3.4)	5	(45.5)	1.3	(1.7)
Harvest Academy	10	(3.0)	5	(50.0)	2.2	(4.6)
All combined	328	(100.0)	167	(50.9)	1.3	(2.0)

[a] Row percent
[b] P<0.05

findings. The strengths include a relatively large sample size and a high participation rate (at 81.8%), meaning that the findings are likely to be generalisable to the source population. This aspect was enhanced by the inclusion of the only special needs school in Honiara city (Red Cross special school). Possible weaknesses are that the random selection was done by the school teachers (although they should not have been aware of the children's clinical oral status), and there were differences in examination conditions across the various schools, particularly with respect to the quality of the available natural light for visual examination. This may have affected the validity and reliability of the dental examination data.

Turning to the findings, caries experience for both age categories was higher than observed in a similar study conducted in 2007 by Vane, in which the average mean dmft of the 6-year-olds and the 12-year-olds was 3.4 (SD 3.8) and 1.0 (SD 1.8) respectively for Honiara city primary schools. Thus, the past 15 years have seen an increase by 29.2% in the average mean dmft of 6-year-olds, from 3.4 (SD 3.8) to 4.8 (SD 4.1); for the 12-year-olds, it increased by 23.1%, from 1.0 (SD 1.8) to 1.3 (SD 2.0). This worsening in caries experience may be due to an increase in the availability of sugary diets and imported snacks over recent years (Vane, 2007).

The WHO oral health country profile report of 2022 described a similar pattern in dental caries experience within the deciduous and permanent dentition among children across the Pacific region, with a substantial disease burden consistently observed in the deciduous dentition, contrasted by relatively lower permanent dentition caries experience. Examples of reported deciduous dentition caries prevalence estimates were 46.7% in Fiji (which had considerably declined from that observed previously), 47.6% in Papua New Guinea, 46.9% in Tonga, and 46.6% in Samoa. In that context, the 83.1% (and mean dmft of 4.8) observed in our study is cause for alarm. Recent research by Skandram *et al.*. (2023) in New Caledonia indicates a caries prevalence of 60% for deciduous teeth. By contrast, the Pacific region has a lower caries prevalence in the permanent dentition, with 50.0% in New Caledonia (Skandram, 2023), Honiara at 49.1% (with a mean DMFT of 1.3), and 21.2% (and mean DMFT of 0.8) in Vanuatu (Ministri Blong Health, 2018).

With our alarming findings on caries prevalence and experience in Honiara primary school children, there is a pressing need for a holistic approach in terms of oral health planning, resource allocation, education, promotion and care. These are paramount and must be tailored to meet the needs of our primary school pupils in Honiara city to mitigate the caries prevalence and caries experience faced by our primary school children.

Conclusion

Dental caries experience is severe among Honiara 6-year-old and 12-year-old primary school children, having remained unchanged or continuing to increase over the past 15 years. The findings reflect the typical Pacific pattern of high deciduous dentition disease experience but lower rates in the permanent dentition, along with marked variation by area (represented by neighborhood schools). A concerted and coordinated public health approach is needed if the situation is to improve.

Author contributions

Conception or design of the work – CI, JTW, SS, TWM, TM, TR, JP, JS, DT, HW
Data collection – CI, JTW, SS, TWM, TM, TR, JP, JS, DT, HW
Data analysis and interpretation – CI, WMT
Drafting the article – CI, JTW, SS, TWM, TM, TR, JP, JS, DT, HW
Critical revision of the article – CI, WMT
Final approval of the version to be published – all authors

Conflict of interest

The authors declare no conflicts of interest.

Data availability statement

The data are available from the corresponding author upon reasonable request.

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