

ORIGINAL RESEARCH

Changes in the oral health of the children of Dili, Timor Leste, between 2002 and 2014

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ABSTRACT

Introduction: This research compared the oral health status of school children in Dili (the capital of Timor Leste) in 2002 and 2014.

Methods: The 2014 oral health survey of Dili's children replicated the methods of an AusAID-supported oral health survey conducted in 2002. Equal numbers of children were invited to participate from four age groups (6–8, 9–11, 12–14 and 15–17 years). For the 2014 survey, the subdistricts of Dom Aleixo, Cristo Rei, Metinaro and Vera Cruz were randomly selected for inclusion. A questionnaire was used to collect data on demographics and oral health behaviours. Oral epidemiological examinations were conducted by four dentists and five dental nurses.

Results: The 2014 survey in Dili recruited 758 participants for the questionnaire and 655 children for the oral examination. In 2014, a lower proportion of children reported brushing their teeth the previous day (97% vs 100%, $p=0.01$) and a larger proportion reported having toothache (40% vs 19%, $p<0.001$) (sometimes to very often) during the previous 12 months. The mean number of decayed, missing or filled teeth in the primary plus permanent dentition (dmft + DMFT) was greater in 2014 than in 2002 (4.2 vs 3.5, $p=0.01$). There was no difference in the prevalence of decay in the primary dentition (39% vs 37%, $p=0.61$) or the mean number of decayed, missing or filled (dmft) teeth in the primary dentition in 2014 compared to 2002 (2.0 vs 1.8, $p=0.47$). However, the prevalence of decay in the permanent dentition was greater in 2014 (70% vs 53%, $p<0.001$) as was the mean DMFT



(2.3 vs 1.7, $p=0.04$). The prevalence of gingival bleeding (65% vs 81%, $p<0.001$) and calculus (57% vs 86%, $p<0.001$) was lower in 2014.

Conclusions: There was an increase in dental caries experiences in Dili school children between 2002 and 2014, associated with more permanent teeth dental caries experiences.

Key words: children, Dili, dmft, oral health, survey.

Introduction

Oral health is essential for good general health¹. Poor oral health is linked with absence from school and work, affects nutrition and diet, and is associated with social stigma and psychological issues¹. Yet, approximately 90% of the world's population (3.9 billion people) experience oral diseases^{1,2}. Preventing and managing oral health problems is a major unmet need in developing economies due to limited resources for dental services³. People from developing economies are increasingly susceptible to dental problems due to an increasing availability of sugar⁴, inadequate exposure to fluoride⁵ and limited oral health education and promotion⁶.

Timor Leste is Asia's most recently established nation⁷ after having undergone a United Nations-sanctioned referendum which voted for independence in 1999. It occupies the eastern half of the island of Timor, located north of Australia⁸. After the referendum, a campaign by Indonesian military and local militia destroyed 70% of the infrastructure and displaced three-quarters of the population⁹. Timor Leste is undergoing a baby boom, with the population expected to triple between 2005 and 2050¹⁰. The population of Timor Leste was 1.2 million in 2010¹¹, of which 234 331 people lived in the capital Dili¹². Children aged less than 14 years are estimated to contribute to approximately 45% of the total population by 2020⁷. The nation is one of the poorer countries in South-East Asia and in the world⁷, with a human development index of 128¹³. Food security is a problem in Timor Leste – the country is ranked third in the world for chronic malnutrition in children¹⁴.

In 2002 AusAID (now the Australian Department of Foreign Affairs and Trade) dental staff in Timor Leste and the

Australian Research Centre for Population Oral Health at the University of Adelaide completed a national oral health survey of Timor Leste with the aim of developing a national oral health profile. The information obtained from the study was used to inform government planning and policy making¹⁵. The study found that dental caries experience was highly prevalent in the primary and permanent teeth of children and was largely present as untreated decayed teeth¹⁵.

This article reports on the oral health status of children in Dili in 2014 and compares them with the oral health status of Dili children in 2002, so that the change in the population oral health in children in Dili can be ascertained. The study intends to inform policies aimed at improving the oral health outcomes of children in Dili and Timor Leste. The hypothesis of the study was that dental caries experience in the children of Dili was significantly greater in 2014 compared to 2002.

Methods

The 2014 oral health survey of Dili's children replicated the methods described by Roberts-Thomson and colleagues in the AusAID report¹⁵.

Study design

Two cross-sectional epidemiological surveys of the oral health of Dili's children.

Study population

Children aged 6–17 years enrolled in primary, junior and senior secondary schools in the district of Dili in 2002 and 2014.



Sampling strategy

The methods of the 2002 East Timor National Oral Health Survey and the Oral Health Knowledge, Attitudes and Behaviour Survey have been previously reported¹⁵.

The 2014 survey replicated the sampling strategy of the 2002 survey. The Dili component of the 2002 survey randomly selected two of the six subdistricts of Dili, while the 2014 survey randomly selected four subdistricts. The two additional subdistricts were selected to account for the increased population size of Dili in 2014 compared to 2002. For the 2014 survey, the sub-districts of Dom Aleixo, Cristo Rei, Metinaro and Vera Cruz were randomly selected for inclusion. Forty schools were selected for inclusion in the study. The number of schools selected for each subdistrict was proportional to the size of the population within the subdistrict. For each local area the authors attempted to recruit one primary school, one junior high school and one senior high school. However, for the 2014 survey, not all localities had all three school types. All schools invited to participate agreed to take part in the study.

Sample size and study power

Data from the 2010 Timor Leste census shows there were 61 300 children aged 6–17 years residing in the Dili region. The present study recruited 758 children, or 1.2% of children in these age groups living in Dili.

The 2002 survey recruited 1024 children across Timor Leste and 201 children in Dili. The sample size required for the 2014 survey was calculated based on a hypothesised 25% greater (from 2002 level) prevalence of dental caries in the permanent dentition. The 2002 survey found 48% of children living in Dili had one or more teeth with decay. To achieve greater than 80% power to detect a significant difference in the prevalence of decay at alpha level 0.05, the authors calculated that three times as many children ($n=603$) would need to be recruited for the 2014 oral examination. The 2002 survey recruited 77.5% of the target number of child participants¹⁵ so it was calculated that 800 children would

need to be invited to participate to recruit approximately 620 participants.

Recruitment

Recruitment took place within 40 schools, with students randomly selected and invited to participate. Equal numbers of children were invited to participate from each of the four age strata (6–8, 9–11, 12–14 and 15–17 years).

Children were provided with a study information sheet and consent form to take home for their parent or guardian to read and complete. One week later the study team visited the school to complete surveys and oral examinations. All parents/guardians provided written consent for their child to participate. All children were accompanied by their parent/guardian for the survey and oral examination.

Participants

Participants were children aged 6–17 years who were attending participating schools.

Data collection

A questionnaire was used to collect data on demographics and oral health behaviours. The 2014 survey used the same questions as the 2002 survey. The questionnaire was designed in English then translated into Tetum (Timor Leste's official language). The questionnaire obtained information on tooth brushing, use of toothpaste, time since last dental visit, reason for visit, type of professional visited and treatment received. Parents and guardians completed the questionnaire at home or at the child's school. For those who were illiterate, the questionnaire was orally administered by a member of the research team during the school data collection visit.

Oral epidemiological examinations were conducted by dental health professionals (four dentists and five dental nurses) who had completed a 5-day training, standardisation and calibration workshop. Reliability of the examiners was assessed among a subsample of 69 children against a gold standard examiner. Full results of the reliability analysis are not reported here; however,



interrater reliability was high (mean Krippendorff's alpha 0.93, range 0.65–1.00, with 2 of 28 teeth below the critical value of $\alpha \geq 0.80$). Oral examinations were conducted in school classrooms. Children were seated in a proclined position and natural sunlight was used. The examination collected information on the number of teeth present, caries prevalence and severity, oral hygiene and the gingival condition. Children's dental status was scored using the decayed missing and filled teeth index (dmft) for deciduous teeth and permanent teeth (DMFT). In addition, periodontal status was assessed using calculus and bleeding indices¹⁴.

Data analysis

Data from the surveys and oral examinations were entered into a spreadsheet by the lead researcher (LFBS). This was amalgamated with data on children living in Dili from the 2002 survey and oral examination, provided by Roberts-Thomson and colleagues. The data were checked for accuracy and completeness prior to export to the Statistical Package for the Social Sciences v23 (IBM; <http://www.spss.com>) for data analysis. With the exception of the preliminary investigation of age and sex distributions across the surveys, the data were weighted to the age and gender distribution of children in Dili based on the 2010 census¹². Data on toothache, avoiding eating and unhappiness about appearance of teeth was collected on a Likert scale with the categories 'never', 'hardly ever', 'sometimes', 'often' and 'very often'. This data was dichotomised for analysis, to 'never/hardly ever' and 'sometimes/often/very often'. Chi-squared tests were utilised to investigate the proportion of children in 2014 versus 2002 who reported specific oral health behaviours (eg tooth brushing the previous day), visits to dentists and receipt of treatment and oral health status (eg the presence of gingival bleeding). Independent *t*-tests were used to investigate mean dmft and DMFT. All tests were two-sided and differences were accepted as significant at alpha 0.05 level.

Ethics approval

Ethics approval for the research was granted by the University of Tasmania Human Research Ethics Committee (reference H13216).

Results

The 2002 survey recruited 1042 children aged 6–17 years in Timor Leste, with 201 of these residing in Dili. The 841 children who participated in the 2002 survey but resided in other regions of Timor Leste were excluded. The 2014 survey in Dili recruited 758 participants (95% response rate) aged 6–17 years, or 1.2% of the 61 300 children within this age group living in Dili according to the 2010 census¹². Overall, and in all age groups, there was no significant difference in the proportion of males to females (Table 1). A smaller number of children ($n=655$, 82% response rate) were recruited to the oral examination component. This was due to some children being absent from school on the day of the oral examination and some children being unwilling to participate in this component of the research.

A slightly lower proportion of children reported brushing their teeth the previous day, a larger proportion of children reported suffering from toothache (sometimes to very often) during the last 12 months or avoiding eating due to toothache, and the proportion of children who reported being unhappy about the appearance of their teeth was higher in 2014 compared to 2002 (Table 2). There was no difference in the proportion of children who had ever visited a dentist between the two surveys. However, a larger proportion of children reported having visited a dentist during the previous 12 months in 2014 compared to 2002.

The prevalence of, and extent of sites with, gingival bleeding and calculus was higher in 2002 compared to 2014 (Table 3). In 2014 compared to 2002, mean DMFT and the mean number of decayed missing or filled teeth in the primary plus permanent dentition (dmft + DMFT) was significantly greater. There was no difference in the prevalence of decay in the primary dentition, the mean number of decayed (d) teeth or total dmft in the primary dentition in 2014 compared to 2002. The prevalence of decay in both the deciduous and permanent dentitions (d + D) was higher in 2014 than 2002.



Table 1: Sex distribution by age (unweighted data), 2002 and 2014 Dili child oral health surveys

Age	2002 national oral health survey Dili (n=201) [†]				2014 national oral health survey Dili (n=758)				p
	Male		Female		Male		Female		
	n	%	n	%	n	%	n	%	
6–8 years	31	57.4	23	42.6	90	48.4	96	51.6	0.24
9–11 years	33	58.9	23	41.1	105	53.3	92	46.7	0.46
12–14 years	28	53.8	24	46.2	97	53.9	83	46.1	1.00
15–17 years	14	41.2	20	58.8	96	49.2	99	50.8	0.39

[†] Missing data n=5

Table 2: Oral hygiene, self-reported oral health and dental visiting behaviour (weighted by age and sex to Dili 2010 census population), Dili 2002 and 2014

Variable	National oral health survey 2002 Dili (n=201) % (95%CI)	National oral health survey 2014 Dili (n=758) % (95%CI)	p
Oral hygiene			
Toothbrushing yesterday	100.0 (98.2, –)	96.7 (95.2, 97.9)	0.01
Use of toothpicks	69.9 (62.5, 76.7)	62.4 (58.8, 65.9)	0.06
Use of toothpaste	99.5 (97.2, 100.0)	99.5 (98.6, 99.9)	0.95
Self-reported oral health			
Toothache (sometimes to very often) during last 12 months	19.2 (14.0, 25.4)	40.2 (36.5, 44.0)	<0.001
Avoid eating (sometimes to very often) during last 12 months due to toothache or pain	12.5 (8.1, 18.2)	34.6 (31.0, 38.3)	<0.001
Unhappy about appearance of teeth (sometimes to very often)	10.6 (6.4, 16.2)	36.3 (32.7, 40.0)	<0.001
Dental visiting behaviour			
Ever visited a dentist	47.5 (39.5, 55.6)	44.5 (40.9, 48.1)	0.50
Visited a dentist during past 12 months	7.0 (3.5, 12.1)	23.9 (20.9, 27.1)	<0.001
Last visited a dentist due to a problem (pain, decay, bleeding gum or trauma) among all children who visited a dentist during the past 12 months	93.2 (84.7, 97.7)	89.2 (85.1, 92.5)	0.32

CI, confidence interval

Discussion

Dental caries experience in Dili school children was significantly greater in 2014 compared to 2002, due to more tooth decay in permanent teeth. The percentage of children with decay in their permanent teeth was 16.4 percentage points higher in 2014 compared to 2002 and mean dmft + DMFT increased from 3.5 to 4.2 teeth. This supported the

hypothesis that dental caries experience in the children of Dili had increased during the 12 years between the two surveys. There was also a higher mean number of filled permanent teeth in 2014 compared to 2002.

The greater dental caries experience in 2014 may be related to increased sugar consumption; with the change to a more youthful population, dental caries experience in Timor Leste can be expected to continue to increase in the future^{2,3,12,16}.



Almost all sugar consumed in Timor Leste is imported and there was a large increase in the sugar imports to Timor Leste between 2003 and 2011. In 2003, sugar imports were 756 tonnes, or 5.2 kg/person/year while in 2007 it was 933 tonnes or 8.5 kg/person/year^{16,17}. By 2014 sugar imports had reached 1883 tonnes^{16,17}. This represents a 149% increase in sugar imports between 2003 and 2014. The higher dmft + DMFT in 2014 may also reflect the movement of people into Dili from the rural areas since the departure of Indonesian troops in 1999. This movement may have resulted in more people moving from traditional Timor diets to Western-style diets, as occurred in India¹⁸. The increased dental caries experience may also be related to the slightly lower proportion of children who reported brushing their teeth the previous day in 2014 compared to 2002. However, the decreased prevalence and extent of gingival bleeding and calculus suggested oral hygiene may have been better in 2014 than in 2002. The increased dental caries experience may help explain why the incidence of toothache in the previous 12 months, avoiding eating due to toothache, and being unhappy about the appearance of teeth was higher in 2014 than in 2002.

The larger mean number of filled primary teeth in 2014 suggested that the dental service was able to supply more restorative dental care in 2014 than 2002. The fact that a higher proportion of children had reported seeing a dentist in the previous 12 months in 2014 than in 2002 indicated that the dental service had been able to increase its restorative service delivery over the year prior to 2014. However, the greater prevalence of decay (D) and larger mean number of permanent decayed teeth (D) indicated that the dental service was unable to supply the volume of dental restorative care required. The findings of the present research emphasise the need to increase the delivery of oral health promotion efforts, and to improve access to routine and restorative dental care, for children in Timor Leste.

The greater dental caries exposure, combined with the changing demographic to a younger population in Timor Leste, will have large implications for the oral health sector. Rapid changes to Western diets have been found in other

developing economies such as South Africa and Benin^{19,20}. The change from a low sugar diet to a Western high sugar diet has had an impact on overall health and oral health in other nations^{18,19,21}. A growing youthful population has also been shown to be related to increased dental caries prevalence^{22,23,24}.

There were several limitations with this study. The baseline of individual sugar consumption in the children of Dili was not established in the 2002 study, making it impossible to assess change in sugar consumption among children in Dili in 2014. Change in sugar consumption was limited to the change in sugar imports for all of Timor Leste. The data analysis was limited by the inability to adjust for the clustered study design of the 2002 survey. Unfortunately, this was not possible as the 2002 dataset that was provided to the researchers did not include cluster information. The survey did not include the local dialects of Timor Leste and may have missed some demographic groupings, thereby reducing the demographic diversity in the survey participants. Strengths of the study include that it used a randomised sample age and sex breakdown analogous to the 2002 survey study. The study recruited a sufficiently large number of children to provide sufficient power to test the study hypothesis. The study provided an important contribution to the oral health profile of the change in oral health status and limitations.

Further research needs to be undertaken to identify children most vulnerable to dental caries within Dili and Timor Leste (eg in low socioeconomic groups) and to develop oral health policies suitable for the Timor Leste situation, such as oral health promotion targeted at particular demographic groups, salt fluoridation, supplying affordable toothbrushes and toothpaste, school-based dental health education and screening, and fluoride and fissure sealant programs.

Conclusions

There was an increase in dental caries experience in Dili school children between 2002 and 2014, associated with a greater permanent teeth dental caries experience.



Table 3: Mean number dmft + DMFT, dmft, DMFT, decayed teeth, missing teeth, filled teeth in the primary and permanent dentitions (weighted by age and sex to Dili 2010 census population), Dili 2002 and 2014

Teeth status	National oral health survey 2002 Dili (n=201)	National oral health survey 2014 Dili (n=655)	Dili 2002 vs Dili 2014
	% or mean % (95% CI)	% or mean % (95% CI)	p
Prevalence of gingival bleeding	81.0 (74.9, 86.1)	64.6 (60.8, 68.2)	<0.001
Extent of sites with gingival bleeding	81.0 (74.9, 86.1)	64.6(60.8, 68.2)	<0.001
Prevalence of calculus	85.8 (80.2, 90.3)	57.1 (53.2, 60.9)	<0.001
Mean extent of sites with calculus	57.7 (57.4, 58.0)	25.4 (25.3, 25.5)	<0.001
Primary dentition			
Prevalence of decay	36.8 (30.1, 43.8)	38.8 (35.0, 42.6)	0.61
Prevalence of missing teeth	6.4 (3.4, 10.7)	8.1 (6.1, 10.5)	0.42
Prevalence of filled teeth	0.0	1.8 (1.0, 3.2)	0.08
Mean number of decayed teeth (d)	1.71 (1.68, 1.74)	1.81 (1.80, 1.82)	0.69
Mean number of missing teeth (m)	0.09 (0.04, 0.14)	0.15 (0.10, 0.20)	0.07
Mean number of filled teeth (f)	0.0 (-)	0.02 (0.01, 0.03)	0.001
Mean dmft	1.80 (1.77, 1.83)	1.99 (1.74, 2.24)	0.47
Permanent dentition			
Prevalence of decay	53.4 (46.3, 60.4)	69.8 (66.1, 73.3)	<0.001
Prevalence of missing teeth	9.9 (6.1, 14.8)	8.2 (2.0, 4.9)	0.48
Prevalence of filled teeth	1.5 (0.3, 4.2)	3.2 (2.0, 4.9)	0.19
Mean number of decayed teeth (D)	1.6 (1.58, 1.62)	2.1 (1.89, 2.23)	0.01
Mean number of missing teeth (M)	0.11 (0.06, 0.16)	0.14 (0.10, 0.18)	0.56
Mean number of filled teeth (F)	0.01 (-0.01, 0.03)	0.07 (0.04, 0.10)	0.004
Mean DMFT	1.73 (1.44, 2.02)	2.26 (2.07, 2.45)	0.04
Primary and permanent dentition			
Prevalence of decay (d + D)	81.9 (75.9, 86.9)	87.5 (84.7, 90.0)	0.04
Mean dmft + DMFT (decayed missing or filled teeth index) in the primary plus permanent dentition	3.53 (3.50, 3.55)	4.02 (4.01, 4.03)	0.048

CI, confidence interval. dmft, decayed, missing or filled teeth in primary dentition. DMFT, decayed, missing or filled teeth in permanent dentition

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