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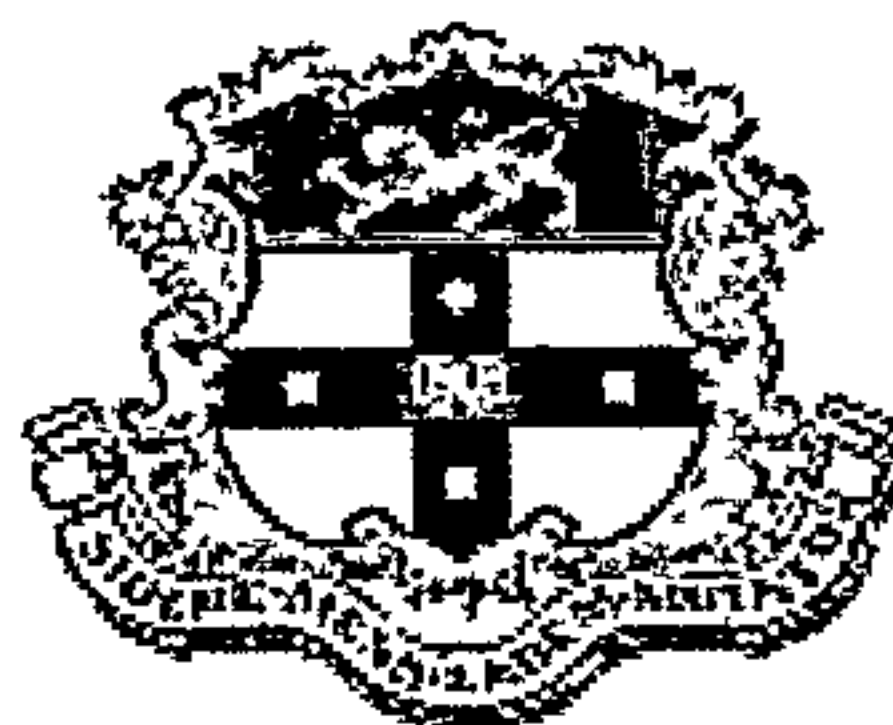
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Dental Caries in Primary School Children residing in the Blue Mountains and Hawkesbury Regions, NSW

Andy Chuan Yu Hsiau, BDS
(University Of Sydney, Australia)

A thesis submitted in partial fulfillment
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Dedication

*This thesis is dedicated to my parents,
Mr. James Yung Tsung Hsiau and
Mrs. Alice Wang Ching Hsiau
And my partner Bakita Cho
For their endless support and encouragement.*

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Summary and recommendations

Dental disease has been identified as one of the most frequent illness conditions reported and a major contributor to ill health in Australia. However, a significant reduction in the prevalence of dental disease had been observed since the introduction of various public health measures. Water fluoridation, fluoride toothpaste, and improved dental services are the major contributing factors to the improvement in dental health.

A comprehensive survey of the dental caries experience in the primary and permanent dentition of kindergarten to year six students was performed in NSW regions of Blue Mountains and Hawkesbury during the second half of 2003.

The aim of the survey was to follow up the baseline survey of caries experience of children by Patterson (1993) following the introduction of water fluoridation in the Blue Mountains region in 1992. A comparison of the outcome was made with children in the Hawkesbury region, which had been fluoridated since 1969.

Around 3,100 children aged from 5 to 13 years were selected from local primary schools and 1,963 students were included in the scope of this survey. That includes 903 from Blue Mountains and 1060 from Hawkesbury regions.

A questionnaire was completed by the parents of the children prior to the clinical survey. Information was sought on: toothbrushing habits, dietary habits, fluoride history and socio-demographic status.

The major findings from this study are that:

1. The current levels of caries experience (dmft/DMFT) in children living in Blue Mountains and Hawkesbury regions are no longer significantly different. The mean dmft score (5 and 6 year-olds) was 0.75 and 0.74 for the Blue Mountains

and Hawkesbury regions respectively. The mean DMFT score (11 and 12-year-olds) was 0.39 and 0.27 for Blue Mountains and Hawkesbury regions respectively.

2. Since fluoridation was introduced in the Blue Mountains region, the total number of decayed and filled primary teeth for 5- to 11-year-olds has fallen by 50% and the proportion of caries freedom has increased from 50 to 70%.
3. High levels of clinical caries freedom were found in both regions. Seventy-one percent of 6-year-olds and 84% of 12-year-olds had no caries experience in their primary and permanent dentition respectively in both the Blue Mountains and Hawkesbury regions.
4. The burden of caries experience in the permanent dentition was carried by only 16% of children at age 12.
5. 70% of the children examined had lifelong exposure to fluoridated water.
6. Longer periods of exposure to fluoridated water were associated with lower caries experience even in today's low caries experience environment.
7. Seventy percent of children had commenced tooth brushing with toothpaste before the age of 2 years.
8. Only a small proportion of children used fluoride supplements.
9. High intake of cordial and cola drinks increased caries risk by 40 to 50%.
10. Children who visited dentists more frequently had up to five times higher caries experience than those who never visited a dentist. This most probably reflects referrals for care by the School Dental Services and social factors

It is concluded that the introduction of water fluoridation in the Blue Mountains region achieved its purpose of bringing about a reduction in dental disease. The use of fluoridated toothpaste also contributed to this reduction. In view of the overall low caries experience among children, the focus of future oral health program should be to reduce the caries experience of children in the socially disadvantaged and higher caries experience groups.

Recommendations from the survey:

1. Water fluoridation should be continued as the cornerstone of oral public health policy.
2. Fluoridated toothpaste should be used in conjunction with water fluoridation to maximize protection to both the primary and permanent dentitions.
3. Oral hygiene instruction programs, concerning the correct use of oral hygiene aides, should be developed and delivered to children and their parents.
 - Children should be encouraged to start toothbrushing early in life.
 - Parents should dispense fluoridated toothpaste used by young children.
 - A low fluoride formulation toothpaste should be used by children under the age of 6.
 - Small headed toothbrushes should be used by children.
 - A minimum of twice daily brushing should be the norm.
4. Use of fluoride supplements discouraged because (1) of the risk of fluorosis and (2) the children who might benefit are unlikely to be reached or supervised appropriately.
5. Consumption of sugary and sticky food from dietary sources should be supervised, particularly just before bed time.
6. Regular dental visits are recommended but care should be taken by the health professionals to minimise invasive treatment and to advance intensive preventive options.
7. Follow up surveys should be conducted at regular intervals to monitor the oral health of the children.

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List of Abbreviations

ABS	Australian Bureau of Statistics
AHS	Area Health Service
BMCC	Blue Mountains City Council
CFI	Community Fluorosis Index (Dean)
F	Fluoride
F ⁻	Fluoride ion
g	gram
Kg	Kilogram
L	Litre
LGA	Local Government Area
mg	milligram
NHMRC	National Health and Medical Research Council
NSW	New South Wales
ppm	parts per million (1 ppm F = 1 mg/L F)
TF Index	Thylstrup and Fejerskov Index
WHO	World Health Organisation
µg	microgram (1 µg = 10 ⁻⁹ kg)

PART 1

**REVIEW OF LITERATURE ON DENTAL CARIES IN
PRIMARY SCHOOL CHILDREN IN AUSTRALIA**

1. Dental caries in Australia

1.1 New South Wales

Prior to water fluoridation, Barnard (1956) began in 1954 the first of the series of studies on children caries experience. It involved 6787 school children in NSW in order to gain data on the prevalence of dental caries according to age, sex, race and environment. In addition, data were gathered on eruption of permanent teeth, dental treatment previously received, and treatment necessary at the time of examination. He also investigated the relationship between the results of radiographical and clinical methods of examination. The children chosen were aged between 6 to 15 years, from both country and Sydney metropolitan areas.

The results were that the percentage of children with a caries free permanent teeth was less than 3% in 12-year-olds in both country and city areas. Boys, in general, had a higher percentage of caries freedom compared with girls. At age 6 and 12 years, the mean DMFT scores were 0.99, and 9.32 respectively. It was also shown that Sydney metropolitan children seemed to have higher DMFT scores than country area children, for example, 6 years old country children had a mean DMFT of 0.80; the score for corresponding Sydney children was 1.30. For 12 years old children, the country region DMFT score was 9.14 whereas in Sydney, it was 9.62. Boys also appeared to have a lower DMFT score than girls. The percentage of decayed portion in relation to total DMFT was high. The decayed portion decreased from 90.3% in 6-year-olds, to 51.8% in 12-year-olds, to 31.3% in 15-year-olds as they progressively become exposed to treatment services and received restorative care.

In conclusion, it was shown that dental caries was widespread among the children in NSW in 1954. Ninety-eight percent of children in the age range 6-15 years had either primary or permanent teeth affected by caries and 88.7% of permanent teeth were affected. In comparison with other children of the world, the caries free experience was greatest in New Zealand and Denmark. Barnard also offered an explanation as to why girls seemed to have higher DMFT score than boys; this can be attributed to the earlier eruption of permanent teeth in girls, whose teeth have therefore had a greater post-eruptive age.

Subsequent to the water fluoridation in Tamworth, Barnard and Martin (1972) carried out dental surveys in Tamworth in 1963, 1969 and 1972. The aim of these surveys were to determine whether the dental health of school children in Tamworth had improved as a result of instituting water fluoridation in 1963 when the fluoride level of the water supply in Tamworth was adjusted to 1ppm.

The results were that the dental caries experience in the primary teeth and permanent teeth of children been greatly reduced. For example, the DMFT score for 12-year-olds was 8.3 prior to fluoridation but reduced to 5.9 in 1969. The dmft score for 6-year-olds was 7.4 and reduced to 4.6 in 1969.

A further improvement in oral health was noted in 1971 whereas in 1963, 18% of children were caries free, in 1971 50% were caries free. In 1963, only 17% of 7 years old children had decay free permanent teeth, but in 1971 the figure had improved to 47%. In 1963, 6-year-olds had, on average, 10 cavities that needed filling and two teeth in need of extraction; however, by 1971 there were only 4.6 cavities and 0.7 teeth to be extracted in 6 years old children. The mean DMFT score for 12-year-olds was 4.7 and the mean dmft score was 3.5 for 6-year-olds in 1971.

From the commencement of water fluoridation in 1963 until 1972, the children had been exposed to 8.5 years of fluoridation. Eighty percent of the NSW population was living in fluoridated areas in 1972. Those children who had lifelong fluoride exposure showed most benefit. The results were that by 1972, 50% of 7 year olds were caries free with dmft score of 2.3. In 1963, only 1% of 8 year olds were caries free but by 1972 the figure had improved to 43%. Treatment needs also changed. In 1963, 90% of 12-year-olds needed fillings; in comparison, only 60% required fillings by 1972.

Later, Martin and Barnard (1979) published further result of the Tamworth surveys. The series of surveys which began prior to the fluoridation of the Tamworth water supply in 1963 had continued now to 1979. In Yass, the first community to introduce water fluoridation in NSW, the water content was adjusted to the optimal level of 1 ppm in 1956. The result in 1972 demonstrated a reduction in caries experience in both the deciduous and permanent dentition of children. In 1979, after over 20 years of fluoridation in Yass, the

school children now had very low level of caries experience. In 12-year-olds, a DMFT score of 2.4 in Yass was significantly lower than the reported DMFT score of 8.0 for 12-year-olds in NSW country areas at that time. The mean dmft score for 6-year-olds Yass children had also declined from 5.6 dmft in 1962 to 1.9 dmft in 1978.

In 1988, after 24 years of water fluoridation in Tamworth, Barnard and Sivaneswaran (1989) carried out a final survey in the region. The subjects in this study were children aged 5, 6, 9, 12 and 15 years. The age groups chosen for the deciduous dentition were 5, 6 and 9 years. Children aged 6, 9, 12 and 15 years were chosen for the permanent dentition. The aim of the longitudinal study was to evaluate changes in the dental health of school children in Tamworth with special interest now in the changes of treatment needs. A total of 63,000 examinations were carried out throughout the entire series of surveys.

The mean dmft score demonstrated a significant reduction from 7.2 to 1.4 during 1963 to 1988 in the primary dentition of 6-year-olds. The mean DMFT score for 12-year-olds was 8.4 in 1963 and 0.9 in 1988. The result also showed that the number of children taking regular fluoride supplements was greater in the younger age groups. The percentage of reduction in dental caries compared to baseline data was around 65-70% by 1979, and by 1988, the reduction from the 1963 baseline was around 90%.

There was also a marked increase in the percentage of caries free permanent dentition. For 6-year-olds, the carious freedom went from 46% to 78% by 1973 and to 95% by 1988. Carious free 9-year-olds comprised around 30% of the total population in 1979 but increased to 85% by 1988. For 12-year-olds, carious freedom increased from less than 1% in 1963 to 30% in 1979 and to 65% in 1988. In the deciduous dentition, the percentage of children free of dental caries rose from 17% in 1963 to over 50% in 1979. By 1988, around 60% of children had caries free deciduous dentition. In 1963, 50% of 6-year-olds required some treatment for their permanent tooth but by 1979, the treatment needs had reduced to only 4%. In 12-years-olds, the percentage of children required fillings or extractions in their permanent teeth dropped from 90% in 1963 to 19% in 1988. The treatment needs also changed dramatically; in 1963, 80% of children aged 5 years required treatment compared to only 27% in 1988. For 6-year-olds, the average number of teeth that required restorations dropped from 4.9 in 1963 to 0.7 in 1988.

In conclusion, the series of surveys showed that the Tamworth region had DMFT/dmft scores that were similar to NSW and Sydney, but in later years caries experience had become less than that of Sydney, NSW and rest of Australia.

In 1982, Burton *et al* (1983) conducted a survey for the Department of Health NSW. The aim of this survey was to determine the caries experience of children in Northern Sydney. The age group of the children was between 11 to 19 years. The survey also sought information on treatment needs in orthodontics, periodontics and was related to anterior teeth trauma. The survey results were used to assess the benefits gained in oral health from the use of school dental services, regular dental examinations, and exposure to fluoridated water. The survey sites were the lower North Shore (LNS), which was fully fluoridated, and the Central Coast (CC), which had both fluoridated and non-fluoridated areas (around 33% fluoridated). Subjects were mostly between 12 to 15 years of age.

The results indicated that 80% of the subjects had attended for oral examinations within the last 12 months, and that 87% of the subjects in LNS and 66% of the subjects in CC were caries free respectively. The percentages of subjects with caries experience in more than one tooth were 4 % and 20 % in LNS and CC respectively. Forty percent of subjects in LNS and 38% in CC had no filled permanent teeth. Overall, 31.8% of subjects were caries free when compared with Barnard's 1955 study when only 1% of the subjects had caries freedom. The mean DMFT score ranged from 1.04 to 3.94 amongst 11 to 18 years old children in LNS and 1.94 to 4.63 for the corresponding children in CC.

The comparative survey data by Barnard (1979) demonstrated that the mean score of DMF teeth for 12-year-olds in Tamworth was 8.3 in 1963, 3.9 in 1973 and 2.2 in 1979. Australia-wide, Carr (1982) found the mean DMF score for 12-year-olds to be 3.9 in 1980 whereas the Burton study had shown a DMF score of 1.3 for LNS and 2.0 for CC for 12-year-olds.

A potential confounder for this result was that the more affluent students, who visited dentists regularly, may have had a higher caries experience due to the placement of small preventive fillings. The author also found that orthodontic treatment need was a most serious and unmet dental need in children at the time.

More recently, Patterson (1990) conducted the Moree dental survey in 1990. A total of 918 children were selected in the Moree district and surrounding areas. The children selected were aged 5, 6, 9 and 12 years.

The mean DMFT score for the region was 0.87 with Moree at 0.36 and Boggabilla at 2.09 DMFT. The mean dmft score for the region was 2.29 with Moree at 2.08 and Toomelah at 3.34. The mean DMFT score in Mungindi was around three times less than the region mean; this was explained by the continued fluoridation in the region. For 9-year-olds, the mean DMFT score of 0.8 was around 2.5 times higher than the Tamworth value of 0.3.

The percentage of 6-year-olds with DMFT=0 was 95% in Moree which was similar to the Tamworth region. The 12-year-olds with DMFT=0 in Moree was only 24% compared to Tamworth's 65%. For the analysis of the deciduous dentition caries experience, children aged 5, 6, 9 and 12 were included. At age 5, the mean dmft score for Moree was 1.9 compared with 1.3 in Tamworth. At age 6, the mean dmft score was 2.3 in Moree compared with 1.4 in Tamworth. At age 9 the percentage of children with dmft=0 was 66% in Moree and 54% in Tamworth.

The results demonstrated the oral health benefits that Tamworth children had gained from water fluoridation when compared with Moree children who did not have access to fluoridation, which corresponded with the result from Barnard (1989) that showed Tamworth children benefited from water fluoridation.

Subsequently, in 1992, Patterson and Weidenhofer (1993) conducted the survey of dental health for children in the Blue Mountains and Hawkesbury regions. The study served as the baseline study for fluoride ion in the Blue Mountains, aimed to find whether there was a significant difference in the prevalence of dental disease in the primary teeth of school children who had continuous residence in the Blue Mountains and Hawkesbury regions.

At that time, children from the Upper Blue Mountains had not had the lifelong exposure to fluoridated water as the children from Hawkesbury had. A questionnaire was used to obtain the data on history of dental care, oral hygiene habits and socio-demographic patterns. The questionnaire included questions on dental attendance, sources of drinking water, tooth

brushing habits and use of fluoride supplements. A total of 18 schools were chosen and 2206 children were involved, including 1106 from the Blue Mountains and 1100 from the Hawkesbury region.

Results showed that 20.6% of parents in the Blue Mountains gained their income from pensioner and benefits schemes with 10.9% in the Hawkesbury region. Children in the Blue Mountains area were more likely to seek dental care than Hawkesbury although more public dentists were available in Hawkesbury. The Blue Mountains had a higher percentage of children with high treatment needs than Hawkesbury and had almost double the need for urgent care.

Regarding the deciduous dentition, children aged 5 to 11 years in the Blue Mountains had a mean dmft score of 1.65 and in Hawkesbury the mean dmft was 0.97. The percentages of children with caries freedom in the Blue Mountains and in Hawkesbury were 51.6% and 65.3% respectively. For the continuous residents, the dmft score was 2.22 for Blue Mountains and 0.84 for Hawkesbury, but non-continuous residents had similar mean dmft scores; 1.3 for the Blue Mountains children and 1.0 for Hawkesbury. The survey of drinking water source showed that the children who drank from the main supply had a mean dmft score of 1.71 in the Blue Mountains and 0.86 in Hawkesbury.

Patterson concluded that children living in the Blue Mountains had a higher level of dental disease; particularly those who used the non-fluoridated main water supply. The use of fluoridated water appeared to be the most significant factor in relation to the difference of dental disease in the two communities.

At the same time of the Blue Mountains survey by Patterson, Bell *et al* (March 1994) from the Dental Health unit of NSW Health Department published the results of the Child Dental Health Survey. The area covered in this survey was NSW city and country areas. The 1992 result indicated that in NSW and surrounding regions, the mean dmft score for 6-year-old children was 1.94 and the mean number of decayed teeth was 1.33. In the permanent dentition, the mean DMFT score for 12-year-old children was 1.17 and the mean number of decayed teeth was 0.64. The mean DMFT score at age 12 ranged from 0.71 in Orana to 1.68 in North Coast region. For the 6-year-olds, the percentage of dmft=0

was 54.3% and DMFT =0 was 95.2%. For 12-year-olds, the percentage of DMFT=0 was 70%.

The survey demonstrated that children with South East Asian origin had the highest mean DMFT followed by children of Middle Eastern origin. It also showed that, Australian-born children with non-Aboriginal mothers had less caries experience when compared with children whose mothers were Aboriginal or born in the Middle East or South East Asia.

Bell showed that the trend for caries experience in children has been decreasing since 1970s. In NSW, from 1977 to 1992, the mean DMFT score of 12-year-olds had decreased from 4.0 to 1.2. The mean dmft score for 6-year-olds had decreased from 2.7 in 1977 to 1.94 in 1992. The pattern of caries experience was changing also. In 1977, there were only around 34% of 12-year-old children who were caries free, but this had since increased to nearly 70% in 1992. Similarly for 6-year-olds, 46% were caries free in 1977 and 60% in 1992.

Bell *et al* (1994) then published further results of the Child Dental Health Survey; the 1993 result demonstrated that the mean dmft score for 6-year-olds was 1.96, with 1.27 being the decayed fraction. The mean dmft score for 6-year-olds ranged from 1.46 in Illawarra to 2.44 in South West Sydney. For the permanent dentition, the mean DMFT score for 12-year-old children was 1.02 with 0.5 being the decayed fraction. The mean DMFT score ranged from 0.58 in the Hunter area to 1.71 in South West Sydney.

In a comparison of DMFT scores by region, metropolitan children had higher mean DMFT scores than rural areas. Children in metropolitan locations also had higher mean numbers of decayed teeth. From 1977 to 1993, the mean DMFT score for 12-year-olds had decreased from four to one; similar reductions can also be seen in the mean dmft score, with reductions from the high of 2.7 in 1977 to 1.96 in 1993.

The Australian Institute of Health and Welfare (AIHW, 1995) then conducted a series of surveys of NSW children. Subjects were aged between 4 and 14 years. The results were that the mean dmft score for children aged 6 was 1.93 and 6-year-olds with dmft=0 was 50.6%. The mean dmft score for children aged 12 was 1.0 and the percentage of children

with dmft=0 was around 53.3%. In the permanent dentition, the mean DMFT score for 12-year-olds was 1.11 and caries freedom was enjoyed by 59.3% of children. At age 14, the mean DMFT score had increased to 1.95 and the percentage of children with DMFT=0 was 43.3%. The survey concluded that the oral health of NSW children has improved significantly.

Following on from the previous survey, the Australian Institute of Health and Welfare (AIHW, 1996), provided further descriptive data on child dental health in NSW of children aged 5, 7, 9, 11 and 13 years. A large majority of children were born in Australia (92.5%) with 3.7% from Asia; the indigenous population comprised only 1.9% of the sample.

The 1996 results demonstrated an improvement in deciduous dentition, the caries experience in children aged 5 to 10 years were ranged from 0.9 to 0.35 dmft. The mean dmft score showed an overall decline in 5-year-olds and an increase to 7-year-olds. The percentage of caries free children ranged from 72.3% in 5-year-olds to 62.3% in 7-year-olds. The mean dmft score for 6-year-olds decreased substantially from 1.75 dmft in 1995 to 0.94 dmft in 1996, however, an explanation for the dramatic improvement was not offered by AIHW. For the permanent dentition, the mean DMFT score increased across the age groups from 0.01 for 5-year-olds to 1.31 for 13-year-olds. The children with DMFT score of zero was 72.3% in 12-year-olds.

In general, the percentage of decayed teeth in total DMFT score was lower in both the youngest and oldest age groups in 1996 when compared with the result in 1995. More than 96% of children in each age group had no deciduous or permanent teeth missing due to caries and more than 55% of children at every age group had no detectable caries. The result also showed a significant increase in the percentage of children with no caries experience across all age groups.

The 1997 survey conducted by the Australian Institute of Health and Welfare (1997) found that mean number of decayed teeth from children aged 5 years or less to children aged 10 years decreased from 0.84 to 0.35. The mean dmft score increased for 8-year-olds in 1997 and the mean dmft score for 6-year-olds was 0.97. The percentage of caries free children

ranged from 73.8% among 5-year-olds to 61% among 9-year-olds. Children aged 6 years or less had the highest percentage of deciduous caries freedom.

Since 1996, there have been changes that show that the mean number of decay had a small decrease up to age 5 with a small increase in the age group thereafter. The dmft score for 7-year-olds decreased from 1.16 in 1996 to 1.10 in 1997, while for 8-year-olds, it increased from 1.12 to 1.18. In relation to the permanent dentition, the mean DMFT score increased quite consistently from 0.01 for 5-year-olds to 0.83 for children aged 14 years. The decayed component increased due to an increase in the number of permanent teeth. The mean DMFT for 12-year-olds was 0.64.

The percentage of children with permanent dentition caries freedom had decreased consistently from 99.7% for 5-year-olds to 60.9% for 15-years and older. For all ages, more than 95% of children in each age group had no deciduous or permanent teeth missing due to caries. A high percentage of children had no caries experience in 1997. However, small changes had occurred since 1996; a small decrease in the percentage of children with caries freedom was noted across most age groups.

Recently, in an attempt to further improve the oral health status of NSW children, the Save Our Kids Smiles (SOKS) ⁽¹⁹⁹⁷⁾ program was implemented in the beginning of 1996. The aim of the program was to allow access to 100% of the eligible population and to provide care, education and motivational sessions at school. The targeted population included kindergarten, second, fourth, sixth, eighth grade students and those who needed urgent care. A total of 200 dental therapist plus supporting staff were included in the SOKS program. In April 1997, the NSW Dental Health Branch published a report which aimed to give a general outline and review of the first year of the SOKS program.

After 1 year, the result showed that 34% of children needed clinical intervention and 58% of children had caries freedom. The result also indicated that 69% of children were reviewed by SOKS and 29% of children were new to the service. Around 66% of children had been seen within the last 12 months. Some 4% of children, at the time of examination had active caries and were in pain. A further 31.7% required restorations and fissure sealants. The rate of frank caries ranged from 27% in kindergarten to 35% in the second

grade and then decreased to around 22% in the eighth grade population. This indicated a high caries freedom amongst children population as shown by AIHW (1996), which had similar levels of caries freedom in their survey.

The review by SOKS program concluded that it had reached its short term goal of reducing the number of children experiencing active caries; this can be shown by the increase in the restorative work performed on those with an identified need. The ultimate aim of SOKS was continue to increase the number of children who have no experience of caries. The report by NSW Dental Health Branch, however, did not sufficiently point out the actual caries experience improvement over the baseline figure. It therefore left some doubts as to the exact effectiveness of the SOKS program.

1.2 Queensland

In 1986, Powell *et al* published the results of a survey which aimed to gain data on caries experience and gingivitis prevalence in Brisbane primary school children. Overall, 580 children aged 6, 9 and 12 years were included in the study. The schools were chosen from areas that had low, middle and high socioeconomic level (SEL) residents. Both primary and permanent dentitions were examined.

The results demonstrated that there were many notable differences in different SEL groups for the primary teeth of children aged 6 and 9 years. For 6-year-olds, the proportion of caries free primary dentition in each SEL group ranging from high, middle to low SEL was 70%, 52% and 23% respectively. The difference in permanent dentition was less marked for 9-year-olds than for 12-year-olds. For 9-year-olds, the proportion of children with caries free permanent teeth ranging from high, middle to low SEL group was 66%, 56% and 47% respectively. There were only a small number of children who exhibited high DMFT scores.

The results indicated that more dental public health resources should be spent amongst low SEL schools than the other groups. The result also demonstrated that relatively few children were at high risk for both caries and gingivitis in any age or any SEL group. The

data on gingivitis indicated that children from high SEL schools displayed a much lower proportion of bleeding sites than those from middle and low SEL schools.

Later, in the 1990s, Slade *et al* (1995) published results of the cross-sectional survey data on dental caries experience obtained from 9690 South Australian children aged 5 to 15 years and 10,195 Queensland children aged 5 to 12 years. The study assessed associations between exposure to fluoride in water and dental caries experience among children in two states. Previous studies had shown that differences in caries experience associated with exposure to fluoride in water ranged from 20% to 52% in relation to the permanent dentition and from 26% to 55% for the primary dentition.

Compared with South Australia, where over 70% of the state was fluoridated, only 5.1% of Queensland residents had fluoridated water. The survey was conducted between June 1991 and May 1992. Children from four areas were chosen, Adelaide (fluoridated since 1971), remainder of South Australia (predominantly non-fluoridated), Townsville (fluoridated in 1965) and Brisbane (non-fluoridated). The examinations were carried out by dental therapists or school dentists.

An associated questionnaire provided data on residential history of the child, sources of drinking water, use of other fluoride vehicles and household characteristics, such as socioeconomic level (SES), education level of parent, and household income. SES, fluoride exposure and interaction between the two were used as explanatory variables in regression models in which dmfs and DMFS were dependent variables.

The results demonstrated that among 5- to 10-year-olds, 39.0% to 56.9% of South Australia children and 38.9 to 57.1% of Queensland children had caries experience in primary teeth. The mean dmfs score for 6-year-olds was 2.61 in South Australia and 3.62 in Queensland. The mean DMFS score for 12-year-olds was 1.16 in South Australia and 1.70 in Queensland. In South Australia, children with lifelong fluoride exposure consistently had lower dmfs than those with no exposure; with differences ranged from 1.35 to 2.4 surfaces. In Queensland, the difference between nil and lifelong fluoride exposure ranged from 1.33 to 2.97 dmfs.

In both states, increased fluoride exposure was associated with reduced dmfs scores. The children from low SES groups had higher mean dmfs and DMFS scores than children from high SES groups. The effects of income and education remained significant after controlling for exposure to fluoridated water.

The result showed a negative and linear relationship between dental caries and lifelong exposure to fluoridated water. The weaker association between DMFS score and fluoridated water in South Australia was considered to be due to the lower caries risk and more fissure sealants placement in that state, and was consistent with a halo effect whereby many food and drinks were likely to have some partial fluoride concentration. Hence a high proportion of the population exposed to fluoridation diminished differences among exposure groups. It was concluded that water fluoridation can both reduce caries levels and also reduce SES inequality in caries experience.

Slade *et al* (1996) also investigated the difference in caries experience among children 5- to 12-years-old who were lifetime residents of either Brisbane or Townsville. Townsville was fluoridated in 1965. The 4588 children selected were lifelong residents of their cities respectively.

In Townsville, the mean dmfs score of children aged 5 to 10 varied from 1.35 to 2.64 and mean DMFS score for children aged 6 to 12 varied from 0.04 to 0.94. In Brisbane, children in the same age groups had a mean dmfs score varied from 2.98 to 4.99 and mean DMFS score from 0.10 to 1.8. On average, Townsville residents had 1.78 less dmfs than Brisbane and the mean DMFS score was 0.23 less in Townsville. Townsville had an average caries experience of 2.01 surfaces per child and Brisbane had 3.69. The author concluded that exposure to fluoridated water was the likely contributor for the difference in caries experience between the two cities which corresponded with the result of the previous study he carried out in 1995.

The dental health of Aboriginal children was investigated in 1996; Seow *et al* (1996) published the results of her study of 184 Australian Aboriginal children in Brisbane city. The mean age of the subjects was 4.4 years. The Developmental Defects of Enamel Index was used to chart enamel defects such as hypoplasia and enamel opacities. WHO criteria

were used to chart dental caries and the Oral Hygiene Index was used to chart plaque, calculus and gingivitis. The results were that 98% of children had at least one tooth affected by enamel defects. Around 78% of the children had caries experience. Those children with maxillary anterior caries lesions had a mean dmft score of 8.6 for girls and 9.3 for boys. Oral debris was found in around 98% of the children.

The study indicated that 78% of the subjects had caries experience compared with only 44% of non-Aboriginal children of similar age. Despite the high caries scores, the filled component of the dmft index only made up around 7% of the total dmft score, which indicated a high restorative need in this group.

Seow concluded that low fluoride exposure, poor oral hygiene and a diet high in refined sugars posed an important caries risk factor in this group of children.

1.3 Victoria

Spencer *et al* (1989) published survey results from a study which aimed to investigate the changing caries experience and risk factors in on children who lived in the municipality of Brunswick, Melbourne during 1977 to 1985. The survey was carried out in 1985 and it followed the protocol of the 1977 survey in the same region. Other similar studies of the time showed a decline in the caries experience in Australian children. The author wanted to confirm that observation and he also aimed to demonstrate the link between socio-demographic variables and the risk of caries experience.

In 1977, 103 children 5- and 6-year-olds were selected. The survey compromised a questionnaire administration and an oral examination. In 1985, 174 children from the same age group were chosen; a questionnaire and oral examination was also used. Equal numbers of male and female children were chosen. There were more children from state schools in 1977, but equal numbers of children were from both independent and state schools in 1985. The result demonstrated that the caries experience in 1985 was significantly lower than in 1977. Overall, the mean dmft score in 1977 was 6.4 and in 1985 it had decreased to 2.3. There were only 10.7% of caries free children in 1977, but in 1985 this figure had increased to 46.6%.

The effect of parental birthplace on caries experience had dramatically decreased; the greatest decrease in caries experience was observed in children of parents from Greece and Italy. Children whose parents came from South East Asian countries had the highest caries experience. Parental occupation-wise, children from the unemployed/pensioner category showed the least change in caries experience since 1977. The result showed that the greatest reduction in caries experience occurred in previously identified at risk groups, that is, among those children whose parents were born outside Australia, were in unskilled occupations, or remained within their ethnicity as shown by their inability to speak or read English. Variables such as fluoridation of water, toothpaste with fluoride, improved oral hygiene can all be used to explain the improvement of dental health. The study highlighted the improvement in dental health and the consistency of association between socio-demographic variables and children at high risk from caries.

In the same region, Brown *et al* (1990) also conducted a survey in 1985 which investigated data from the School Dental Services. This indicated that whilst Melbourne 8-year-olds had worse dental health than similar children in Geelong area in 1979, the situation in 1985 was the opposite. The study also aimed to determine the effects on dental caries status from factors such as socioeconomic level, residential history and fluoride history.

Historically, in 1977, the water supply for Melbourne was adjusted to contain one part per million of fluoride but water fluoridation was not introduced in Geelong. Eight-year-old children were chosen to participate in this study since it was ideal to have children with a full lifetime exposure to fluoridated water. A total of 209 children from Geelong and 208 from Melbourne were chosen. Socioeconomic status information was obtained from the Victoria Education Department. Questionnaires were given to children to be completed by their parents to find out the use of fluoride supplements, exposure to fluoridated water, tooth brushing habit and supplement usage during pregnancy. The results were that 77% of children had lived in Melbourne during all of their life compared with 74% for Geelong; 46% of Geelong subjects had taken fluoride supplements compared with only 10% in Melbourne. Overall fluoride exposure, that took into account of all forms of fluoride, showed that 85.6% of Melbourne subjects had high exposure and 82.8% of Geelong subject had none or low exposure to fluoride. The overall mean dmft score was 2.5 and the mean DMFT score was 0.5 for Melbourne children whereas in Geelong subjects had a

mean dmft score of 2.9 and a mean DMFT score of 0.5. Taking into consideration of other explanatory factors, the mean dmft scores for continuous residents were 2.3 for Melbourne and 3.1 for Geelong. Melbourne children who, did not use supplements, had a dmft of 2.4 compared with 3.5 for Geelong.

The indication was that the fluoride history rather than the residential history was the important factor for carious experience. The use of supplements showed a reverse U shape distribution where low and high SES groups use supplements less than the middle SES group. The mean dmft scores were 3.6, 2.4 and 1.6 from lowest to highest SES group respectively. This result indicated that subjects with the lowest SES and lowest fluoride experience had the highest mean dmft score. These results showed further that water fluoridation would also be beneficial for children in Geelong, particularly those in the lower social classes.

Morgan *et al* (1998) commenced a three year longitudinal study in 1989 to assess the cost effectiveness of a comprehensive school-based pit and fissure dental sealant and fluoride mouth-rinsing program in two non-fluoridated regions in Victoria; Geelong and Ballarat. The study was aimed to establish whether, in the current state of low dental caries and abundant fluoride in a variety of forms, more oral health gain could still be achieved. The Victoria regions of Geelong and Ballarat were selected for the study due to their low levels of natural fluoride in water and both regions had no fluoridated water supply.

The prospective non-randomized trial consisted of an intervention group with 256 students and a control group with 266 students. All subjects were aged 12- to 13-years. The test group received annual examinations, weekly mouth-rinses, annual placement/replacement of fissure sealants and annual oral hygiene instruction. The control group received annual examinations and annual oral hygiene education sessions from private dentists only. The selected year 7 students were known to have high levels of dental caries experience.

The result demonstrated that the majority of subjects in the intervention group had no overall increase in caries. However, in the control group, 39% of the subjects experienced no overall increase in caries, but 56% of the subjects experienced an increase in caries on one or more surfaces. The same increase in caries experience only occurred in less than

30% of subjects in the intervention group. The percentage for fissure sealants to last more than one year after placement was between 60 to 70%.

At the end of 3 years, mean DMFS scores in the intervention group was 0.93 whereas the control group was 2.35, the difference was 1.42 DMFS score. Pit and fissure caries and smooth surface caries accounted for differences of 1.00 and 0.42 respectively. The increase in the mean DMFS score over the 3 years period was greater in the control group. The mean DMFS score increased by 0.54 in the intervention group compared with 0.93 in the control group. The overall effectiveness of the comprehensive school-based program was 1.22 DMFS score reduction over 3 years.

The result demonstrated that even with the widespread fluoride use in the community (topical fluoride supplements and fluoride toothpastes), and a marked decline in the levels of dental caries, a school based dental program can still result in improvements in oral health. Goggin (1991) had also shown similar outcomes with savings of between 1.22 to 1.90 tooth surfaces over 4 years. This current study also showed that approximately 70% of the improvement in oral health was in the pit and fissure surfaces, with the remainder occurring in relation to the smooth surfaces.

The author concluded that this program would represent an efficient and effective use of community resources in non-fluoridated areas and that a comprehensive preventive dental program introduced to adolescent populations at high risk of caries can have a significant impact in caries reduction.

The survey data was further analysed by Crowley *et al* (2000). His aim was to determine the long term cost benefit of the program in the non-fluoridated regions. He found that the benefit to cost ratio, under all criteria, improved with each progressive year of the community wide programme and the overall benefit to cost ratio was positive with reduction of caries experience in children. The result showed that there were benefits to be gained from the implementation of a comprehensive dental preventive programme throughout the secondary school system in the non-fluoridated areas comparable to Geelong and Ballarat.

1.4 Western Australia

Prichard (1969) conducted a survey on 5000 West Australian school children. The purpose of the survey was to provide baseline data for future studies on the effects of fluoridation. The selected subjects from both metropolitan and country schools were all aged between 6 to 14 years. Children were grouped according to fluoride supplement exposure; groups were pre-natal, post-natal, and a combination of both and no fluoride supplementation. The results were that in the comparison with the no fluoride group, the post-natal fluoride group demonstrated a 40% reduction in caries experience. A 70% reduction in caries experience was shown in the group that received fluoride supplementation both pre-natally and after birth compared with the non-fluoride group. Lastly, the group comprising of those received supplementation both before and after birth demonstrated a 40% reduction in caries experience when compared with those child who had only received fluoride supplement following birth. The Royal Commission (1968) into fluoride supplement found that “apart from a few comprehending families the use of tablet as a public health measure is a total failure.”

The current survey revealed that there were high usages of fluoride supplement in the lower age groups. That, combined with the large number of caries free children, was indicative of the success of health education in this area. However, the supplement usage in the general population was not satisfactory.

More recently, in 1981, Medcalf and O’Grady (1983) conducted a survey in the city of Bunbury in Western Australia on the dental health of children 8 and 15 years of age. Western Australia has had fluoridation since 1968 and 90% of the state’s population live in a fluoridated environment. Bunbury however, was not fluoridated. A previous survey in 1977 demonstrated that after 10 years of fluoridation in Perth, children aged 8 years living in Bunbury experienced two fold the number of DMF teeth than comparable children living in Perth. Seven hundred children were included in the current study. Questionnaires were sent to 434 8-year-olds and 273 15-year-olds seeking to obtain information on the use of fluoride tablets and residential history.

The results were that 55% of 8-year-olds and 36% of 15-year-olds had lifelong residency in Bunbury. Children who took fluoride tablets daily had, on average, 2.78 surfaces affected

by caries compared to 8.7 surfaces for those children that sometimes or never took fluoride tablets. Immigrant children had the same mean dfs score as those children of the same age who lived in Bunbury since birth. The 15-year-olds Bunbury children who had never used fluoride tablet had an average 2.2 or 31% more DFS score than those from fluoridated areas. It was shown that children who were raised in Bunbury and did not take fluoride tablets daily had 2.79 more dfs at age 8 years and 2.2 more DFS score at 15 years of age when compared to those who did. Nearly all Bunbury children had experienced caries by the age of 8 whereas only 75 % of children in the fluoridated areas had experienced caries at this age. Data showed that 63% of parents had instituted fluoride supplements daily but only 10% had maintained it. This indicated the lack of effectiveness of supplementation program as a caries preventive measure in the community. There was no significant difference in the caries level between children who used a fluoride supplement sometimes and those who had never used them. The data also demonstrated that children living in non-fluoridated districts required more treatment and also more complex treatment.

In similar survey regions, Stockwell *et al* conducted a cross-sectional survey in 1990 to compare the caries experience in schoolchildren between non-fluoridated Bunbury/Busselton regions and fluoridated metropolitan Perth. Children aged 5, 8 and 15 years were chosen and socio-economic status was used to classify each child. A total of 3436 children were examined.

The data demonstrated that on average, Bunbury/Busselton children had consumed about nine times more fluoride tablets than Perth children and the placement of fissure sealants were about 50% more prevalent in Perth than in Bunbury. Overall, children in Bunbury/Busselton had 15% to 18% more caries experience when compared to the Perth children. The survey demonstrated that Bunbury/Busselton children had an average of 1.06 more df surfaces than the Perth children and 0.48 more DF surfaces. The children examined in the Bunbury/Busselton region had approximately 43% greater risk of having caries experience in their primary dentition than Perth and 39% more risk in their permanent dentition. The relative risk between two areas was around 1.43 in relation to the primary dentition and 1.39 for the permanent dentition. This survey indicated that although there was a less marked difference in caries experience between the fluoridated and non-fluoridated area, such a difference still existed. The author came to the conclusion that the

fluoride level in water supplies was the most likely contributor to the caries experience difference.

The following year, Riordan (1991) also conducted a survey which aimed to determine the caries prevalence and caries experience in 12-year-old children in the Perth metropolitan area that and in the Bunbury region. A correlation to relate the results to the timing and magnitude of exposure to fluoride from water, supplements, and toothpaste was also made. In the current study, 376 children were selected from Perth and 338 children from the Bunbury area. Questionnaires were given to the participants to obtain information on the location of residence, type of water supply, history of supplement usage, fluoride toothpaste usage and toothpaste swallowing habit. Fluoride exposure was classified as short, medium and long term.

The results showed that a large proportion of Perth resident had always lived in ideally fluoridated areas, and the majority in the Bunbury region had lived in low fluoridated areas. Fluoride supplements were used by around 20% of residents in Bunbury whereas only 2% in Perth had used supplements. The mean DMFT score was 0.89 in Perth and 1.57 in Bunbury. This result indicated that all fluoride exposures were associated with reduced caries experience and that an increase in total fluoride exposure was associated with decrease in mean DMFT scores. This result supported the previous findings from Medcalf and O'Grady (1983) and Stockwell *et al* (1990). The data suggested that water fluoridation had an important anti-caries effect; particularly for the 4- to 12-year-olds and that seemed to indicate that the post-eruptive effect of fluoride was more important than pre-eruptive effect.

Soon after, Riordan (1993) carried out a further study and published the results on the prevalence of dental caries and dental fluorosis among 7-year-olds in Perth. The examinations were conducted in dental therapy centres (DTC). A questionnaire covered residence from birth, age of weaning, use of fluoride tablets and toothpaste was sent out by the DTC. A total of 350 children were examined. Riordan correlated the data with age of weaning, fluoride exposure from water; fluoride toothpaste and fluoride supplement use. The results were that 88.9% of subjects had lived for 2.5 years in a fluoridated area between birth and age 4, that 76.2% of children had been breast fed, and that fluoride

supplements were used by 4.6% of the subjects. The prevalence of dental caries in permanent teeth was low. Of the 35 children who had caries, 25 children had a DMFT of 1, nine children had a DMFT of 2 and one child had a DMFT of 3. The mean DMFT score was 0.13. The 16 subjects who had used supplements all had zero DMFT. In other fluoridated area of Western Australia, in 1988, the mean DMFT scores of 7- and 8-year-olds was 0.12 and 0.22 respectively

It was noted that the mean DMFT score was higher in girls than in boys of the same age. This was said to be due to the earlier eruption of teeth in girls and that they were therefore at greater risk of caries for a longer period of time. The author concluded that current caries experience was low and that more attention should be placed on the appearance of fluorosis.

1.5 South Australia

Fanning *et al* (1979) published a report based on the analysis of surveys of South Australian kindergarten children conducted from 1970 to 1976. The data were collected during yearly examinations. Around 5000 kindergarten children were examined each year throughout South Australia. The aim of this study was to investigate the combined caries-preventive effect of fluoridated water and fluoride tablets. In addition, data was gathered on the preventive effect of fluoride on primary teeth.

Other studies at that time had reported that there were no benefits from fluoride supplement for children aged 3 to 6 years unless tablets had been taken daily for two to three years. Questionnaires were used to gain information on the fluoridated water and fluoride supplement intake. The effect of fluoride tablets on dental caries was investigated in non-fluoridated areas.

It was demonstrated that the increase in the number of caries free children corresponded to the time that fluoride tablets were taken. Eighty-seven percent of children aged 3 to 4 years who took fluoride tablets daily had no caries. Similarly, 74% of children aged 4 to 5 years and 72% of children aged 5 to 6 years who had consumed fluoride tablets daily were caries free. Those 3 to 4, 4 to 5, and 5 to 6 years old children who did not have daily fluoride tablets was associated with caries-free percentages of 65%, 48% and 40% respectively. The

result indicated that it was necessary for fluoride tablets to be taken on a daily basis for at least 3 years to become effective against caries.

Water fluoridation resulted in a significant reduction in dental caries for children aged 4 to 5 years. The percentage of caries free children from 1970 to 1976 increased from 66% to 80% at age 3 to 4 years, from 49% to 67% at age 4 to 5 years, and from 41% to 75% at age 5 to 6 years. The corresponding percentages for caries free children who received neither fluoridated water nor tablet were 69%, 49% and 41% in 1976. The effect of water fluoridation was also reflected in the mean dmft scores which showed reductions from 1.34 to 0.48 in 3-to 4-year-olds, 2.15 to 1.08 in 4- to 5-year-olds and from 2.85 to 1.83 in 5- to 6-year-olds children within the 6 year time frame.

Fanning concluded that fluoride tablets taken daily and lifelong may provide more protection than water fluoridation alone, however, he pointed out that consideration must be given to the continued and diligent use of tablets. Therefore, it was concluded that water fluoridation was still the most efficient public health measure available in caries prevention.

More recently, Arrow (1998) published the results of a two year controlled trial on the anti-caries effects of a professional tooth cleaning plus dental health education program and those of a standard preventive program. The standard program included the use of fissure sealants and application of topical fluoride only. The reasoning behind this study was that occlusal pit and fissure caries accounted for a high proportion of the total caries experience amongst children and plaque accumulation was greatest on the occlusal surfaces of molar teeth.

A total of 404 6-year-olds children took part. There were 207 in test group and 197 in control group (standard program). Examinations were carried out at the beginning and 12 and 24 months later. Children were placed into socioeconomic group according to their place of residence. In this study, more children in the test group were from higher socioeconomic regions. The result demonstrated that after two years, the intervention group may have had some preventive effects but the differences were not statistically significant when compared with the control group.

A total of 32 test subjects and 31 control subjects developed caries of the first permanent molars. The risk ratio was 0.9. Children in both groups had an average DMFT score of 0.3. The 24 months result suggested that the two preventive programs did not differ in respect to controlling of occlusal caries in molars.

The finding of this study suggested that twice daily brushing with fluoride toothpaste plus preventive care aimed at children with deciduous dentition caries experience and children with hypomineralized first permanent molars would be a good health promotion program in the public arena.

1.6 Tasmania

Wimmer (1985) reported on a survey of Tasmanian school dental services from 1979 to 1980. In total, 1971 Tasmanian school children aged 6, 8, 10, 12 and 14 years were selected, and they were then grouped according to socioeconomic status data from Tasmania Education Department. These particular groups were further classified into either fluoride or non-fluoride groups on the basis of questionnaires completed by parents regarding residential history, use of fluoride supplements, type of drinking water, and history of dental care. Subjects were further grouped into four categories according to the amount of fluoride ingested. The results were that 21.4% of children had lifelong fluoride exposure, 60.4% of children had 3 or more years of fluoride exposure and 28% of the children from this study had no experience of fluoride.

In children aged 6 to 8 years, the percentage reduction in dmft scores with the fluoride experience group 0 to 3 ranged from 43 to 55%. The mean overall dmft scores for 6-to 8-year-olds were between 2.59 to 5.97. The result of this survey demonstrated that between 1958 and 1979 there was a significant reduction in caries experience in children population due to increased exposure to fluoride.

1.7 Australia wide

Barnard (1969) published data on the areas in Australia that had been fluoridated by 1968. Prior to 1961, only Beaconsfield in Tasmania (1953) and Yass in NSW (1956) had been

fluoridated. By 1968 around 39 communities and 4 million people had access to fluoridated water.

In NSW, the Fluoridation to Public Water Supplies Act was passed in 1957. Canberra was then fluoridated in 1963. The Hunter District announced plans for fluoridation in 1968. Victoria had only two communities that were fluoridated in 1968.

In Queensland, legislation to allow for the fluoridation of public water supplies was introduced by 1963. By June 1968, five communities were already fluoridated; others which were waiting to be fluoridated included Allora, Gold Coast, Proserpine and Wandoan.

In June 1968, no communities had been fluoridated in South Australia. However, the first areas planned to be fluoridated were Adelaide metropolitan and fringe areas.

In Western Australia, the Fluoridation of Public Water supplies Act was passed in 1966, and in 1968, 75% of the population was receiving fluoridated water. At that time, residents in Bunbury, Albany and Geraldton did not have access to fluoridated water.

Tasmania passed a fluoridation act in 1962; however, it has noted previously that Beaconsfield, in 1953, was the first community to be fluoridated in Australia. The Northern Territory had not proceeded with fluoridation in 1968.

In 1983, Carr (1983) reported on the survey conducted from 1977 to 1982 of the annual assessment of school children aged 4 to 13 years. Examinations were carried out by dental therapists and each year between 250,000 to 827,361 students were examined. Weighting factors in respect to the data from each of the State were used relative to the State's population of children. A DIMF score was recorded where "I" represented "indicated for extraction".

During 1977 to 1982, a reduction of 41.4% in the mean DIMF score for age 6- to 13-year-olds was recorded and for children aged 6 to 13 years, the average number of permanent teeth that required fillings had declined by 63%. The decayed component had decreased

but the filled component, as a percentage to DIMF, had increased. Other studies also showed the trend of decreasing caries experience. Barnard (1956) recorded a mean DIMF score of 11 for children aged 13 to 14 years. Where as by 1972, WHO International Collaborative Study of Dental Man Power showed those aged 13 to 14 years in Sydney area had a mean DIMF 6.0.

Carr concluded that the annual change of caries experience for children aged 6 to 12 years seemed to have halted at an average minimum level of around 0.32 DIMF per child. This current data indicated that the decline in annual increment of dental caries had ceased as it has settled in to a constant minimum level. The factors that had contributed to the decline of dental caries included fluoridation of water, use of fluoridated tooth paste and an increase in community awareness in oral health. The author also noted that the ingestion of fluoride from dentifrices would equally contribute to the decline in caries prevalence.

Three years later, in 1986, Spencer (1986) published a paper which aimed to investigate various community oral health trends in Australian adolescent during the period from 1965 to 1978. The age of the children were all between 11- and 16-years-old. The trends investigated were exposure to fluoridated water supplies, use of fluoride supplements and use of fluoride containing dentifrices. He predicted future changes up to 1990 including reductions in the severity of caries and the continued positive impact on caries associated with each fluoride vehicle.

Spencer noted that mean DMFT scores were associated with age, length of lifetime exposure to fluoridated water, regular use of fluoride supplements and the market share of fluoride toothpaste.

One trend was that from 1966 to 1977, the proportion of children who regularly used fluoride supplements in non-fluoridated water supply areas had increased. However, Spencer also noted that as subjects age, the fluoride supplements usage decreased proportionally.

He reported that the market share held by fluoride toothpaste was negligible during 1965 to 1970. It increased to 45% during 1970 to 1975 and then to 94% by the 1980s. The number

of children who had lifetime exposure to fluoridated water supplies was negligible in 1965; the number rose slightly up to 1970s and then increased dramatically through to 1980s.

The results showed that the percentage reduction in caries severity for 12- and 17-year-olds during 1970 to 1980 was 48.8% and 39.3% respectively. For 12-year-olds in the 1980s, the total reduction in caries severity from the baseline was 57%, in which 63% of the decrease was due to fluoridated water supplies, 32% due to fluoride toothpaste and rest due to fluoride supplements. Spencer predicted that by the 1990s, the percentage reduction due to fluoridated water would be 70%, fluoride tooth paste 26% and only 2% would be due to fluoride supplements.

In conclusion, it was shown that fluoridated water supplies, fluoride supplements and fluoride containing dentifrices were all significantly associated with caries severity in Australian adolescents. The strength of association between caries severity and different fluoride vehicles showed that fluoridated water was the most important vehicle, followed by fluoride supplements and fluoride toothpaste.

In 1988, Barnard published the results of the National Oral Health Survey in Australia. The aim of this survey was to examine the changes to the dental status of children in NSW and compare it with the rest of the country. The mean DMFT score of NSW 12-year-olds dropped from 9.3 to 0.8 from 1954 to 1988.

Historically, Barnard reported that in 1954, the mean DMFT score was 9.3 at age 12 with high percentage of decayed and missing teeth. By 1963, 4.8 of the DMFT at age 12 were expressed as decayed teeth and a further 1.3 as teeth missing due to caries. Although utilization of dental services had increased, the DMFT scores ranged from 8.0 to 9.0. By 1968, 80% of Sydney was fluoridated, and the fluoride toothpaste had taken up 26% of the market by 1971. Toward the end of 1970s, 12-year-olds had a mean DMFT score of 2.0 and the fluoride toothpaste made up 62% of the market. For the deciduous dentition at age 6, by 1982, the mean dmft score had dropped from 4.8 in 1970 to 2.6 in 1984.

Caries free children also increased from 1% in 1954 to 37% in 1984. The total sugar intake was still high at around 50kg per head per year in 1982. In 1982, over 80% of children in NSW lived in fluoridated areas and fluoride toothpaste takes 94% of the market.

Results of the National Oral Health Survey showed that children 5 years of age had a mean dmft score of 1.5. Males had a slightly higher dmft figure than females. In a ranking of states, QLD and SA had the highest caries experience; Tasmania and ACT had the lowest caries experience. The survey showed that the mean dmft score for 5- to 9-year-olds was 1.7. A decrease in the mean dmft scores for 5 and 6-year-olds was also noted, which were 3.1 in 1977 and 1.7 in 1987. For the permanent dentition, the mean DIMFT score for 12-year-olds was 1.8 and 61% of the children had caries experience.

The Australian Institute of Health Dental Statistics and Research, University of Adelaide (1990), then published the results of their child dental health survey in 1989. Subjects comprised a stratified random sample of children in all Australian States and Territories. A total of 3478 children were selected for the survey aged between 4 to 15 years. Deciduous dentition data were obtained from children aged 5 to 12 years, and permanent dentition data were obtained from children aged 5 to 15 years.

The mean dmft score was 2.45 at age 4 and gradually went down to 0.75 at age 12 due to deciduous teeth exfoliation. The percentage of children with zero dmft at year 12 was 70.7%. The mean DMFT score ranged from 0.06 for 5-year-olds to 3.35 at age 15. The percentage of children with zero DMFT was 49.8% for 12 year olds. The percentage of children with zero DMFT was high for 6-year-olds; 95.2% of the children had no decay or fillings in their mouths.

The results of Australian Institute of Health and Welfare Dental Statistics and Research Unit survey from previous studies was further analysed by Spencer *et al* (1994), where he aimed to describe and interpret data on the changing prevalence of dental caries in Australia and New Zealand. Spencer also aimed to identify some determinants of caries, and remarked on the consequences of the trends in relation to the provision of oral health care.

Spencer reported that caries experience began to decrease from about 1965, which matched the increase in both exposures to water fluoridation and fluoride toothpaste. The mean DMFT score for 12-year-olds had decreased further from 4.8 in 1977 to 1.2 in 1992. In 1977, only 10% of children were caries free, but by 1992, 54% of the children were caries free. Caries now affected a minority of children, and only few children experienced a high level of caries.

Spencer indicated that high risk strategies were now being adopted for the prevention of caries among Australian children. Some population groups showed little improvement in caries prevalence including Aboriginals and recent migrants. In 1992, Aboriginal children had a substantially higher mean DMFT scores than both children born overseas and Australian born non-Aboriginals. Not only did Aboriginal children have a higher DMFT score, most of the caries experience was present as untreated decay.

In conclusion, the caries data indicated a decrease in child caries experience, which lasted through the 80s for the 6-year-olds but then stopped. For 12-year-olds, the decrease continued into the 1990s, although at a slower rate.

Spencer (1996) published a review on the rationale, context and support for water fluoridation in Australia. Historically, the earliest major cities to be fluoridated in Australia were Canberra and Hobart in 1964, which was then followed by Perth and Sydney in 1968. Melbourne was fluoridated in 1977 and Brisbane remained unfluoridated. The fluoride concentration in water supplies varied from 0.6ppm in Darwin to 1.1ppm in Hobart.

Spencer pointed out that many previous studies had already investigated the effectiveness of water fluoridation. These included the Tamworth study, which began in 1963 and continued on till 1988. The Tamworth study demonstrated that for 12-year-olds, the decrease in the mean DMFT score from 1963 to 1973 was 49%. Spencer reported that Wimmer (1985) found that among 12-year-olds, the fluoride exposed group had a DMFT score that was 51% less than the no fluoride group. Among surveys by Brown *et al* (1990), Stockwell *et al* (1990) and Riordan (1991), results all demonstrated reductions in caries experience due to fluoridated water in the range of 31-43%. The NHMRC (1991) found that water fluoridation was associated a 40% reduction in DMFT score in 1987.

The author himself also carried out child fluoride studies in 1991, 1992 and 1995. These results were that the mean dmfs score for children aged 6 years with no exposure to fluoride was 4.04 in Queensland and 4.10 in South Australia. By comparison, the mean dmfs score for children aged 6 years with lifelong fluoride exposure was 2.34 in Queensland and 1.70 in South Australia.

Spencer found that the caries protective effect from fluoride was stronger for deciduous teeth than for permanent teeth. The results also demonstrated that the high dmfs and DMFS scores were mainly found in children with low socioeconomic backgrounds, however, socioeconomic inequalities were reduced with exposure to water fluoridation. Nearly two third of the Australian population by 1996 were resided in areas with fluoridated water supplies.

Spencer reported that the water fluoridation was associated with an average reduction of 2 dmfs and between 0.12 and 0.30 DMFS. It also reduced the difference in caries experience between high and low socio-economic group by around 1 dmfs and 0.2 DMFS per child respectively. He concluded that water fluoridation remained the most effective and economic measure to achieve a community wide reduction in caries.

In 1997, Diesendorf *et al* suggested that there might be some mechanism by which fluoride damages bone. He also said that there was a negligible benefit from ingesting fluoride, and that any benefit from fluoridation came from the action of fluoride at the surface of the teeth before fluoridated water was swallowed. Diesendorf stated that health authorities in Australia and New Zealand should consider the discontinuation of the fluoridation in drinking water.

Subsequently, Spencer (1998) tested previous claims made by Diesendorf on new evidence regarding water fluoridation. Spencer also provided opposing arguments on the relationship between fluoride and bone fracture. He cited evidence on both the pre-eruptive and post-eruptive benefit of fluoride ingestion. A study by Klein (1948) suggested the benefit of fluoride was both pre- and post-eruptive. Post-eruptive effects included lowering of pH for dissolution of fluorapatite crystals, reduced energy requirements for

remineralisation of fluorapatite crystals, decreases acid production by plaque and altered plaque microbial composition. NHMRC (1991) found that the water fluoridation was associated with 60% and 40% reduction of caries experience in 1977 and 1987 respectively.

In summary, Spencer reported that water fluoridation was found to be effective in preventing caries even in the presence of toothpaste with fluoride and other topical fluoride vehicles, and it represented a good public health measure through its ability to reduce socioeconomic inequalities.

PART 2

DENTAL CARIES EXPERIENCE IN THE BLUE MOUNTAINS AND HAWKESBURY REGIONS

2. Introduction

Australia is a federation of six States and two Territories. The states are responsible for community health and the implementation of health care programs. The legislation providing for water fluoridation in Australia is established at the State or Territory level. Fluoridation commenced in the State of New South Wales (NSW) in 1956 in the community of Yass. The Fluoridation of Public Water Supplies Act was passed in 1957 to authorise and control the addition of fluorine to public water supplies in NSW (Barnard 1969). This study is about caries experience following water fluoridation in the Blue Mountains and Hawkesbury regions.

Sydney, NSW, commenced water fluoridation in 1968 (Spencer 1996). The fluoride level for Sydney water was then set at an optimal level of 1.0 ppm (Anon 1968). The Hawkesbury Local Government Area is located north-west of Sydney stretching from the Cumberland Plain to the Blue Mountains escarpments. The piped water in Hawkesbury has been fluoridated since 1969 at the optimal level of 1.0ppm. The Sydney Water Board took over the control of the Blue Mountains water supply in 1980 and informed the Blue Mountains City Council that the water supply would be fluoridated in due course. Works to upgrade the water supplies at Greaves Creek and Cascade Dam commenced in 1990 and two new fluoridation plants were installed. In April 1992, the water supply to Leura, Katoomba, Medlow Bath, Blackheath, and Mt Victoria areas in the western Blue Mountains region were fluoridated. The fluoride concentration was adjusted to 1 ppm.

2.1 Purpose of the study

This study was conducted with the primary purpose of following up the caries experience outcome among children in the Blue Mountains since the introduction of water fluoridation, and to compare this outcome with the caries experience among children in Hawkesbury, where fluoridation had been introduced much earlier in 1969.

In addition to the effects of fluoridation on caries experience, a secondary purpose was to investigate the effects of other risk factors for caries and to assess their strengths of

association with caries experience. The other factors investigated were diet factors, tooth brushing habits, and exposure to fluoride toothpaste, fluoride gel, fluoride rinses, and fluoride tablets. Further investigations into the effects on caries experience of country of origin, parent education level, socioeconomic status, and dental health factors were also carried out.

2.2 Baseline survey

Patterson and Weidenhofer (1993) carried out a study in the Blue Mountains and Hawkesbury Local Government Areas (LGA) in 1992. The study aimed to establish whether differences existed in dental caries experience in primary school children aged 5 to 11 years who had been continuous residents in the two survey areas. It was aimed to serve as a basis of comparison for future studies. Patterson found that children in the Blue Mountains had a higher level of dental disease and he concluded that the non-availability of fluoridated water in the Blue Mountains was the most significant reason for the different disease levels in the two communities.

The Hawkesbury LGA was chosen as a comparison region in the survey due to its similarity in socio-demographic factors (it has been fluoridated since 1969) and geographic proximity to the Blue Mountains.

2.3 Local Demographic Information

2.3.1 The Blue Mountains Local Government Area

The Blue Mountains LGA has a population of 73,675 people (2001 census) and extends from Lapstone in the east to Mt Victoria in the west, north to Bell and follows the Bells-Line-of-Road to Berambing (www.bmcc.nsw.gov.au). It covers 143,000 hectares on the Great Dividing Range in the west of the Greater Sydney Region. About 70% of the area is incorporated in the Blue Mountains National Park.

In 2001, there were over 16,200 persons employed in the Blue Mountains LGA. Many were employed in community services and the hospitality industry, with others employed

in retails trade, health services, education, construction, government and personal services. Around 65% of the local population had full time employment and 34% had part time employment.

The LGA has shown a significant population growth as a general trend. The population rose from 55,877 in 1981 to 63,779 in 1986; an increase of around 14.3% annually. The population further increased to 72,506 in 1996. The largest growth has taken part in areas such as Medlow Bath, Megalong Valley and Mt Wilson/Mt Irvine/Mt Tomah.

2.3.2 The Hawkesbury Local Government Area

Hawkesbury covers around 2,800 sq Kms and extends from the Cumberland Plain in the south and east, to the foothills and escarpments of the Blue Mountains to the west and north. Hawkesbury is divided by five rivers, and includes the Hawkesbury/Nepean, Grose, Colo and Macdonald River valleys.

The population of Hawkesbury as at the 30th June 2001 was 61,073. In the period between 1976 and 2001, the population has more than doubled. It grew from less than 30,000 people in 1976 to 61,073 in 2001. Between 1996 and 2001 it was increasing by 6.4% annually. South Windsor recorded the highest increase in residents followed by Kurrajong Hills, East Kurrajong, Yurramundi-Agnes Banks and Lower Colo. South Windsor and Bligh Park are the major population centres.

The wholesale and retail sectors provide the major employment opportunities in the area, followed by community services, defence and public administration, and manufacturing. The LGA provides a mixture of rural and urban lifestyles and the Hawkesbury River system attracts a considerable number of visitors.

(Map of the Blue Mountains and Hawkesbury – Appendix A)

2.4 Ethics review

Permission for the survey was obtained from the Human Research Ethics Committees of the following organizations:

- The University of Sydney
- The New South Wales Department of Education and Training
- The Wentworth Area Health Services

(Ethics approval – Appendix B)

3. Material and Method

3.1 Target population

The target population was the primary school children in the Blue Mountains and Hawkesbury Local Government Areas of Sydney, New South Wales.

3.2 The 1992 sample

The 1992 survey included clusters of children of which each cluster comprised the age 6 and age 12 children in selected primary schools. The schools in each region were stratified according to size, and then schools were randomly selected within each stratum. The number of schools selected in each stratum was proportional to the stratum size. The selected schools are shown in Table 3.1.

Table 3.1: Selected schools for the 1992 baseline survey of caries experience

<i>Blue Mountains LGA</i>	<i>Hawkesbury LGA</i>
Blackheath Gateway Christian	Bilpin Public
Blackheath Public	Cattai Public
Katoomba North Public	Ebenezer Public
Katoomba Public	Glossodia Public
Leura Public	Kurrajong North Public
Mt Victoria Public	Kurrajong Public
St Canices Primary School	Kuyper Christian*
	Maraylaya Public
	Oakville Public
	Vineyard*
	Wilberforce Public School

*Not included in the current study

3.3 The 2003 sample

The sampling of subjects in 2003 followed the baseline survey design by Patterson in 1992, with the exception that children of all ages were included in current study. In the 2003 survey, children were sampled from only those schools selected in the 1992 survey with two exceptions; Kuyper Christian and Vineyard schools in the Hawkesbury LGA were excluded due to boundary changes in the Area Health Services. The class lists of the children attending the schools were provided by the principals.

3.4 Approach to schools

School principals were approached by letter of invitation to take part in the survey. An appointment was then made with each principal to explain the study fully. All school principals agreed to take part in the survey and completed a formal letter giving consent.

(Letter for school principals–Appendix C)

3.5 Recruitment of subjects

Children of all ages were included in the 2003 survey. All students were given an information pack containing an information statement, a consent form and a questionnaire to take home and parents were requested to return the completed questionnaire and the consent form to the school before the examination date. A reminder notice was sent to the parent one week after forwarding the information packages via their children. Only subjects for whom consent had been given were examined. Students who were missing from school on the day of examination were not given an alternative date for an examination due to the busy study schedule.

(Information package for parents/guardians – Appendix D)

3.6 Questionnaire survey

The questionnaire used for the survey was obtained from the Australian Research Centre for Population Oral Health (ARCPPOH). This questionnaire was used in this survey to allow for standardised collection of information within Australia. Information was collected on the following topics: dental practices, birth place and residential movements,

dietary intake, characteristics of the household and general information. Some minor amendments were made for the questionnaire to allow for demographic variations.

(The questionnaire – Appendix E)

3.7 Clinical survey

The diagnostic criteria for dental caries were according to WHO guidelines (WHO 1997). Teeth were examined wet under artificial lighting by the visual and gentle tactile method and no radiographs were taken. Plain dental mirrors and WHO probes were used during the examinations. The status of the occlusal, mesial, distal, buccal and lingual tooth surfaces were recorded separately. Related treatment needs were also determined and recorded. In addition, developmental defects of enamel were determined according to the Developmental Defects of Enamel Index (DDE Index) criteria (WHO 1997), and the plaque deposits were rated according to the Plaque Index of Silness and Loe (1967).

(Data code for clinical survey – Appendix I)

3.8 The conduct of the examination

Examinations were carried out in rooms made available within the school grounds. These included normal classrooms, meeting rooms, and Community Medical Centres. Portable folding examination chairs were used for student to lie on. Halogen lights were used as the light source. One examiner and one recorder were paired. The children were led by their teachers and came in order of their class. Protective eye wares were provided and examinations were carried out with student in supine position. The results were called out by the examiner and entered directly into a laptop computer by the recorder.

3.9 Survey team

The survey team consisted of two primary examiners (dental surgeons), two recorders (dental surgeons), two supervisors (University of Sydney Lecturers), one photographer (dental surgeon) and one part time co-coordinator (dental therapist). The roles were interchanged between team members as required.

3.10 Examiner calibration

Examiner calibration was developed prior to the survey using images of caries lesions and other conditions. Examiners were calibrated at the commencement of the survey under the supervision of the calibrating examiners. Intra-examiner reliability was monitored by recalling children for a second examination without the knowledge of the primary examiner; this was organized by the recorder and supervisor. Inter-examiner calibration was also carried out at regular intervals with the calibrating examiner.

Examiner reliability was assessed via calculations of the Kappa statistic by using the duplicated measurements from both intra- and inter-examiners. Both simple and weighted kappa values were calculated.

(Kappa table – Appendix G)

3.11 Data entry

Data were recorded directly into a pre-set excel spread sheet on a Dell Inspiron 8500 series laptop during the survey. The information recorded at the time of the survey was name, identity number, date of birth, date of examination, sex and examiner.

Data from the completed questionnaires were checked and recoded where necessary before being entered into an electronic database manually by data entry operator.

(Sample Excel Data sheet – Appendix H)

3.12 Analysis

Data were checked for inconsistencies and abnormal values through inspections of the distributions of variables. When discrepancies were found, the questionnaires were checked and the database was amended.

The analysis of the data was carried out using the SAS statistical software for Windows (Version 8, copyright by SAS Institute Inc., Cary, NC, USA).

3.12.1 The development of the analysis

Age specific dmft and DMFT comparisons between for Blue Mountains and Hawkesbury regions were performed using the t-test.

The analysis initially focused on the deciduous and permanent dentitions 5 to 6-year-olds and 11 to 12-year-olds respectively. This was to follow the analysis method of the child dental health survey NSW (AIHW, 2000).

Bivariate analyses of the associations between caries experience (dmft for age 6 and DMFT for age 12) and all potential explanatory variables were performed. Data from children aged 5 were not included with that of the 6-year-olds because they did not have decayed incisors (only 1 of n=74 had decayed primary incisors) (See appendix Tables K). We were interested in comparisons with existing data that does not include 5-year-olds in Australia. Mean dmft/DMFT scores were computed for each categorical variable class and differences were tested using the Kruskal-Wallis test. For continuous type explanatory variables, the bivariate associations with dmft/DMFT scores were explored using linear regression.

Risk of dental caries in the primary and permanent dentitions was explored separately among the 5-9 year-olds and 6-13 year-olds respectively. This risk was explored using logistic regression analyses whereby potential explanatory variables were those showing a univariate association ($p < 0.2$) with dmft and DMFT. Variables thus identified were used as independent predictors in multiple logistic regression analyses. The dmft/DMFT values were dichotomized as “0” for zero dmft/DMFT and “1” for dmft/DMFT one and above.

Explanations of caries experience in the primary and permanent dentitions of 5-9 and 6-13 year-olds respectively were conducted using multiple logistic regression modeling methods, where the backward stepwise selection option was employed. However, since a great majority of children were caries free, this limited the potential to find significant associations and therefore the use of poisson regression modeling was also explored.

4. Results - Overall caries experience

A total of 3,100 children aged between 5 to 13 years were selected, and of these, 1,963 children who had parental consent took part in the survey. This number included 1060 children from the Hawkesbury region and 903 children from the Blue Mountains region as shown in Table 4.1.

The overall response rate was 63 percent. Where the Hawkesbury region had 66% response rate and the Blue Mountains had 61%.

The differences of dmft/DMFT index between male and female children were found to be not significant; therefore separate results were not shown.

4.1 Deciduous dentition caries experience

The distributions of mean dmft among children in the Blue Mountains and Hawkesbury regions by age are given in Table 4.2.

Caries experience in the deciduous dentition is expressed as the mean number of decayed, missing and filled teeth. The mean and standard deviation for each component of the dmft index for the ages 5-12 years are given in Table 4.3. There was a noted decline in the decayed component with increasing age, from 0.45 teeth among 6-year-olds to 0.15 teeth among 12-year-olds. The numbers of missing teeth due to caries are small across all age groups. Filled teeth increased from a mean of 0.24 at age 5 to 0.54 at age 9, then declined to a mean of 0.21 at age 12. The mean dmft score increased from 0.59 to 0.88 between ages 5 and 7 then declined to 0.37 at age 12. The percentage of children who had clinically caries-free dentition declined from 80.0% to 65.7% between the ages of 5 and 8 years, however, this percentage then increased steadily to 82.5% at age 12. The d/dmft ratio was highest among 6-year-olds (57.7%) and declined to 30.3% for children aged 11 years.

4.2 Permanent dentition caries experience

The distributions of mean DMFT among children in the Blue Mountains and Hawkesbury regions by age are given in Table 4.4.

The mean number of decayed permanent teeth was low in all age groups (Table 4.5). Mean D-teeth increased with age from 0.01 at age 6 to a high of 0.1 at age 12. The filled pattern with also increased steadily from 0.02 at age 6 and peaked at 0.26 for age 11. Mean DMFT scores also increased gradually with age, from 0.03 at age 6 to 0.33 at age 11; the DMFT score for age 12 was 0.30. A high percentage of children (more than 90%) had no permanent dentition caries experience by age 9 and more than 80% of children remained clinically caries-free up to age 13.

Table 4.1: The sample of children examined in the Blue Mountains and Hawkesbury regions, NSW

Age (in years)	Blue Mountains						Hawkesbury						Total						
	Male			Female			Both			Male				Female			Both		
	n	%		n	%		n	%		n	%			n	%		n	%	
5	21	4.8		23	5.0		44	4.9		14	2.7		17	3.2		31	3.0		75
6	67	15.2		93	20.0		160	17.7		81	15.4		82	15.3		163	15.4		323
7	60	13.7		72	15.5		132	14.6		68	13.0		73	13.6		141	13.3		273
8	63	14.3		72	15.5		135	15.0		86	16.4		76	14.2		162	15.3		297
9	74	16.9		57	12.3		131	14.5		78	14.9		82	15.3		160	15.1		291
10	57	13.0		69	14.9		126	14.0		81	15.4		66	12.3		147	13.9		273
11	55	12.5		39	8.4		94	10.4		64	12.2		77	14.4		141	13.3		235
12	39	8.9		38	8.2		77	8.5		51	9.7		61	11.4		112	10.6		189
13	3	0.6		1	0.2		4	0.4		2	0.3		1	0.2		3	0.2		7
Total	439	100		464	100		903	100		525	100		535	100		1060	100		1963

Table 4.2: Distribution of mean dmft among children in the Blue Mountains and Hawkesbury regions by age.

Age	Blue Mountains			Hawkesbury			dmft difference	p-value*
	n	Mean dmft	SD	n	Mean dmft	SD		
5	43	0.44	1.26	31	0.70	1.54	-0.37	0.28
6	160	0.84	1.78	163	0.73	1.54	0.11	0.93
7	132	0.75	1.75	140	1.00	1.05	-0.25	0.23
8	135	0.90	1.54	162	0.83	1.63	0.07	0.19
9	131	0.75	1.45	160	0.96	1.72	-0.21	0.27
10	126	0.71	1.47	147	0.76	1.50	-0.05	0.37
11	94	0.89	1.65	141	0.51	1.10	0.38	0.03
12	77	0.42	0.98	112	0.34	1.00	0.08	0.50

*Wilcoxon two sample test.

Table 4.3: Deciduous dentition caries experience statistics for the combined Blue Mountains and Hawkesbury regions by age

Age	Children	decayed (d)		missing (m)		filled (f)		dmft		d/dmft	dmft=0	
	n	mean	SD	mean	SD	mean	SD	mean	SD	%	%	%
5	75	0.31	0.97	0.04	0.35	0.24	0.77	0.59	1.38	52.5	80.0	
6	323	0.45	1.18	0.02	0.19	0.32	0.95	0.78	1.66	57.7	71.3	
7	273	0.42	1.12	0.03	0.22	0.43	1.10	0.88	1.80	47.7	71.4	
8	297	0.32	0.77	0.04	0.24	0.50	1.20	0.86	1.59	37.2	65.7	
9	291	0.29	0.78	0.03	0.27	0.54	1.19	0.87	1.61	33.3	67.0	
10	273	0.21	0.61	0.03	0.24	0.50	1.23	0.74	1.49	28.4	68.5	
11	235	0.20	0.57	0.00	0.01	0.47	1.10	0.66	1.36	30.3	71.9	
12	189	0.15	0.45	0.01	0.10	0.21	0.77	0.37	0.99	40.5	82.5	

Table 4.4: Distribution of mean DMFT among children in the Blue Mountains and Hawkesbury regions by age.

Age	Blue Mountains			Hawkesbury			DMFT difference	p-value*
	n	mean DMFT	SD	n	mean DMFT	SD		
6	160	0.04	0.25	163	0.02	0.17	0.02	0.40
7	132	0.05	0.32	140	0.04	0.22	0.01	0.78
8	135	0.16	0.61	162	0.15	0.56	0.01	0.90
9	131	0.18	0.59	160	0.30	0.89	-0.12	0.36
10	126	0.27	0.72	147	0.35	0.80	-0.04	0.28
11	94	0.40	0.87	141	0.51	0.75	-0.11	0.22
12	77	0.36	0.84	112	0.25	0.77	0.11	0.15
13	4	0.00	0.00	3	0.33	0.58	-0.33	0.42

*Wilcoxon two sample test.

Table 4.5: Permanent dentition caries experience statistics for the combined Blue Mountains and Hawkesbury regions by age

Age	Children	Decayed (D)		Missing (M)		Filled (F)		DMFT		D/DMFT		DMFT=0	
	n	mean	SD	mean	SD	mean	SD	mean	SD	%		%	
5	75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0		100.0	
6	323	0.01	0.08	0.00	0.00	0.02	0.18	0.03	0.21	22.2		98.1	
7	273	0.03	0.23	0.00	0.00	0.01	0.15	0.04	0.27	62.5		97.4	
8	297	0.05	0.32	0.00	0.00	0.10	0.49	0.16	0.59	33.5		91.6	
9	291	0.04	0.24	0.00	0.00	0.20	0.70	0.24	0.77	18.1		88.3	
10	273	0.05	0.34	0.01	0.14	0.25	0.67	0.32	0.76	17.1		81.3	
11	235	0.08	0.36	0.00	0.00	0.26	0.74	0.33	0.80	23.0		80.4	
12	189	0.10	0.47	0.00	0.00	0.20	0.63	0.30	0.80	33.8		84.1	
13	7	0.00	0.00	0.00	0.00	0.14	0.38	0.14	0.38	0.0		85.7	

5. Results - The primary dentition at age 6

5.1 Bivariate associations of primary dentition caries experience by potential explanatory variables

Table 5.1 presents the bivariate analysis of primary dentition caries experience and potential explanatory variables for 6-year-olds. The potential explanatory variables fall under the headings of: toothbrushing factors, other fluoride exposure, variables not otherwise categorised, socioeconomic factors, and demographic factors. Of the 46 potential explanatory variables, four were found to be significantly associated with the mean dmft score. These were FGEL1 (Fluoride gel application by school dental services) listed under other fluoride exposure; VISIT (Time since last dental visit); VISWHERE (Location of last dental visit); and VISWHY (Why did you last seek treatment for child) listed under variables not otherwise categorised.

5.1.1 Dental caries and other fluoride exposure

The bivariate analysis showed that fluoride gel application by The School Dental Service (FGEL1) was a statistically significant risk factor for dental caries. Those children who had no fluoride gel application were shown to have a lower mean dmft score than the children who had received gel applications. The children who had received fluoride gel applications had twice the dmft score compared with those who did not receive applications. The majority of the 6-year-olds (more than 90%) had not used fluoride tablets, drops or mouthrinses. Most of them (more than 80%) had no received fluoride gel application at this particular age as well

5.1.2 Dental caries and toothbrushing factors

The majority of the children were shown to have brushed at least once a day since toothbrushing commenced. They had also used mainly low fluoride concentration

toothpaste (82%) when toothbrushing commenced and a large proportion of children (57%) had continued with this type of toothpaste. The usage of small sized toothbrushing also was common; it was shown that more than 75% of children used small toothbrushes. All toothbrushing variables were not significantly associated with deciduous caries experience.

The result also showed that when children first started to brush, they tend to eat more toothpaste (59%) and swallow after rinsing at a greater percentage (34%). However, when they reached the age of 6, only a smaller number of children (35%) continued to eat toothpaste and most of the children (82%) started to rinse and spit.

5.1.3 Dental caries and socioeconomic/demographic factors

All potential explanatory variables were not significantly associated with deciduous caries experience due to the limited number of cases, however, result showed that children of Aboriginal and Torres Strait Islander origin had higher dmft score (2.1 and 3.0 respectively) when compared to children of other origins (0.76). Similar result was also shown when parents were of Aboriginal and Torres Strait Islander origin; their children also exhibited a higher dmft score.

5.1.4 Dental caries and variables not otherwise categorised

Bivariate analyse showed that the time since last dental visit (VISIT), location of last dental visit (VISWHERE) and reason for last seek treatment for child (VISITWHY) were statistically significant risk factors for dental caries experience.

Parents of 41% of the children reported that they had never taken their children to see a dentist. The lowest mean dmft score was associated with those children who last visited a dentist more than two years ago, 0.06, and the highest value, 1.29, was for those children who visited a dentist less than six months ago; this difference between the two mean dmft scores was 20-fold.

Regarding the location of last dental visit, the highest mean dmft score of 1.5 was for children who last visited a public child dental clinic. The children who had never received dental care had the lowest mean dmft score of 0.4.

The reason for seeking treatment was also significantly associated with dmft; parents of 129 children (40%) reported that their child had never received dental care, and 119 children (37%) had a dental check up only at their last visit. Those children who received fillings at their last visit had the highest mean dmft score, 2.59.

5.2 Linear regression of deciduous caries experience on potential explanatory variables

Table 5.2 contains the results of the linear regression of mean dmft score on explanatory variables. The potential explanatory variables fall under the headings of: toothbrushing factors, other fluoride exposure, dietary factors and variables not otherwise categorised. Of the 39 variables, two were significantly associated with caries experience in 6-year-olds. These were WF (Years spent in a water fluoridated area) listed under other fluoride exposure; and CORD2 (Sweetened cordial drinks taken one hour before bed) listed under dietary factors.

5.2.1 Dental caries and other fluoride exposure

The analysis showed that the time (unit in years) living in a water fluoridated area (WF) was associated with deciduous caries experience (parameter estimate = -0.19, F-value = 5.54, p = 0.02). This indicated that every year children spent in a water fluoridated area would result in reductions of 20% in the dmft score.

The other potential risk factors listed under the headings were in all cases limited to a few children only and therefore no meaningful comparison was possible.

5.2.2 Dental caries and dietary factors

Consumption of sweetened cordial drinks one hour before bed (CORD2) was significantly associated with primary caries experience (parameter estimate = 0.57, F-value = 4.2, p-value = 0.04). This showed that with each cordial drink consumed before bed will result in an increase in dmft score by 57%.

5.2.3 Dental caries and toothbrushing factors

The age of the child at the commencement of toothbrushing was shown to be not significant with p value at 0.67.

5.2.4 Dental caries and variables not otherwise categorised

All potential explanatory variables within this category were not significantly associated with deciduous caries experience.

Table 5.1: Bivariate associations of deciduous dentition caries experience among 6-year-olds living in the Blue Mountains and Hawkesbury regions with residence history, fluoride history and health related behaviour variables

Potential explanatory variable	Category (numbered)	Number	mean dmft	SD	SE	Chi-square	p value
<i>Toothbrushing factors</i>							
TBEVER Ever brushed his/her teeth with toothpaste	1. Yes 2. No Missing/Excluded data	315 3 5	0.77 2.67 0.50	1.620 4.618 1.000	0.090 2.666 0.500	0.268	0.136
TPTIMES1 Frequency of brushing with toothpaste at age when toothbrushing commenced	1. Less than once a day 2. Once a day 3. Twice a day 4. More than twice Missing/Excluded data	64 143 101 2 13	0.56 0.90 0.82 0.00 0.46	1.446 1.898 1.526 0.000 0.776	0.181 0.159 0.152 0.000 0.215	2.405	0.602
TPTIMES2 Frequency of brushing with toothpaste now	1. Less than once a day 2. Once a day 3. Twice a day 4. More than twice Missing/Excluded data	17 116 174 1 15	1.00 0.77 0.79 3.00 0.40	2.715 1.644 1.607 0.737	0.658 0.153 0.122 0.190	3.954	0.581
TPTYPE1 Type of toothpaste used when toothbrushing commenced	1. Fluoride toothpaste 2. Children's toothpaste 3. Non-fluoridated paste 4. Don't know/not sure Missing/Excluded data	37 266 5 1 14	0.43 0.85 0.80 0.00 0.43	0.899 1.780 1.303 0.756	0.148 0.109 0.583 0.202	3.543	0.473
TPTYPE2 Type of toothpaste used now	1. Fluoride toothpaste 2. Children's toothpaste 3. Non-fluoridated paste 4. Don't know/not sure Missing/Excluded data	118 183 5 1 16	0.67 0.90 0.80 0.00 0.38	1.427 1.862 1.304 0.719	0.131 0.138 0.583 0.180	0.976	0.633

Potential explanatory variable		Category (numbered)	Number	mean dmft	SD	SE	Chi-square	p value
TPLICK1 Ever noticed child eating or licking toothpaste when toothbrushing commenced		1. Often	33	1.12	2.666	0.464	0.353	0.562
		2. Sometimes	157	0.75	1.466	0.117		
		3. Never	119	0.77	1.634	0.150		
		Missing/Excluded data	14	0.43	0.756	0.202		
TPLICK2 Ever noticed child eating or licking toothpaste now		1. Often	10	0.50	1.080	0.341	1.166	0.693
		2. Sometimes	106	0.77	1.395	0.136		
		3. Never	191	0.84	1.869	0.135		
		Missing/Excluded data	16	0.38	0.719	0.180		
TBSIZE1 Size of toothbrush when toothbrushing commenced		1. Small size	302	0.80	1.681	0.097	0.442	0.632
		2. Regular size	6	1.00	2.449	1.000		
		Missing/Excluded data	15	0.40	0.737	0.190		
TBSIZE2 Size of toothbrush now		1. Small size	242	0.73	1.553	0.100	2.066	0.165
		2. Regular size	64	1.09	2.150	0.269		
		Missing/Excluded data	17	0.35	0.702	0.170		
TBSPIT1 What child did after toothbrushing when toothbrushing commenced		1. Just swallow	55	0.64	1.457	0.197	6.243	0.217
		2. Rinse and swallow	56	0.57	1.386	0.185		
		3. Rinse and spit	144	1.05	2.025	0.168		
		4. Just spit	47	0.57	1.078	0.157		
		5. Other	0					
		6. Don't know	8	0.25	0.707	0.250		
		Missing/Excluded data	13	0.46	0.776	0.215		

continued over

Potential explanatory variable		Category (numbered)	Number	mean dmft	SD	SE	Chi-square	p value
TBSPIT2 What child does after toothbrushing now		1. Just swallow	6	0.17	0.408	0.167	8.455	0.088
		2. Rinse and swallow	18	0.06	0.236	0.056		
		3. Rinse and spit	262	0.81	1.658	0.102		
		4. Just spit	23	1.39	2.535	0.528		
		5. Other	0					
		6. Don't know	0					
TPP1 Amount of toothpaste used on his/her toothbrush when toothbrushing commenced		Missing/Excluded data	14	0.43	0.755	0.202		
		1. Full brush	21	0.86	1.388	0.303	1.981	0.490
		2. Pea sized	80	0.60	1.472	0.165		
		3. Smear	207	0.87	1.799	0.125		
		Missing/Excluded data	15	0.40	0.735	0.190		
TPP2 Amount of toothpaste used on his/her toothbrush now		1. Full brush	57	0.56	1.102	0.145	3.704	0.091
		2. Pea sized	165	1.01	1.954	0.152		
		3. Smear	85	0.55	1.427	0.155		
		Missing/Excluded data	16	0.44	0.727	0.182		
Other fluoride exposure								
FTAB Ever taken fluoride tablets or drops		1. Fluoride tablets only	10	1.70	2.350	0.746	3.550	0.080
		2. Fluoride drops only	11	0.36	0.809	0.244		
		3. Fluoride tablets and drops	2	3.00	4.242	3.000		
		4. No fluoride tablets or drops	295	0.76	1.642	0.096		
		5. Don't know	1	1.00				
		Missing/Excluded data	4	0.50	1.000	0.500		
FRIN Ever used fluoride mouthrinse		1. Yes	8	0.38	0.744	0.263	1.566	0.882
		2. No	308	0.80	1.693	0.096		
		3. Don't know	3	1.00	1.000	0.577		
		Missing/Excluded data	4	0.50	1.000	0.500		

continued over

Potential explanatory variable		Category (numbered)	Number	mean dmft	SD	SE	Chi-square	p value
TOF1 Frequency of fluoride tablets or drops intake Birth - 6 months		1. More than once a day	0				1.306	0.585
		2. Once a day	1	0.00				
		3. 5 to 6 times a week	0					
		4. 2 to 4 times a week	1	0.00				
		5. Once a week	0					
		6. Infrequently/varied	0					
		7. Did not take at this age	8	0.77	1.642	0.092		
		Missing/Excluded data	313	1.50	2.507	0.886		
TOF2 Frequency of fluoride tablets or drops intake 6 months - 4 years		1. More than once a day	0				6.214	0.463
		2. Once a day	8	1.63	2.263	0.800		
		3. 5 to 6 times a week	0					
		4. 2 to 4 times a week	3	2.00	2.645	1.527		
		5. Once a week	2	1.00	1.414	1.000		
		6. Infrequently/varied	2	0.00	0.000	0.000		
		7. Did not take at this age	2	0.00	0.000	0.000		
		Missing/Excluded data	306	0.76	1.645	0.094		
TOF3 Frequency of fluoride tablets or drops intake Over 4 years		1. More than once a day	0				2.351	0.589
		2. Once a day	9	1.56	2.350	0.783		
		3. 5 to 6 times a week	0					
		4. 2 to 4 times a week	2	0.50	0.707	0.500		
		5. Once a week	0					
		6. Infrequently/varied	7	1.14	2.267	0.857		
		7. Did not take at this age	2	0.00	0.000	0.000		
		Missing/Excluded data	303	0.76	1.635	0.094		
ROF1 Frequency of fluoride mouthrinse use when started using fluoride mouthrinse		1. Every day	0				1.392	0.779
		2. A few times a week	2	0.00	0.000	0.000		
		3. Once a week	1	0.00	0.000	0.000		
		4. Infrequently	4	0.25	0.500	0.250		
		Missing/Excluded data	316	0.80	1.678	0.094		

continued over

Potential explanatory variable	Category (numbered)	Number	mean dmft	SD	SE	Chi-square	p value
ROF2 Frequency of fluoride mouthrinse use now or when stopped using fluoride mouthrinse	1. Every day	1	0.00			0.818	0.891
	2. A few times a week	1	0.00				
	3. Once a week	0					
	4. Infrequently	6	0.50	0.836	0.341		
	Missing/Excluded data	315	0.79	1.679	0.095		
FGEL1 Fluoride gel application by School Dental Service	1. Yes	4	1.50	1.732	0.866	11.220	0.050
	2. No	259	0.71	1.658	0.103		
	3. Don't know	19	1.74	2.256	0.518		
	Missing/Excluded data	41	0.76	1.220	0.190		
FGEL2 Fluoride gel application at Private dental practice	1. Yes	35	0.86	1.309	0.221	13.252	0.093
	2. No	246	0.68	1.669	0.106		
	3. Don't know	14	1.71	1.977	0.528		
	Missing/Excluded data	28	1.11	1.728	0.326		
FGEL3 Fluoride gel application at home	1. Yes	3	0.00	0.000	0.000	17.600	0.141
	2. No	270	0.72	1.683	0.102		
	3. Don't know	4	2.25	1.500	0.750		
	Missing/Excluded data	46	1.07	1.541	0.227		
Socioeconomic factors							
EDM Father/male guardian's education	1. Some high school	44	1.43	2.609	0.393	5.847	0.118
	2. Completed high school	86	0.79	1.595	0.172		
	3. Some vocational training	28	0.71	1.243	0.235		
	4. Vocational training	38	0.84	1.424	0.231		
	5. Some Uni or College	37	0.38	0.721	0.119		
	6. Completed Uni or Cillege	81	0.65	1.637	0.182		
	Missing/Excluded data	9	0.33	0.707	0.235		

continued over

Potential explanatory variable		Category (numbered)	Number	mean dmft	SD	SE	Chi-square	p value
EDF Mother/female guardian's education		1. Some high school	42	1.02	1.645	0.254	11.712	0.324
		2. Completed high school	58	0.57	1.403	0.184		
		3. Some vocational training	47	0.74	1.326	0.194		
		4. Vocational training	50	1.18	1.997	0.282		
		5. Some Uni or College	22	0.36	0.953	0.203		
		6. Completed Uni or Cllege Missing/Excluded data	46 58	0.57 0.84	0.168 1.989	0.248 0.261		
JOBM Father/male guardian's job		1. Managers & administrators	10	0.50	0.707	0.224	5.733	0.716
		2. Professionals	15	0.80	1.265	0.327		
		3. Associate professionals	93	0.56	1.346	0.140		
		4. Tradespersons	25	0.56	1.083	0.217		
		5. Advanced clerical & service	48	1.04	1.988	0.287		
		6. Int. clerical & service	23	0.52	1.082	0.226		
		7. Int. production/transport	0					
		8. Element. clerical & service	3	0.33	0.573	0.333		
		9. Labourers Missing/Excluded data	18 44	0.61 0.86	1.037 1.503	0.244 0.227		
JOBF Mother/female guardian's job		1. Managers & administrators	18	0.78	1.114	0.263	15.639	0.178
		2. Professionals	26	0.27	0.827	0.162		
		3. Associate professionals	53	0.64	1.872	0.257		
		4. Tradespersons	67	0.91	1.773	0.217		
		5. Advanced clerical & service	7	1.14	1.574	0.595		
		6. Int. clerical & service	14	0.57	0.938	0.251		
		7. Int. production/transport	23	0.87	1.486	0.310		
		8. Element. clerical & service	3	3.67	3.786	2.186		
		9. Labourers Missing/Excluded data	34 63	0.79 0.84	1.513 1.919	0.260 0.242		

continued over

Potential explanatory variable	Category (numbered)	Number	mean	dmft	SD	SE	Chi-square	p value
WORKM								
Father/male guardian's work condition	1. Yes, full time	67		0.90	1.394	0.170	1.931	0.124
	2. Yes, part time	136		0.53	1.409	0.121		
	3. No, not currently working	100		0.99	2.052	0.205		
	Missing/Excluded data	20		1.10	1.804	0.403		
WORKF								
Nother/female guardian's work condition	1. Yes, full time	211		0.69	1.535	0.106	1.305	0.272
	2. Yes, part time	24		1.33	1.949	0.398		
	3. No, not currently working	22		0.64	1.217	0.259		
	Missing/Excluded data	66		0.92	2.025	0.249		
INC								
Total household income per year	1. Up to \$20,000	38		1.08	2.306	0.374	4.760	0.686
	2. \$20,001 to \$40,000	61		0.59	1.521	0.195		
	3. \$40,001 to \$60,000	89		0.78	1.536	0.163		
	4. \$60,001 to \$80,000	62		0.79	1.516	0.192		
	5. \$80,001 to \$100,000	27		0.44	1.086	0.209		
	6. Over \$100,000	19		0.95	1.715	0.393		
	Missing/Excluded data	27		1.04	2.084	0.401		
<i>Demographic factors</i>								
ENG								
English mainly spoken at home	1. Yes	312		0.78	1.676	0.095	1.383	0.748
	2. No	6		1.17	1.602	0.654		
	Missing/Excluded data	5		0.40	0.894	0.400		
ABTS								
Child of Aboriginal or Torres Strait Islander origin	1. No	308		0.76	1.576	0.090	3.927	0.125
	2. Yes, Aboriginal	7		2.14	4.180	1.580		
	3. Yes, Torres Strait Islander	1		3.00				
	4. Yes, Both	1		0.00				
	Missing/Excluded data	6		0.33	0.817	0.333		

continued over

Potential explanatory variable	Category (numbered)	Number	mean dmft	SD	SE	Chi-square	p value
KBORN Country where child born	1. Australia	310	0.80	1.688	0.096	0.565	0.569
	2. Overseas	8	0.25	0.707	0.250		
	Missing/Excluded data	5	0.40	0.894	0.400		
MBORN Country where mother born	1. Australia	264	0.84	1.766	0.109	0.809	0.446
	2. Overseas	53	0.57	1.100	0.151		
	Missing/Excluded data	6	0.33	0.816	0.333		
SINGLE Child in a one-parent household	1. Yes	52	0.88	2.229	0.309	0.974	0.830
	2. No	264	0.76	1.538	0.095		
	Missing/Excluded data	7	1.00	1.527	0.577		
ABTSM Father/male guardian Aboriginal or Torres Strait Islander	1. No	304	0.76	1.579	0.091	0.877	0.415
	2. Yes, Aboriginal	8	1.88	3.944	1.394		
	3. Yes, Torres Strait Islander	1	0.00				
	4. Yes, Both	1	0.00				
	Missing/Excluded data	9	0.78	1.394	0.465		
ABTSF Mother/female guardian Aboriginal or Torres Strait Islander	1. No	264	0.79	1.600	0.099	4.432	0.525
	2. Yes, Aboriginal	2	0.00	0.000	0.000		
	3. Yes, Torres Strait Islander	1	3.00				
	4. Yes, Both	0					
	Missing/Excluded data	56	0.75	1.956	0.261		
Variables not otherwise categorised							
FORM Child fed infant formula	1. Yes	226	0.76	1.681	0.111	0.284	0.753
	2. No	92	0.87	1.659	0.173		
	3. Don't know	0					
	Missing/Excluded data	5	0.40	0.894	0.400		

Potential explanatory variable	Category (numbered)	Number	mean dmft	SD	SE	Chi-square	p value
FORMIX Water added to infant formula	1. Tap water - mains supply	168	0.75	1.701	0.131	7.833	0.657
	2. Carbon/charcoal filtered	10	0.00	0.000	0.000		
	3. Osmosis/distillation filtered	10	0.80	1.316	0.416		
	4. Mineral/spring water	4	0.25	0.500	0.250		
	5. Tank water	30	1.10	2.040	0.372		
	6. Unknown	1	0.00				
	Missing/Excluded data	100	0.85	1.616	0.162		
PREM Child born prematurely	1. Yes	19	0.53	0.697	0.160	0.485	0.618
	2. No	284	0.78	1.650	0.098		
	3. Don't know	0					
	Missing/Excluded data	20	1.05	2.394	0.535		
BW Known birth weight	1. Yes	285	0.77	1.631	0.097	5.945	0.384
	2. Don't know	5	1.80	1.643	0.735		
	Missing/Excluded data	33	0.73	1.924	0.335		
	Observations	108				3.045	0.081
BWK Birth weight	Missing/Excluded data	215					
	1. Yes	92	0.74	1.623	0.169	0.332	0.935
	2. No	214	0.79	1.702	0.116		
	Missing/Excluded data	17	0.88	1.453	0.352		
INSURE Private insurance	1. less than 6 months	78	1.29	2.077	0.235	26.222	0.001
	2. between 6 and 12 months	49	1.14	1.957	0.280		
	3. between 1 and 2 years	38	0.63	1.125	0.183		
	4. more than 2 years ago	16	0.06	0.250	0.063		
	5. never	132	0.46	1.384	0.120		
	6. don't know	1	4.00				
	Missing/Excluded data	9	0.67	1.414	0.471		

continued over

Potential explanatory variable		Category (numbered)	Number	mean dmft	SD	SE	Chi-square	p value
VISWHERE Place of last dental visit		1. private dentist	106	0.77	1.575	0.153	16.380	0.001
		2. public hospital dental clin	27	1.33	2.130	0.410		
		3. public child dental clinic	41	1.54	2.157	0.337		
		4. never had dental care	128	0.40	1.045	0.092		
		Missing/Excluded data	21	1.00	2.608	0.569		
VISWHY Why did you last seek treatment for child		1. pain relief	9	1.67	2.398	0.799	49.689	0.000
		2. check-up	119	0.75	1.653	0.152		
		3. filling	27	2.59	2.080	0.400		
		4. crooked teeth	2	1.00	1.410	1.000		
		5. other	17	0.41	1.004	0.243		
		6. never had care	129	0.38	1.032	0.091		
		Missing/Excluded data	20	1.05	2.665	0.596	16.380	0.001
		1. private dentist	106	0.77	1.575	0.153		
		2. public hospital dental clin	27	1.33	2.130	0.410		
		3. public child dental clinic	41	1.54	2.157	0.337		
		4. never had dental care	128	0.40	1.045	0.092		
		Missing/Excluded data	21	1.00	2.608	0.569	49.689	0.000
		1. pain relief	9	1.67	2.398	0.799		
		2. check-up	119	0.75	1.653	0.152		
		3. filling	27	2.59	2.080	0.400		
		4. crooked teeth	2	1.00	1.410	1.000		
		5. other	17	0.41	1.004	0.243		
		6. never had care	129	0.38	1.032	0.091		
		Missing/Excluded data	20	1.05	2.665	0.596		

Table 5.2: Linear regression of caries experience (dmft) on potential explanatory variables in relation to 6-year-olds living in the Blue Mountains and Hawkesbury regions.

Potential explanatory variable	Number	Parameter estimate	SE	F-value	p Value
<i>Toothbrushing factors</i>					
TBAGE Age started brushing with toothpaste	304 19	-0.05	0.120	0.183	0.669
<i>Other fluoride exposure</i>					
T1AGE Age started taking fluoride tablets or drops	21 302	-0.38	0.332	1.322	0.250
T2AGE Age stopped taking fluoride tablets or drops	11 312	0.80	0.583	1.858	0.173
TAB1 Fluoride tablets taken by child Birth - 6 months	0 323				
DROP1 Fluoride drops taken by child Birth - 6 months	2 321	-12.22	0.006	0.000	0.986
TAB2 Fluoride tablets taken by child 6 months - 4 years	7 316	0.21	0.014	0.224	0.636
DROP2 Fluoride drops taken by child 6 months - 4 years	7 316	0.01	0.012	0.000	0.988

Potential explanatory variable		Number	Parameter estimate	SE	F-value	p Value
TAB3 Fluoride tablets taken by child Over 4 years	Observations Missing/Excluded data	9 314	0.09	0.020	0.076	0.782
DROP3 Fluoride drops taken by child Over 4 years	Observations Missing/Excluded data	9 314	-0.18	0.016	0.132	0.717
RAGE1 Age started using fluoride mouthrinse	Observations Missing/Excluded data	9 314	0.73	0.378	0.456	0.499
RAGE2 Age stopped using fluoride mouthrinse	Observations Missing/Excluded data	1 313				
FGEL1X Frequency of fluoride gel application by School Dental Service	Observations Missing/Excluded data	5 318	0.44	0.513	0.723	0.395
FGEL2X Frequency of fluoride gel application at Private dental practice	Observations Missing/Excluded data	35 288	0.38	0.200	3.648	0.056
FGEL3X Frequency of fluoride gel application at home	Observations Missing/Excluded data	2 321	-5.98	0.017	0.000	0.984
WF Years spent in a water fluoridated area	Observations Missing/Excluded data	289 34	-0.19	0.080	5.544	0.019

Potential explanatory variable		Number	Parameter estimate	SE	F-value	p Value
<i>Dietary factors</i>						
FRUIT1	Fruit intake in usual day	279	0.09	0.121	0.6051	0.437
		44				
FRUIT2	Fruit intaken 1hr before bed	249	0.28	0.232	1.4488	0.229
		74				
JUS1	Fruit juice and fruit drinks in usual day	95	-0.01	0.097	0.0029	0.957
		228				
JUS2	Fruit juice and fruit drinks 1hr before bed	43	-0.17	0.290	0.352	0.553
		280				
CORD1	Sweetened cordial drinks in usual day	171	0.08	0.102	0.547	0.460
		152				
CORD2	Sweetened cordial drinks 1hr before bed	169	0.57	0.279	4.218	0.040
		154				
FIZ1	Fizzy drinks/sport drinks in usual day	83	0.08	0.195	0.165	0.685
		240				
FIZ2	Fizzy drinks/sport drinks 1hr before bed	78	0.29	0.572	0.250	0.617
		245				

continued over

Potential explanatory variable		Number	Parameter estimate	SE	F-value	p Value
COLA1	Observations	50	0.08	0.259	0.088	0.767
Cola drinks in usual day	Missing/Excluded data	273				
COLA2	Observations	73	0.17	1.231	0.019	0.891
Cola drinks 1hr before bed	Missing/Excluded data	250				
MILK1	Observations	241	-0.06	0.111	0.259	0.611
Plain milk in usual day	Missing/Excluded data	82				
MILK2	Observations	113	0.08	0.207	0.138	0.710
Plain milk 1hr before bed	Missing/Excluded data	210				
YOG1	Observations	200	0.16	0.161	0.952	0.329
Sweetened dairy products in usual day	Missing/Excluded data	123				
YOG2	Observations	53	0.04	0.308	0.019	0.891
Sweetened dairy products 1hr before bed	Missing/Excluded data	270				
CHOC1	Observations	173	0.17	0.128	1.851	0.174
Chocolate and sugary lollies in usual day	Missing/Excluded data	150				
CHOC2	Observations	42	0.28	0.375	0.5407	0.462
Chocolate and sugary lollies 1hr before bed	Missing/Excluded data	281				
MUES1	Observations	163	0.06	0.182	0.1156	0.734
Muesli bar and health bars in usual day	Missing/Excluded data	160				

continued over

Potential explanatory variable	Number	Parameter estimate	SE	F-value	p Value
MUES2 Muesli bar and health bars 1hr before bed	Observations Missing/Excluded data 150 173	0.28	0.365	0.5947	0.441
RAISIN1 Dried fruit in usual day	Observations Missing/Excluded data 223 100	0.04	0.209	0.0386	0.844
RAISIN2 Dried fruit 1hr before bed	Observations Missing/Excluded data 243 80	0.31	0.565	0.2993	0.584
<i>Variables not otherwise categorised</i>					
EXOM Father/male guardian's number of past teeth extracted.	Observations Missing/Excluded data 199 124	0.14	0.100	1.8172	0.178
EXOF Mother/female guardian's number of past teeth extracted.	Observations Missing/Excluded data 173 150	-0.77	0.762	1.9911	0.158
FILLM Father/male guardian's number of fillings.	Observations Missing/Excluded data 220 103	-0.01	0.104	0.0388	0.844
FILLF Mother/female guardian's number of fillings.	Observations Missing/Excluded data 234 89	-0.04	0.105	2.7548	0.097

6. Results - The permanent dentition at age 12

6.1 Bivariate associations - Caries experience by potential categorical type explanatory variables

Result of the bivariate analysis of DMFT score and potential explanatory variables for 12-year-olds are shown in Table 6.1. The potential explanatory variables fall under the headings of: toothbrushing factors, other fluoride exposure, variables not otherwise categorised, socioeconomic factors, and demographic factors.

Out of 46 variables, only three variables had significant associations. These were TPLICK1 (Ever noticed child eating or licking toothpaste) listed under toothbrushing factors; ROF1 (Frequency of fluoride mouthrinse use when started using fluoride mouthrinse) listed under other fluoride exposure and KBORN (Country where child was born) listed under demographic factors.

6.1.1 Dental caries and toothbrushing factors

The licking of toothpaste when toothbrushing commenced (TPLICK1) is significantly associated with permanent caries experience. The 10 children who often licked toothpaste when they were young had the highest mean DMFT score, 0.60, when compared to those who sometimes or never licked toothpaste, (0.21 and 0.28 respectively). All other toothbrushing variables were not significantly associated.

The result showed that majority of the 12-year-olds brushed twice daily and used fluoride toothpaste now. They also commonly used regular sized toothbrush now (73%).

6.1.2 Dental caries and other fluoride exposure

Eighty nine percent of the subjects had not used fluoride tablets or drops. The majority of 12-year-olds also reported to have never used fluoride mouthrinses (83%).

Twenty-three children had used fluoride mouthrinses. The frequency of fluoride mouthrinse usage when started using fluoride mouthrinse (ROF1) was the only explanatory variable within this category that was significantly associated with permanent caries experience. Those children who rinsed everyday had 7.7 times more DMFT than those who rinsed infrequently (Kruskal-Wallis $\chi^2=4.75$, $p = 0.03$).

6.1.3 Dental caries and demographic factors

Country of birth was the only significant explanatory variable in this category (KBORN). A total of 180 out of 189 children were born in Australia. The overseas born children exhibited 4.5 times higher DMFT than Australian born children (Kruskal-Wallis $\chi^2= 3.39$, $p = 0.04$).

6.1.4 Dental caries and variables not otherwise categorised,

All potential explanatory variables within this category were not significantly associated with permanent dentition caries experience, although place of last dental visit (VISWHERE) exhibited a weak association with DMFT. Children who last visited a public hospital dental clinic and a public child dental clinic exhibited higher DMFT scores, 0.32 and 0.53 respectively, than those who last visited a private dentist, 0.2 (Kruskal-Wallis $\chi^2= 10.26$, $p = 0.06$).

6.1.5 Dental caries and socioeconomic factors

All potential explanatory variables were not significantly associated with permanent dentition caries experience.

6.2 Bivariate association - Linear regression of caries experience on potential continuous type explanatory variables

The linear regression of permanent caries experience on explanatory variables is shown in Table 6.2. The potential explanatory variables fall under the headings of: toothbrushing factors, other fluoride exposure, dietary factors, and variables not otherwise categorised. Out of 39 variables, only JUS1 (fruit juice and fruit drinks intake one hour before bed), listed under dietary factors, was significantly associated with DMFT score.

6.2.1 Dental caries and dietary factors

Fruit juice and fruit drinks intake one hour before bed showed a negative and significant association with permanent caries experience (F-value = 5.5. $p = 0.02$), indicated that DMFT score drop by 0.56 per unit increase in drinks consumption. All other dietary variables were not significantly associated with DMFT.

6.2.2 Dental caries and toothbrushing factors/ other fluoride exposure/ other variables not otherwise categorised

All potential explanatory variables within these categories were not significantly associated with deciduous caries experience.

Table 6.1: Bivariate association of permanent dentition caries experience among 12-year-olds living in the Blue Mountains and Hawkesbury regions with residence history, fluoride history and health related behaviour variables

Potential explanatory variable	Category (numbered)	Number	DMFT	SD	SE	Chi-square	p value
<i>Toothbrushing factors</i>							
TBEVER Ever brushed his/her teeth with toothpaste	1. Yes 2. No Missing/Excluded data	188 1	0.30 0.00	0.799	0.058	0.187	0.710
TPTIMES1 Frequency of brushing with toothpaste at age when toothbrushing commenced	1. Less than once a day 2. Once a day 3. Twice a day 4. More than twice Missing/Excluded data	13 80 89 1 6	0.38 0.24 0.30 0.00 0.83	0.650 0.680 0.845 1.602	0.180 0.076 0.090 0.654	3.959	0.487
TPTIMES2 Frequency of brushing with toothpaste now	1. Less than once a day 2. Once a day 3. Twice a day 4. More than twice Missing/Excluded data	5 58 116 2 8	0.40 0.34 0.25 0.00	0.894 0.785 0.756 0.000	0.400 0.103 0.070 0.000	1.907	0.680
TPTYPE1 Type of toothpaste used when toothbrushing commenced	1. Fluoride toothpaste 2. Children's toothpaste 3. Non-fluoridated paste 4. Don't know/not sure Missing/Excluded data	59 118 4 2 6	0.20 0.29 1.00 0.50 0.83	0.581 0.818 1.154 0.707 1.602	0.076 0.075 0.577 0.500 0.654	7.162	0.147
TPTYPE2 Type of toothpaste used now	1. Fluoride toothpaste 2. Children's toothpaste 3. Non-fluoridated paste 4. Don't know/not sure Missing/Excluded data	164 11 4 1 9	0.28 0.18 0.50 1.00 0.56	0.772 0.603 1.000 1.333	0.060 0.182 0.500 0.444	5.240	0.688

continued over

Potential explanatory variable	Category (numbered)	Number	DMFT	SD	SE	Chi-square	p value
TPLICK1 Ever noticed child eating or licking toothpaste when toothbrushing commenced	1. Often	10	0.60	1.350	0.427	4.820	0.049
	2. Sometimes	67	0.21	0.591	0.072		
	3. Never	105	0.28	0.766	0.075		
	Missing/Excluded data	7	1.00	1.528	0.577		
TPLICK2 Ever noticed child eating or licking toothpaste now	1. Often	2	1.00	1.414	1.000	2.161	0.512
	2. Sometimes	14	0.29	0.726	0.194		
	3. Never	163	0.28	0.764	0.060		
	Missing/Excluded data	10	0.50	1.269	0.401		
TBSIZE1 Size of toothbrush when toothbrushing commenced	1. Small size	161	0.25	0.727	0.057	2.675	0.133
	2. Regular size	22	0.45	0.963	0.205		
	Missing/Excluded data	6	0.83	1.602	0.654		
TBSIZE2 Size of toothbrush now	1. Small size	42	0.43	0.966	0.149	1.120	0.245
	2. Regular size	138	0.24	0.689	0.058		
	Missing/Excluded data	9	0.56	1.333	0.444		
TBSPIT1 What child did after toothbrushing when toothbrushing commenced	1. Just swallow	17	0.35	0.996	0.242	2.716	0.763
	2. Rinse and swallow	17	0.29	0.849	0.206		
	3. Rinse and spit	121	0.26	0.739	0.067		
	4. Just spit	20	0.25	0.639	0.143		
	5. Other	1	0.00				
	6. Don't know	7	0.43	0.787	0.297		
	Missing/Excluded data	6	0.83	1.602	0.654		

continued over

Potential explanatory variable	Category (numbered)	Number	DMFT	SD	SE	Chi-square	p value
TBSPIT2							
What child does after toothbrushing now	1. Just swallow	2	1.00	1.414	1.000	3.987	0.439
	2. Rinse and swallow	9	0.00	0.000	0.000		
	3. Rinse and spit	161	0.29	0.780	0.061		
	4. Just spit	8	0.25	0.707	0.250		
	5. Other	0					
	6. Don't know	0					
	Missing/Excluded data	9	0.56	1.333	0.444		
TPP1							
Amount of toothpaste used on his/her toothbrush when toothbrushing commenced	1. Full brush	16	0.44	0.727	0.182	7.677	0.086
	2. Pea sized	70	0.23	0.745	0.089		
	3. Smear	96	0.27	0.761	0.078		
	Missing/Excluded data	7	1.00	1.528	0.577		
TPP2							
Amount of toothpaste used on his/her toothbrush now	1. Full brush	77	0.22	0.599	0.068	2.766	0.261
	2. Pea sized	83	0.31	0.896	0.089		
	3. Smear	20	0.30	0.657	0.147		
	Missing/Excluded data	9	0.78	1.394	0.465		
Other fluoride exposure							
FTAB							
Ever taken fluoride tablets or drops	1. Fluoride tablets only	10	0.40	1.265	0.400	2.185	0.937
	2. Fluoride drops only	4	0.00	0.000	0.000		
	3. Fluoride tablets and drops	2	0.00	0.000	0.000		
	4. No fluoride tablets or drops	168	0.30	0.787	0.060		
	5. Don't know	2	0.00	0.000	0.000		
	Missing/Excluded data	3	0.33	0.573	0.333		
TOF1							
Frequency of fluoride tablets or drops intake Birth - 6 months	1. More than once a day	1	0.00			1.400	0.433
	2. Once a day	3	0.00	0.000	0.000		
	3. 5 to 6 times a week	0					
	4. 2 to 4 times a week	0					
	5. Once a week	0					
	6. Infrequently/varied	1	0.00				
	7. Did not take at this age	4	1.00	2.000	1.000		
	Missing/Excluded data	180	0.29	0.766	0.057		

continued over

Potential explanatory variable	Category (numbered)	Number	DMFT	SD	SE	Chi-square	p value
TOF2 Frequency of fluoride tablets or drops intake 6 months - 4 years	1. More than once a day 2. Once a day 3. 5 to 6 times a week 4. 2 to 4 times a week 5. Once a week 6. Infrequently/varied 7. Did not take at this age Missing/Excluded data	1 5 0 1 1 1 5 175	0.00 0.00 0.00 0.00 0.00 0.80 0.30	 0.000 1.788 0.775	 0.000 0.800 0.059	1.899	0.783
TOF3 Frequency of fluoride tablets or drops intake Over 4 years	1. More than once a day 2. Once a day 3. 5 to 6 times a week 4. 2 to 4 times a week 5. Once a week 6. Infrequently/varied 7. Did not take at this age Missing/Excluded data	1 3 0 0 1 3 4 177	0.00 0.00 0.00 1.33 0.00 0.29	 0.000 2.309 0.771	 0.000 1.333 0.058	2.776	0.277
FRIN. Ever used fluoride mouthrinse	1. Yes 2. No 3. Don't know Missing/Excluded data	23 156 7 3	0.39 0.29 0.00 0.33	1.076 0.772 0.000 0.577	0.224 0.062 0.000 0.333	1.871	0.732
ROF1 Frequency of fluoride mouthrinse use when started using fluoride mouthrinse	1. Every day 2. A few times a week 3. Once a week 4. Infrequently Missing/Excluded data	5 4 3 11 166	1.40 0.00 0.00 0.18 0.28	1.949 0.000 0.000 0.603 0.754	0.872 0.000 0.000 0.182 0.058	4.750	0.027
ROF2 Frequency of fluoride mouthrinse use now or when stopped using fluoride mouthrinse	1. Every day 2. A few times a week 3. Once a week 4. Infrequently Missing/Excluded data	4 6 3 9 167	0.75 0.00 0.00 0.22 0.31	1.500 0.000 0.000 0.666 0.804	0.750 0.000 0.000 0.222 0.062	2.286	0.624

continued over

Potential explanatory variable	Category (numbered)	Number	DMFT	SD	SE	Chi-square	p value
FGEL1 Fluoride gel application by School Dental Service	1. Yes	13	0.77	1.235	0.343	6.092	0.172
	2. No	92	0.26	0.810	0.085		
	3. Don't know	46	0.24	0.603	0.089		
	Missing/Excluded data	38	0.29	0.768	0.125		
FGEL2 Fluoride gel application at Private dental practice	1. Yes	49	0.29	0.866	0.124	0.606	0.992
	2. No	100	0.29	0.769	0.077		
	3. Don't know	23	0.30	0.635	0.132		
	Missing/Excluded data	17	0.35	0.996	0.242		
FGEL3 Fluoride gel application at home	1. Yes	2	0.00	0.000	0.000	1.639	0.646
	2. No	135	0.26	0.712	0.061		
	3. Don't know	4	0.25	0.500	0.250		
	Missing/Excluded data	48	0.42	1.027	0.148		
<i>Demographic factors</i>							
KBORN Country where child born	1.Australia	180	0.27	0.754	0.056	3.387	0.036
	2.Overseas	5	1.20	1.789	0.800		
	Missing/Excluded data	4	0.25	0.500	0.250		
MBORN Country where mother born	1.Australia	152	0.26	0.714	0.058	1.274	0.282
	2.Overseas	32	0.50	1.135	0.201		
	Missing/Excluded data	5	0.20	0.447	0.200		
ENG English mainly spoken at home	1. Yes	183	0.28	0.759	0.056	1.865	0.498
	2. No	2	2.00	2.828	2.000		
	Missing/Excluded data	4	0.25	0.500	0.250		

continued over

Potential explanatory variable	Category (numbered)	Number	DMFT	SD	SE	Chi-square	p value
ABTS	1. No	178	0.30	0.807	0.061	0.349	0.772
Child of Aboriginal or Torres Strait Islander origin	2. Yes, Aboriginal	4	0.50	1.000	0.500		
	3. Yes, Torres Strait Islander	0					
	4. Yes, Both	0					
	Missing/Excluded data	7	0.14	0.378	0.143		
SINGLE	1. Yes	36	0.39	0.803	0.134	1.569	0.741
Child in a one-parent household	2. No	149	0.28	0.804	0.066		
	Missing/Excluded data	4	0.25	0.500	0.250		
ABTSM	1. No	178	0.30	0.807	0.060	0.289	0.934
Father/male guardian Aboriginal or Torres Strait Islander	2. Yes, Aboriginal	1	0.00				
	3. Yes, Torres Strait Islander	0					
	4. Yes, Both	0					
	Missing/Excluded data	10	0.30	0.674	0.213		
ABTSF	1. No	145	0.30	0.844	0.070	0.909	0.809
Mother/female guardian Aboriginal or Torres Strait Islander	2. Yes, Aboriginal	3	0.00	0.000	0.000		
	3. Yes, Torres Strait Islander	0					
	4. Yes, Both	0					
	Missing/Excluded data	41	0.29	0.642	0.100		
Socioeconomic factors							
EDM	1. Some high school	34	0.35	0.917	0.157	3.666	0.711
Father/male guardian's education	2. Completed high school	62	0.31	0.822	0.104		
	3. Some vocational training	14	0.07	0.267	0.071		
	4. Vocational training	15	0.33	0.617	0.159		
	5. Some Uni. or College	11	0.64	1.286	0.387		
	6. Completed Uni. or College	42	0.21	0.716	0.110		
	Missing/Excluded data	11	0.27	0.647	0.195		

continued over

Potential explanatory variable		Category (numbered)	Number	DMFT	SD	SE	Chi-square	p value
EDF Mother/female guardian's education		1. Some high school	30	0.53	1.106	0.202	3.380	0.688
		2. Completed high school	32	0.28	0.812	0.144		
		3. Some vocational training	13	0.08	0.277	0.077		
		4. Vocational training	35	0.23	0.598	0.101		
		5. Some Uni or College	14	0.29	1.069	0.286		
		6. Completed Uni or Cllege Missing/Excluded data	23 42	0.26 0.29	0.864 0.636	0.180 0.098		
JOBM Father/male guardian's job		1. Managers & administrators	13	0.15	0.555	0.154	5.500	0.972
		2. Professionals	7	0.57	1.511	0.571		
		3. Associate professionals	45	0.33	0.826	0.123		
		4. Tradespersons	17	0.29	0.848	0.206		
		5. Advanced clerical & service	19	0.32	0.671	0.154		
		6. Int. clerical & service	20	0.35	0.988	0.221		
		7. Int. production/transport	1	0.00				
		8. Element. clerical & service	5	0.00	0.000	0.000		
		9. Labourers Missing/Excluded data	7 32	0.28 0.28		0.144		
JOBF Mother/female guardian's job		1. Managers & administrators	15	0.47	1.125	0.291	5.215	0.710
		2. Professionals	18	0.33	1.028	0.243		
		3. Associate professionals	22	0.18	0.501	0.107		
		4. Tradespersons	45	0.31	0.821	0.122		
		5. Advanced clerical & service	6	0.00	0.000	0.000		
		6. Int. clerical & service	8	0.63	1.408	0.498		
		7. Int. production/transport	4	0.75	1.500	0.750		
		8. Element. clerical & service	3	0.00	0.000	0.000		
		9. Labourers Missing/Excluded data	20 44	0.10 0.27	0.447 0.623	0.100 0.094		

continued over

Potential explanatory variable	Category (numbered)	Number	DMFT	SD	SE	Chi-square	p value
WORKM Father/male guardian's work condition	1. Yes, full time	54	0.31	0.928	0.126	0.056	0.983
	2. Yes, part time	88	0.31	0.733	0.078		
	3. No, not currently working	35	0.26	0.817	0.138		
	Missing/Excluded data	12	0.25	0.622	0.179		
WORKF Nother/female guardian's work condition	1. Yes, full time	126	0.29	0.820	0.073	0.067	0.977
	2. Yes, part time	14	0.29	1.069	0.286		
	3. No, not currently working	7	0.43	0.787	0.297		
	Missing/Excluded data	42	0.29	0.636	0.098		
INC Total household income per year	1. Up to \$20,000	22	0.41	0.959	0.204	11.785	0.286
	2. \$20,001 to \$40,000	36	0.17	0.507	0.085		
	3. \$40,001 to \$60,000	32	0.50	0.880	0.156		
	4. \$60,001 to \$80,000	41	0.20	0.749	0.117		
	5. \$80,001 to \$100,000	13	0.00	0.000	0.000		
	6. Over \$100,000	17	0.53	1.124	0.273		
	Missing/Excluded data	28	0.29	0.854	0.161		
<i>Variables not otherwise categorised</i>							
FORM Child fed infant formula	1. Yes	152	0.32	0.794	0.064	0.306	0.755
	2. No	76	0.34	0.793	0.091		
	3. Don't know	2	0.00	0.000	0.000		
	Missing/Excluded data	6	0.60	1.342	0.600		
FORMIX Water added to infant formula	1. Tap water - mains supply	94	0.39	0.918	0.095	4.499	0.421
	2. Carbon/charcoal filtered	4	0.00	0.000	0.000		
	3. Osmosis/distillation filtered	0					
	4. Mineral/spring water	2	0.00	0.000	0.000		
	5. Tank water	9	0.00	0.000	0.000		
	6. Unknown	0					
Missing/Excluded data			80	0.24	0.698	0.095	

continued over

Potential explanatory variable	Category (numbered)	Number	DMFT	SD	SE	Chi-square	p value
PREM Child born prematurely	1. Yes 2. No 3. Don't know Missing/Excluded data	18 153 1 17	0.17 0.29 0.00 0.53	0.514 0.792 1.068	0.121 0.064 0.259	2.739	0.558
BW Known birth weight	1. Yes 2. Don't know Missing/Excluded data	160 8 21	0.28 0.25 0.48	0.777 0.707 0.981	0.061 0.250 0.214	0.603	0.548
BWK Birth weight	Observations Missing/Excluded data					0.383	0.536
INSURE Private insurance	1. Yes 2. No Missing/Excluded data	62 111 16	0.24 0.34 0.19	0.783 0.837 0.544	0.099 0.079 0.136	1.034	0.622
VISIT Last dental visit	1. less than 6 months 2. between 6 and 12 months 3. between 1 and 2 years 4. more than 2 years ago 5. never 6. don't know Missing/Excluded data	50 49 38 29 15 2 6	0.28 0.31 0.50 0.17 0.00 0.00 0.50	0.809 0.796 1.084 0.468 0.000 0.000 0.837	0.342 0.114 0.176 0.087 0.000 0.000 0.342	5.929	0.432
VISWHERE Place of last dental visit	1. private dentist 2. public hospital dental clinic 3. public child dental clinic 4. never had dental care Missing/Excluded data	91 25 51 17 5	0.20 0.32 0.53 0.00 0.60	0.670 0.802 1.046 0.000 0.894	0.070 0.160 0.146 0.000 0.400	10.263	0.063

Potential explanatory variable	Category (numbered)	Number	DMFT	SD	SE	Chi-square	p value
VISWHY Why did you last seek treatment for child	1. pain relief	13	0.54	0.877	0.243	12.202	0.081
	2. check-up	107	0.26	0.793	0.077		
	3. filling	15	0.80	1.320	0.341		
	4. crooked teeth	14	0.21	0.579	0.155		
	5. other	17	0.18	0.529	0.128		
	6. never had care	18	0.00	0.000	0.000		
	Missing/Excluded data	5	0.60	0.894	0.400		

Table 6.2: Linear regression of caries experience (DMFT) on potential explanatory variables in relation to 12-year-olds living in the Blue Mountains and Hawkesbury regions.

Potential explanatory variable	Number	Parameter estimate	SE	F-value	p Value
<i>Toothbrushing factors</i>					
TBAGE Age started brushing with toothpaste	Observations Missing/Excluded data 174 15	0.18	0.126	2.163	0.141
<i>Other fluoride exposure</i>					
T1AGE Age started taking fluoride tablets or drops	Observations Missing/Excluded data 13 176	0.41	0.380	0.610	0.438
T2AGE Age stopped taking fluoride tablets or drops	Observations Missing/Excluded data 13 176	0.40	0.422	0.897	0.344
TAB1 Fluoride tablets taken by child Birth - 6 months	Observations Missing/Excluded data 5 184	-12.29	754.500	0.000	0.987
DROP1 Fluoride drops taken by child Birth - 6 months	Observations Missing/Excluded data 4 185	-12.28	1067.000	0.000	0.991
TAB2 Fluoride tablets taken by child 6 months - 4 years	Observations Missing/Excluded data 6 183	-11.75	402.700	0.001	0.977

Potential explanatory variable	Number	Parameter estimate	SE	F-value	p Value
DROP2 Fluoride drops taken by child 6 months - 4 years	2 187	-10.39	411.500	0.001	0.980
TAB3 Fluoride tablets taken by child Over 4 years	3 186	-11.84	376.200	0.001	0.975
DROP3 Fluoride drops taken by child Over 4 years	1 188	-6.14	533.500	0.000	0.991
RAGE1 Age started using fluoride mouthrinse	21 168	0.02	0.230	0.008	0.930
RAGE2 Age stopped using fluoride mouthrinse	0 189	0.00	0.000	0.000	0.000
FGEL1X Frequency of fluoride gel application by School Dental Service	10 179	0.33	0.278	1.412	0.235
FGEL2X Frequency of fluoride gel application at Private dental practice	45 144	0.07	0.088	0.720	0.396
FGEL3X Frequency of fluoride gel application at home	2 187	-3.64	180.200	0.000	0.984
WF Years spent in a water fluoridated area	164 25	-0.02	0.063	0.094	0.760

Potential explanatory variable		Number	Parameter estimate	SE	F-value	p Value
<i>Dietary factors</i>						
FRUIT1	Fruit intake in usual day	107	-0.03	0.1211	0.124	0.725
		82				
FRUIT2	Fruit intaken 1hr before bed	87	-0.25	0.4846	0.270	0.603
		102				
JUS1	Fruit juice and fruit drinks in usual day	148	-0.56	0.2403	5.509	0.019
		41				
JUS2	Fruit juice and fruit drinks 1hr before bed	94	-0.94	0.726	1.685	0.194
		95				
CORD1	Sweetened cordial drinks in usual day	79	0.06	0.060	1.074	0.300
		110				
CORD2	Sweetened cordial drinks 1hr before bed	64	0.31	0.679	0.207	0.649
		125				
FIZ1	Fizzy drinks/sport drinks in usual day	99	-0.01	0.278	0.001	0.976
		90				
FIZ2	Fizzy drinks/sport drinks 1hr before bed	124	1.14	0.860	1.743	0.187
		65				

continued over

Potential explanatory variable		Number	Parameter estimate	SE	F-value	p Value
COLA1	Observations	120	0.23	0.242	0.921	0.337
Cola drinks in usual day	Missing/Excluded data	69				
COLA2	Observations	115	1.11	0.712	2.447	0.118
Cola drinks 1hr before bed	Missing/Excluded data	74				
MILK1	Observations	99	-0.17	0.188	0.861	0.353
Plain milk in usual day	Missing/Excluded data	90				
MILK2	Observations	104	0.17	0.413	0.162	0.687
Plain milk 1hr before bed	Missing/Excluded data	85				
YOG1	Observations	55	-0.02	0.285	0.005	0.943
Sweetened dairy products in usual day	Missing/Excluded data	134				
YOG2	Observations	59	-0.34	0.629	0.293	0.589
Sweetened dairy products 1hr before bed	Missing/Excluded data	130				
CHOC1	Observations	83	0.09	0.237	0.139	0.709
Chocolate and sugary lollies in usual day	Missing/Excluded data	106				
CHOC2	Observations	97	-0.41	0.7459	0.296	0.586
Chocolate and sugary lollies 1hr before bed	Missing/Excluded data	92				
MUES1	Observations	105	0.15	0.2503	0.362	0.547
Muesli bar and health bars in usual day	Missing/Excluded data	84				

continued over

Potential explanatory variable		Number	Parameter estimate	SE	F-value	p Value
MUES2 Muesli bar and health bars 1hr before bed	Observations Missing/Excluded data	99 90	0.38	0.9404	0.163	0.686
RAISIN1 Dried fruit in usual day	Observations Missing/Excluded data	36 153	0.03	0.2913	0.008	0.929
RAISIN2 Dried fruit 1hr before bed	Observations Missing/Excluded data	29 161	0.04	0.8553	0.002	0.966
<i>Variables not otherwise categorised</i>						
EXOM Father/male guardian's number of past teeth extracted.	Observations Missing/Excluded data	115 74	0.08	0.078	1.163	0.281
EXOF Mother/female guardian's number of past teeth extracted.	Observations Missing/Excluded data	93 96	0.03	0.077	0.149	0.700
FILLM Father/male guardian's number of fillings.	Observations Missing/Excluded data	127 62	0.01	0.044	0.067	0.796
FILLF Mother/female guardian's number of fillings.	Observations Missing/Excluded data	130 59	0.03	0.038	0.809	0.368

7. Results - Predictors of caries experience in the primary dentition – age 5 to 9 years

7.1 Univariate associations with deciduous dentition caries experience

Only a minute fraction, 23 of 1358 (1.7%), 5-9 year-olds had decayed incisors (see appendix tables XXX). Hence, the result of the analyses that follow, were essentially based on data derived from the primary molars.

The dmft values were dichotomised as 0 (dmft = 0), 1 (dmft = 1 or above). Results of logistic regression analyse of univariate associations with dmft1 is shown in Table 7.1. The potential explanatory variables fall under the headings of: toothbrushing factors, other fluoride exposure, variables not otherwise categorised, dietary factors, and socioeconomic factors. The potential explanatory variable shown in Table 11 were identified in logistic regression analysis as those showing a univariate association ($p < 0.2$) with dmft1 (See Tables 5.1 and 5.3). A total of 31 explanatory variables are included, 11 of which are significant at $p = 0.05$.

7.1.1 Dental caries and other fluoride exposure

Children who used fluoride tablets only (FTAB), those who stopped taking fluoride tablets or drops at a later age (T2AGE), and those who had fluoride gel application by school dental service (FGEL1) were statistically significant factors for dmft1.

The children who used fluoride tablet only were shown to have a high odds ratio whose 95% confidence intervals did not include unity. This indicated that children who used fluoride tablets only had three times more caries risk compared with those who had never used fluoride supplements (OR = 2.9, CI₉₅ 1.6, 5.5). Age when fluoride supplements ceased was also shown to be associated with an increase of caries risk (OR = 1.4, CI₉₅ 1.0,

2.0). In addition, the children who had fluoride gel application by School Dental Service were shown to have more than four times the caries risk when compared to those who had not received this service (OR = 4.3, CI₉₅ 2.0, 9.4).

7.1.2 Dental caries and dietary intake

The intake of certain types of foods were significantly associated with caries risk; these included fruit intake one hour before bed (FRUIT2), sweetened cordial drinks one hour before bed (CORD2) and cola drinks consumed in a usual day (COLA1).

Intake of fruit one hour before bed showed a 52% increase in caries risk, while to have taken sweetened cordial drinks showed a 34% increase in risk. The consumption of cola drinks also resulted in an increased of caries risk of 48%. The explanatory variables were all associated with odds ratios that were significantly different from unity.

7.1.3 Dental caries and variables not otherwise categorised

The children who were fed infant formula (FORM) experienced a reduced risk of caries; they were 24% less likely to have one or more dmft risk when compared with those who did not have infant formula. The associated 95% confidence intervals did not include unity and it is a significant association. The water type added to infant formula (FORMIX) was also significantly associated with caries risk. When tank water was used as the source of water, caries risk was increased by 270% compared with those children who used tap water in their infant formula (OR = 2.7, CI₉₅ 1.2, 2.1).

The time since last dental visit (VISIT), location of last dental visit (VISWHERE) and reason for last seeking treatment for child (VISWHY) was associated with an increased caries risk.

Children who last visited dentist less than six months ago and were seen in public dental clinics were around four times more likely to have one or more dmft than those who

never had dental care; children who sought pain relief and fillings during their last visit were more than 14 times the more likely to have one or more dmft when compared to those who never had care. These associations were highly significant.

Finally, child age was also associated with increased caries risk (OR = 1.1, CI₉₅ 1.0,1.2).

7.1.4 Dental caries and toothbrushing factors

There were no significant associations (p-value less than 0.05) with caries experience and toothbrushing factors. It is observed that most children used a small head toothbrush when the brushing commenced, and continued to do so when they got older. Also, on completion of brushing, most children rinsed their mouths first then spit.

7.2 Multiple logistic regression analysis using backward stepwise variable selection to explain deciduous caries experience

The dmft values were dichotomised as 0 (dmft = 0), 1 (dmft = 1 or above). All variable in Table 7.1 were entered into a regression where variable selection was based on backward stepwise selection to explain deciduous caries experience. The result is the best fitting regression model explaining caries experience and is presented in Table 7.2. A total of five variables were independently predictive of dmft1.

A high odds ratio was associated with reason for seeking treatment (VISWHY). Children seeking pain relief and treatment for fillings had 19 and 15 times respectively the risk of having caries experience (dmft greater than one) when compared with those who had never received care. Frequency of consumption of sweetened cordial drinks one hour before bed (CORD2), consumption of fruit one hour before bed (FRUIT2) and frequency of consumption of cola drinks in a usual day (COLA1) were all associated with an increase of caries risk around 40%.

The use of infant formulas (FORM) was associated with reductions in caries risk of about 30% (OR = 0.71, CI₉₅ 0.53, 0.96).

7.3 Poisson regression model using deviance change selection to explain deciduous dentition caries experience

The dmft values were dichotomised as 0 (dmft = 0), 1 (dmft = 1 or above). The alternative method for investigating caries risk was to use poisson regression. As for the multiple logistic regression analysis, the variables in table 7.1 were entered into the regression. In this analysis, variable selection was based on deviance change, and dmft values were dichotomised as 0, 1.

Table 7.3 displays the best fitting poisson regression model for explaining caries experience. A total of six explanatory variables were shown to be independently predictive of dmft1. Age was forced into the model because of its known risk association with caries.

Reason for last dental visit (VISITWHY), consumption of fruit one hour before bed (FRUIT2), frequency of consumption of cola drinks in a day (COLA1), frequency of consumption of fruit juice and drinks consumed one hour before bed (JUS2) and fluoride tablets taken by child from age 6 months to 4 years (TAB2) was predictors of increased caries risk. A high risk ratio was found in children who received fillings at their last dental visit; they had a seven-fold increase in caries risk when compared with those who never had dental care (RR = 7.1, CI₉₅ 1.5, 2.1).

The only risk ratio that was significantly less than one was associated with intake of infant formula. The children who had infant formula exhibited 12% less caries risk than those who had not taken the infant formula (RR = 0.9, CI₉₅ -0.27, 0.0).

Table 7.1: Risk of dental caries in the deciduous dentition among children aged 5-9 years living in the Blue Mountains and Hawkesbury regions. Potential explanatory variables were identified in logistic regression analysis as those showing a univariate association ($p < 0.2$) with dmft1*. Categories shown in bold are reference categories in relation to odds ratio estimates.

*Outcome Variable = dmft1 where dmft values are dichotomised as 0 (dmft = 0), and 1 (dmft 1 or above)					
Explanatory Variable	Variable category	Number	OR	95%CI	p value
<i>Toothbrushing factors</i>					
TBAGE	Observations	1182	1.08	0.979 1.201	0.121
Age started brushing with toothpaste	Missing/Excluded data	76			
TPLICK1	1. Often	127	0.76	0.486 1.192	0.232
	2. Sometimes	532	1.26	0.973 1.626	0.080
	3. Never	557			
	Missing/Excluded data	42			
TPLICK2	1. Often	32	0.54	0.221 1.338	0.185
	2. Sometimes	331	1.19	0.906 1.56	0.211
	3. Never	846			
	Missing/Excluded data	49			
TBSIZE1	1. Small size	1155	1.52	0.809 2.857	0.194
	2. Regular size	57			
	Missing/Excluded data	46			
TBSIZE2	1. Small size	801	0.87	0.672 1.123	0.283
	2. Regular size	408			
	Missing/Excluded data	49			
TBSPIT2	1. Just swallow	26	0.40	0.138 1.18	0.097
	2. Rinse and swallow	47	0.60	0.295 1.221	0.159
	3. Just spit	106	1.09	0.715 1.674	0.680
	4. Rinse and spit	1030			
	Missing/Excluded data	49			

Explanatory Variable	Variable category	Number	OR	95%CI	p value
<i>Other fluoride exposure</i>					
FTAB Ever taken fluoride tablets or drops	1. Fluoride tablets only	40	2.93	1.55 5.527	0.001
	2. Fluoride drops only	40	1.29	0.665 2.5	0.452
	3. Fluoride tablets and drops	12	2.40	0.767 7.478	0.133
	4. No fluoride tablets or drops Missing/Excluded data	1144 22			
T2AGE Age stopped taking fluoride tablets or drops	Observations	49	1.41	1.004 1.99	0.048
	Missing/Excluded data	1209			
TAB2 Fluoride tablets taken by child 6 months - 4 years	Observations	35	2.09	0.972 4.479	0.059
	Missing/Excluded data	1223			
TAB3 Fluoride tablets taken by child Over 4 years	Observations	24	1.51	0.907 20523	0.113
	Missing/Excluded data	1234			
FRIN Ever used fluoride mouthrinse	1. Yes	59	1.28	0.842 3.244	0.379
	2. No	1163			
	Missing/Excluded data	21			
RAGE1 Age started using fluoride mouthrinse	Observations	52	0.74	0.498 1.101	0.137
	Missing/Excluded data	1206			

Explanatory Variable	Variable category	Number	OR	95%CI	p value
FGEL1 Fluoride gel application by School Dental Service	1. Yes	28	4.32	1.995 9.369	0.000
	2. Don't Know	156	2.05	1.443 2.917	0.000
	3. No	862			
	Missing/Excluded data	212			
FGEL1X Frequency of fluoride gel application by School Dental Service	Observations	23	1.44	0.93 2.212	0.103
	Missing/Excluded data	1235			
FGEL2 Fluoride gel application at Private dental practice	1. Yes	208	1.68	1.223 2.318	0.001
	2. Don't Know	86	2.12	1.347 3.335	0.001
	3. No	845			
	Missing/Excluded data	119			
FGEL2X Frequency of fluoride gel application at Private dental practice	Observations	64	1.11	0.974 1.269	0.116
	Missing/Excluded data	1194			
<i>Dietary factors</i>					
FRUIT1 Fruit intake in usual day	Observations	754	1.08	0.967 1.202	0.173
	Missing/Excluded data	504			
FRUIT2 Fruit intake 1hr before bed	Observations	865	1.52	1.193 1.912	0.001
	Missing/Excluded data	393			
JUS2 Fruit juice and fruit drinks 1hr before bed	Observations	634	1.22	0.937 1.598	0.139
	Missing/Excluded data	624			

Explanatory Variable	Variable category	Number	OR	95%CI	p value
CORD2 Sweetened cordial drinks 1hr before bed	Observations Missing/Excluded data	954 304	1.34	1.024 1.755	0.033
COLA1 Cola drinks in usual day	Observations Missing/Excluded data	1023 235	1.48	1.143 1.917	0.003
CHOC1 Chocolate and sugary lollies in usual day	Observations Missing/Excluded data	608 650	1.11	0.970 1.263	0.132
RAISIN1 Dried fruit in usual day	Observations Missing/Excluded data	705 553	1.13	0.934 1.375	0.204
Socioeconomic factors					
WORK Fulltime or parttime employment	1.not working 2.part-time 3.full-time Missing/Excluded data	72 110 800 276	-1.33 1.54	0.797 2.206 1.018 2.33	0.277 0.041
Variables not otherwise categorised					
FORM Child fed infant formula	1. Yes 2. No Missing/Excluded data	876 337 45	0.76	0.58 0.99	0.042
AGE Age of children	Observations Missing/Excluded data	1256 2	1.11	1.006 1.221	0.037

continued over

Explanatory Variable	Variable category	Number	OR	95%CI	p value
FORMIX Water added to infant formula	1. Tank Water	30	2.68	1.243 2.135	0.000
	2. Carbon/charcoal filtered	10	0.69	0.279 1.708	0.423
	3. Osmosis/distillation filtered	10	1.50	0.629 3.562	0.362
	4. Mineral/spring water	4	1.84	0.75 4.524	0.183
	5. Tap water - mains supply Missing/Excluded data	168 100			
VISIT Last dental visit	1. less than 6 months	322	3.91	2.747 5.561	0.000
	2. between 6 and 12 months	283	2.45	1.692 3.545	0.000
	3. between 1 and 2 years	185	2.29	1.514 3.462	0.000
	4. more than 2 years ago	77	1.06	0.558 2.014	0.859
	5. never Missing/Excluded data	352 39			
VISWHERE Place of last dental visit	1. private dentist	491	2.03	1.452 2.848	0.000
	2. public hospital dental clinic	122	3.92	2.499 6.158	0.000
	3. public child dental clinic	237	3.81	2.61 5.547	0.000
	4. never had dental care Missing/Excluded data	343 65			
VISWHY Why did you last seek treatment for child	1. pain relief	43	21.88	9.66 49.54	0.000
	2. check-up	580	1.95	1.501 2.727	0.000
	3. filling	115	14.83	8.96 24.57	0.000
	4. crooked teeth	28	1.67	0.678 4.099	0.266
	5. other	81	1.77	0.99 3.095	0.054
	6. never had care Missing/Excluded data	354 57			

Table 7.2: Explanation of caries experience in primary teeth of children aged 5-9 years living in the Blue Mountains and Hawkesbury regions - best fitting multiple logistic regression model using backward stepwise variable selection. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome Variable = dmft1 where dmft values are dichotomised as 0 (dmft = 0), and 1 (dmft 1 or above)				
Explanatory variable	Variable category	Odds Ratio	95% CI	p-value
CORD2 Sweetened cordial dinks taken 1hr before bed	Frequency	1.36	1.020, 1.821	0.039
FORM Intake of infant formula	Yes	0.70	0.522, 0.952	0.021
	No			
FRUIT2 Fruit intake 1hr before bed	Frequency	1.42	1.091, 1.870	0.010
COLA1 Cola drinks in usual day	Frequency	1.41	1.065, 1.890	0.020
VISWHY Why did you seek treatment for child	Pain relief	19.20	8.352, 44.152	0.000
	Check-up	1.96	1.393, 2.765	0.000
	Filling	14.99	8.987, 25.040	0.000
	Crooked teeth	1.87	0.751, 4.653	0.177
	Other	1.78	0.990, 3.212	0.053
	Never had care			

Table 7.3: Explanation of caries experience in primary teeth of children aged 5-9 years living in the Blue Mountains and Hawkesbury regions - best fitting poisson regression model where selection was based on deviance change. Categories shown in bold are reference categories in relation to risk ratio estimates.

Outcome Variable = dmft1 where dmft values are dichomomised as 0 (dmft = 0) and 1 (dmft 1 or above)					
Explanatory variable	Variable category or value	Risk Ratio	95% CI	p-value	
VISWHY Why did you seek treatment for child	Pain relief	6.08	4.665, 7.933	0.000	
	Check-up	1.95	1.589, 2.392	0.000	
	Filling	7.10	5.743, 8.785	0.000	
	Crooked teeth	2.07	1.254, 3.414	0.005	
	Other	2.00	1.463, 2.746	0.001	
	Never had care				
FRUIT2 Fruit intake 1hr before bed	Frequency	1.14	1.014, 1.281	0.028	
COLA1 Cola drinks in usual day	Frequency	1.44	1.294, 1.596	0.000	
FORM Intake of infant formula	Yes	0.88	0.763, 1.004	0.050	
	No				

continued over

Explanatory variable	Variable category or value	Risk Ratio	95% CI	p-value
AGE Age in years of children	Frequency	0.98	0.927, 1.026	0.343
TAB2 Fluoride tablets taken by child from age 6 months - 4 years	Frequency	1.40	1.119, 1.745	0.003
JUS2 Fruit juice and drinks taken 1hr before bed	Frequency	1.25	1.113, 1.411	0.000

8. Result - Predictors of caries experience in the permanent dentition –age 6 to 13 years

8.1 Univariate associations with permanent dentition caries experience

Caries experience in the permanent dentition was almost exclusively confined to the first permanent molars (see appendix Tables K). Essentially therefore, our analysis of caries experience was based on the caries experience of the first permanent molars.

The DMFT values were dichotomised as 0 (DMFT = 0), 1 (DMFT = 1 or above). The result of the logistic regression analysis of univariate associations with DMFT1 is shown in Table 8.1. The potential explanatory variables fall under the headings of: toothbrushing factors, other fluoride exposure, dietary factors and variables not otherwise categorised. The potential explanatory variables shown in Table 12 were identified in logistic regression analyse as those showing a univariate association ($p < 0.2$) with DMFT1.

8.1.1 Dental caries and toothbrushing factors

The age when children started brushing with toothpaste (TBAGE) was a risk factor for caries (OR = 1.14, CI₉₅ 1.0, 1.3), that is, the age at the commencement of toothbrushing is associated with a 14% more probability of having DMFT of one or more compared with the probability associated with brushing commencement one year earlier. Children who now brushed less than once a day with toothpaste (TPTIMES2) also showed an increase in permanent caries risk of 80% when compared to those children who brushed twice a day or more.

Children who used low fluoride formulation toothpaste at the time of the survey (TPTYPE2) had a reduction in permanent caries risk of about 45% when compared to those who used standard fluoride toothpaste. Children who used a small sized toothbrush

(TBSIZE1) also displayed a reduction in caries risk of about 50% when compared to those who used a regular sized toothbrush.

8.1.2 Dental caries and other fluoride exposure

Children who was given a fluoride gel application by The School Dental Service (FGEL1) were shown to have five times more caries risk when compared to those who had no fluoride gel application (OR = 5.2, CI₉₅ 3.0, 8.8). The number of years expose to water fluoridated area (WF) was associated with increased cares risk as well (OR = 1.15, CI₉₅ 1.1, 1.2). Note that this variable excluded children with a zero exposure. The frequency of fluoride gel application by The School Dental Service (FGEL1X) was also associated with an increased caries risk (OR = 1.6, CI₉₅ 1.2, 2.1).

8.1.3 Dental caries and dietary factors

The frequency of consumption of cola drinks in a usual day (COLA1) was associated with an increase in permanent caries risk (OR = 1.3, CI₉₅ 1.1, 1.7), on the other hand, the frequency of consumption fruit juice and fruit drinks in a usual day (JUS1) was associated with a reduction in caries risk (OR = 0.8, CI₉₅ 0.7, 0.9).

8.1.4 Dental caries and variables not otherwise categorised

Children who had last visited a dentist (VISIT) were more at risk to caries compared to those who had never had visit. The OR associated had a range of visiting patterns ranged from 3.1 to 5.0. Similarly for children who were treated in dental clinics (VISWHERE) were associated with an OR ranged from 3.5 to 5.9. They were more likely to have one or more DMFT than those who never had dental care; children who last sought treatment (VISITWHY) were ranged from 3.7 to 7.6 times more likely to have one or more DMFT when compared to those children who never had care.

Finally, child age was also associated with increased caries risk (OR = 1.1, CI₉₅ 1.0,1.2).

8.2 Multiple logistic regression analyses using backward stepwise variable selection to explain permanent caries experience

The DMFT values were dichotomised as 0 (DMFT = 0), 1 (DMFT = 1 or above). All variables in Table 8.1 were entered into a multiple logistic regression where variable selection was based on backward stepwise selection. The result shown in Table 8.2 is the best fitting regression model explaining permanent caries experience. Four explanatory variables were significantly associated with permanent caries experience: the place where children last visited dentist (VISWHERE); age of children (AGE), consumption of fruit juice and fruit drinks in a usual day (JUS1); and chocolate, sugary lollies eaten in a usual day (CHOC1).

Compared to children who never had dental visits, children who visited a public hospital dental clinic and public child dental clinic were shown to have an increased permanent caries risk. The OR associated ranged from 3.2 to 4.1. The age of children (OR = 1.4, CI₉₅ 1.2,1.5), and consumption of chocolate, sugary lollies in a usual day were associated with an increased caries risk. (OR = 1.2, CI₉₅ 1.0,1.3).

Fruit juice and fruit drinks consumed in a usual day was associated with reductions in caries risk of about 20% (OR = 0.8, CI₉₅ 0.7,0.9).

8.3 Poisson regression model using deviance change selection to explain permanent caries experience

The DMFT values were dichotomised as 0 (DMFT = 0), 1 (DMFT = 1 or above). Since 90% of children had DMFT=0, the explanation of caries experience was explored using the alternative method of poisson regression. As for the logistic regression analysis, all

variables in Table 8.1 were entered into the analysis. The best fitting poisson regression model for explaining caries experience showed a total of five explanatory variables to be independently predictive of DMFT1 (Table 8.3).

Age of children (AGE) (RR=1.27), place of last dental visit (VISWHERE) (RR ranging from 2.36 to 4.36), frequency of fluoride gel usage at private dental practice (FGEL2X) (RR=1.01) and cola drinks consumed in a usual day (COLA1) (RR=1.36) were each highly significant predictors of increased caries risk. High risk ratios were found in children who had visited public hospital dental clinic (RR = 4.4) and public child dental clinic (RR = 3.5).

The only risk ratio that was significantly less than one was associated with the intake of fruit juice and fruit drinks in a usual day (JUS1) (RR= 0.85) indicating that the children who had fruit juice and fruit drinks in a usual day exhibited a 15% reduction in caries risk.

Table 8.1: Risk of dental caries in the permanent dentition among children aged 6-13 years living in the Blue Mountains and Hawkesbury regions. Potential explanatory variables were identified in logistic regression analysis as those showing a univariate association ($p < 0.2$) with DMFT1*. Categories shown in bold are reference categories in relation to odds ratio estimates.

*Outcome Variable = DMFT1 where DMFT values are dichotomised as 0 (DMFT = 0) and 1 (DMFT 1 or above)					
Explanatory variable	Variable category	Number	OR	95%CI	p value
<i>Toothbrushing factors</i>					
TBAGE Age started brushing with toothpaste	Observations Missing/ excluded data	1766 122	1.14	1.026 1.272	0.016
TPTIMES2 Frequency of brushing with toothpaste now	1. Less than once a day 2. Once a day 3. Twice a day or more Missing/ excluded data	108 636 1077 67	1.79 1.09	1.042 3.091 0.793 1.503	0.035 0.590
TPTYPE1 Type of toothpaste used when toothbrushing commenced	1. Non-fluoridated paste 2. Children's toothpaste 3. Fluoride toothpaste Missing/ excluded data	26 1413 372 64	2.36 0.89	0.896 6.202 0.619 1.284	0.082 0.537
TPTYPE2 Type of toothpaste used now	1. Non-fluoridated paste 2. Children's toothpaste 3. Fluoride toothpaste Missing/ excluded data	31 571 1204 76	1.05 0.55	0.362 3.040 0.382 0.786	0.930 0.001
TBSIZE1 Size of toothbrush when toothbrushing commenced	1. Small size 2. Regular size Missing/ excluded data	1712 108 68	0.62	0.362 1.067	0.084

Explanatory variable	Variable category	Number	OR	95%CI	p value
TBSIZE2 Size of toothbrush now	1. Small size 2. Regular size Missing/ excluded data	949 864 75	0.53	0.39 0.719	0.000
TPP1 Amount of toothpaste used on his/her toothbrush when toothbrushing commenced	1. Full brush 2. Pea sized 3. Smear Missing/ excluded data	154 581 1085 68	1.65 1.05	1.025 2.667 0.754 1.462	0.039 0.771
TPP2 Amount of toothpaste used on his/her toothbrush now	1. Full brush 2. Pea sized 3. Smear Missing/ excluded data	544 966 303 75	1.59 1.30	0.981 2.571 0.821 2.052	0.059 0.265
<i>Other fluoride exposure</i>					
FTAB Ever taken fluoride tablets or drops	1. Fluoride tablets only 2. Fluoride drops only 3. Fluoride tablets and drops 4. No fluoride tablets or drops Missing/ excluded data	70 55 17 1716 30	1.80 1.27 0.54	0.948 3.414 0.565 2.845 0.72 4.122	0.073 0.565 0.555
FRIN Ever used fluoride mouthrinse	1. Yes 2. No Missing/ excluded data	121 1698 26	1.57	0.937 2.614	0.087
FGEL1 Fluoride gel application by School Dental Service	1. Yes 2. Don't know 3. No Missing/ excluded data	75 324 1140 349	5.16 1.88	3.02 8.822 1.285 2.756	0.000 0.000

continued over

Explanatory variable	Variable category	Number	OR	95%CI	p value
FGEL1X Frequency of fluoride gel application by School Dental Service	Observations Missing/ excluded data	64 1824	1.55	1.172 2.059	0.002
FGEL2 Fluoride gel application at Private dental practice	1. Yes 2. No 3. Don't know Missing/ excluded data	392 1161 160 175	0.79 0.47	0.477 1.324 0.3 0.743	0.378 0.001
FGEL2X Frequency of fluoride gel application at Private dental practice	Observations Missing/ excluded data	268 1620	1.10	1.005 1.213	0.039
FGEL3 Fluoride gel application at home	1. Yes 3. No 2. Don't know Missing/ excluded data	12 1419 33 424	0.75 0.40	0.132 4.253 0.163 0.964	0.746 0.041
WF Years spent in a water fluoridated area	Observations Missing/ excluded data	1234 24	1.15	1.084 1.222	0.000
<i>Dietary factors</i>					
FRUIT1 Fruit intake in usual day	Observations Missing/ excluded data	1213 675	0.90	0.782 1.027	0.116
JUS1 Fruit juice and fruit drinks in usual day	Observations Missing/ excluded data	1265 623	0.81	0.707 0.934	0.004

Explanatory variable	Variable category	Number	OR	95%CI	p value
COLA1 Cola drinks in usual day	Observations Missing/ excluded data	1368 520	1.32	1.054 1.656	0.016
COLA2 Cola drinks taken 1hr before bed	Observations Missing/ excluded data	1063 825	1.86	0.914 3.764	0.087
MILK1 Plain milk In usual day	Observations Missing/ excluded data	1120 768	0.88	0.762 1.007	0.064
CHOC1 Chocolate and sugary lollies in usual day	Observations Missing/ excluded data	637 1251	1.11	0.964 1.273	0.150
RAISIN1 Dried fruit in usual day	Observations Missing/ excluded data	819 1069	0.81	0.63 1.048	0.109
SINGLE Child in a one-parent household	1. Yes 2. No Missing/ excluded data	357 1494 37	1.28	0.9 1.83	0.169
<i>Variables not otherwise categorised</i>					
INSURE Private insurance	1. Yes 2. No Missing/ excluded data	577 1187 124	0.81	0.578 1.131	0.214
VISIT Last dental visit	1. less than 6 months 2. between 6 and 12 months 3. between 1 and 2 years 4. more than 2 years ago 5. never Missing/ excluded data	515 470 327 157 364 55	5.00 3.65 4.21 3.10	2.676 9.344 1.917 6.945 2.169 8.152 1.415 6.784	0.000 0.000 0.000 0.005

continued over

Explanatory variable	Variable category	Number	OR	95%CI	p value
VISWHERE Place of last dental visit	1. private dentist	806	3.47	1.874 6.441	0.000
	2. public hospital dental clinic	220	5.88	2.993 11.55	0.000
	3. public child dental clinic	418	4.87	2.578 9.217	0.000
	4. never had dental care	361			
	Missing/ excluded data	83			
VISWHY Why did you last seek treatment for child	1. pain relief	85	7.60	3.475 16.64	0.000
	2. check-up	960	3.70	2.008 6.801	0.000
	3. filling	184	6.40	3.212 12.77	0.000
	4. crooked teeth	66	6.76	2.89 15.81	0.000
	5. other	147	4.01	1.864 8.621	0.000
	6. never had care	377			
AGE Age of children	Missing/ excluded data	70			
	Observations	1834	1.42	1.311 1.544	0.000
	Missing/ excluded data	54			

Table 8.2: Explanation of caries experience in permanent teeth of children aged 6-13 years living in the Blue Mountains and Hawkesbury regions - best fitting multiple logistic regression model using backward stepwise variable selection. Categories shown in bold are reference categories in relation to odds ratio estimates.

Outcome Variable = DMFT1 where DMFT values are dichotomised as 0 (DMFT = 0), and 1 (DMFT 1 or above)				
Explanatory variable	Variable category	Odds Ratio	95% CI	p-value
VISWHERE Place of last dental visit	Private dentist	2.38	1.266, 4.486	0.007
	Public hospital dental clinic	4.13	2.062, 8.255	0.000
	Public child dental clinic	3.22	1.673, 6.188	0.001
	Never had care			
AGE Age of children	Frequency	1.36	1.242, 1.477	0.000
JUS1 Fruit juice and fruit drinks taken in usual day	Frequency	0.81	0.702, 0.944	0.006
CHOC1 Chocolate, sugary lollies eaten in usual day	Frequency	1.16	1.007, 1.330	0.040

Table 8.3: Explanation of caries experience in permanent teeth of children aged 6-13 years living in the Blue Mountains and Hawkesbury regions - best fitting poisson regression model where selection was based on deviance change. Categories shown in bold are reference categories in relation to risk ratio estimates.

Outcome Variable = DMFT1 where DMFT values are dichotomised as 0 (DMFT = 0) and 1 (DMFT 1 or above)				
Explanatory variable	Variable category	Risk Ratio	95% CI	p-value
AGE Age of children	Frequency	1.27	1.197, 1.354	0.000
VISWHERE Place of last dental visit	Private dentist	2.36	1.451, 3.869	0.006
	Public hospital dental clinic	4.36	2.614, 7.250	0.000
	Public child dental clinic	3.51	2.138, 5.783	0.000
	Never had care			
JUS1 Fruit juice and fruit drinks taken in usual day	Frequency	0.85	0.771, 0.939	0.001
FGEL2X Frequency of fluoride gel usage at private dental practice	Frequency	1.10	1.030, 1.169	0.001
COLA1 Cola drinks in usual day	Frequency	1.36	1.191, 1.575	0.000

9. Discussion

The result of the current survey showed that what was previously observed by Patterson and Weidenhofer in 1993, that is, children living in the Blue Mountains had a higher level of dental disease when compared to Hawkesbury children of the same age, no longer appeared to be the case. The current survey found that the differences in mean caries experience between the two regions were not significant. Overall, there was a dramatic improvement in the Blue Mountains region and a smaller improvement for the Hawkesbury region. The majority of children in Blue Mountains by 2003 had lifelong exposure to fluoridated water.

9.1 Limitations

Several of the variables used in this analysis are based on the ability of respondents to recall practices that occurred about a decade ago; it is therefore prone to a biased recollection and memory error, and hence a source of misclassification. There were sections on this in the questionnaires, particularly in relation to the history of toothbrushing, fluoride supplement use and dietary habit that may be more prone to memory bias; however, the age at which use of toothpaste was reported to have commenced was very close to that reported by Brown *et al.* (1990) for eastern Australia. It has been shown that recall concerning place of residence is reliable (Grembowski, 1988), and many respondents gave detailed answers about the use of fluoride supplements and dietary habits, suggesting that this information was reliable; it is also consistent with other data from Stockwell *et al.* 1990.

9.2 Deciduous dentition (Age 5-6)

The deciduous dentition caries experience among 5- and 6-year-olds (Table 9.1) in the Blue Mountains and Hawkesbury regions in the current study was found to be lower (0.75 for Blue Mountains and 0.74 for Hawkesbury) than other studies conducted in

fluoridated areas around Australia. In NSW, Barnard (1989) reported that the mean dmft score for 6-year-olds in Yass was 1.4 in 1988. Bell *et al.* (1994a, 1994b) observed that in NSW, the mean dmft score in 6-year-olds was 1.94; this result saw mean dmft score ranged from 1.46 in Illawarra to 2.44 in South West Sydney. In a study by Patterson and Weidenhofer (1993), they found that 6-year-olds in Blue Mountains had a mean dmft score of 1.65 and in Hawkesbury the mean dmft was 0.97. In 1997, Spencer reported that the mean dmft score for 6- and 7-year-olds was 0.97 in 1997. By 2000, Spencer reported a comparable dmft score in Sydney, where children aged 5 and 6 years had a mean dmft score ranged from 0.63 in Northern Sydney to 1.13 in the Wentworth region. Earlier and elsewhere in Australia, numbers of studies have shown higher dmft scores than found in the current study. In South Australia, Fanning (1980) reported a reduction in the mean dmft score from 2.85 to 1.83 in 5- to 6-year-olds children within the 6 years study time frame. In Tasmania, Wimmer (1985) observed the mean dmft score for 6-year-olds to be 2.59. In Melbourne, Spencer (1986) reported a 2.3 dmft score in 1985 among 6-year-olds.

9.3 Permanent dentition (Age 11-12)

For the permanent dentition caries experience (Table 9.2), the mean DMFT score among 11- and 12-year-olds in the current survey (0.39 for Blue Mountains and 0.27 for Hawkesbury) was found to be an improvement over the baseline survey and lower than other study results in Australia. In NSW, Barnard and Martin (1979) showed that permanent caries experience was 2.4 DMFT in 1979. In Sydney, a study by Burton *et al.* (1983) observed a DMFT score of 1.3 for the Lower North Shore region. In more recent studies, Barnard (1989) reported a DMFT score of 1.9 for 12-year-olds in Tamworth region. Bell *et al.* (June, 1994) also carried out studies in NSW, where he observed the mean DMFT score among 12-year-olds to be 1.2. However, AIHW (1999) reported a value of 0.39 DMFT score for 12-year-olds which is comparable with the current study. A high score of 0.71 DMFT was reported in the Wentworth region (AIHW 2000). In other parts of Australia, many studies demonstrated a DMFT result considerably higher than the current study. In Western Australia, Riordan (1991) observed the mean DMFT score for 12-year-olds to be 0.89 in Perth and 1.57 in Bunbury. Patterson and

Weidenhofer (1993) reported that the mean DMFT score for the Moree region was 0.87. In Victoria, Morgan *et al* (1998) found the mean DMFT score of 0.3 which was close to the result of the current study.

9.4 Overall caries experience (dmft/DMFT)

A large number of children were found to have caries freedom in both primary and permanent dentition. In the current study, 71% of 6-year-olds in both the Blue Mountains and Hawkesbury regions had no caries experience in their primary dentition and 84% of 12-year-olds had no caries experience in the permanent dentition. This showed a continued improvement when compared to other recent studies. Bell *et al.* (1994a) observed 54% primary caries freedom in 6-year-olds and 70% permanent caries freedom in 12-year-olds. In the baseline study, Patterson and Weidenhofer (1993) reported primary caries freedom of 52% and 61% in Blue Mountains and Hawkesbury regions respectively. Spencer (1997) reported that 65% of 6 year-olds had no primary caries experience and 72% of 12-year-olds had no permanent caries experience.

The length of time children lived in a fluoridated area was shown to be related to the caries experience, our analysis for 6-year-olds supported the observation that increased length of residence in a fluoridated area was associated with a reduced primary caries experience (Table 5.2). The same but weaker association was also found in the permanent dentition, where 12-year-olds were shown to have less caries experience as they spent more time living in a fluoridated environment (Table 6.2). This observation had been shown in other studies. In Tasmania, Wimmer (1985) found that among 12-year-olds, the fluoride exposed group had a DMFT score that was 51% less than the non fluoride group. The same findings were also reaffirmed by Stockwell *et al* (1990); where his result demonstrated a reduction in caries experience due to fluoridated water ranged from 31-43%. A report by NHMRC (1991) noted that water fluoridation was associated with a 60% reduction in DMFT score in 1977 and a 40% reduction in DMFT score in 1987. Riordan (1991) has shown that the longer the period of exposure to fluoridated water, with the lower the associated caries experience. Susser (1987) also stated that any

response that is proportional to dose is strongly persuasive of a causal relation, as suggested by the current relationship between the level of water fluoride exposure and the level of caries experience. These findings together with those of our survey, suggest a significant post-eruptive effect of fluoridated water on caries, which is supported by the modern view that the major effect of fluoridation is post rather than pre-eruptive.

Toothbrushing factors were a topic of investigation in the current study. The earlier the child's age at the commencement of toothbrushing was thought to be associated with a lower caries experience, and this was shown to be the case in the current study. Our results showed that children who commenced toothbrushing later in life had increased chances of having higher caries experiences in both their deciduous and permanent dentitions. Early commencement of toothbrushing may indicate greater interest in oral health and hygiene. Brown *et al.* (1990), who studied children in eastern Australia, reported that children from higher social classes started toothbrushing earlier, which may support the reason for lower caries experience and support the current finding. The finding itself, however, may be an artifact due to recall error. A prospective study design or the use of direct interviews to collect such information may yield more accurate results. It is encouraging though to see that we had observed over 70 percent of children who started brushing their teeth with toothpaste before the age of two years.

Other toothbrushing factors which showed significant associations with permanent caries experience in our study were frequency of brushing, type of toothpaste used and size of toothbrushes (Table 8.1). These areas of association were related to fluoride intake both topically and systemically. We found that those children who used non-fluoride toothpaste, brushed less than once a day and used regular sized toothbrushes to had higher permanent caries experience (OR between 1.05-1.8). These observations were in accordance with other findings; Carr (1983) commented that the decline of dental caries can be contributed to the use of fluoridated toothpaste and noted that the ingestion of fluoride from dentifrices would equally contribute to the decline in caries prevalence. By the 1980s, the market share held by fluoride toothpaste was significant at 94% (Spencer 1986). Spencer reported that 32% of the decline in caries prevalence in the 1980s was due

to fluoride toothpaste. Many past studies had also reaffirmed that toothbrushing frequency even in the presence of fluoridated water can still have significant effect on caries experience; Arrow (1998) reported the result of his two years study which showed that twice daily brushing with fluoride toothpaste plus preventive care aimed at children would be an effective way to reduce caries. Regarding the size of toothbrush used, the use of regular sized toothbrush may have resulted in less efficient cleaning due to the lesser ability of children to maneuver toothbrushes of this size in their mouth and harder access toward the back of mouth. Small sized toothbrushes would seem to suit children better. This variable may also reflect on the oral health related knowledge and care from parents, as parents who were more aware of the proper oral hygiene techniques would tend to purchase the correct type of toothbrush that was suitable for their children's age.

It is assumed that fluoride supplements use and caries prevalence would be inversely associated due to increased amount of fluoride intake. However, this was found not to be the case in the present study in both primary and permanent dentition. The result actually displayed a positive relation, which meant that the children who had used more fluoride supplements at a younger age showed higher caries experience. Children given various forms of fluoride supplements (variable FTAB, FGEL1 and FGEL2) were up to five times more likely to have either primary or permanent caries experience than children who had never used fluoride supplements (Table 7.1 and Table 8.1). This result was discovered after logistic analysis was completed. The most plausible explanation in our study for the observation was that children who received fluoride supplements actually had a higher caries experience to start out with. They were sent to receive dental treatment for caries after a School Dental Assessment. That was carried out by the NSW School Dental Services. Only children who have frank carious lesions are referred for treatment, topical fluoride applications are performed. This explanation most likely applies to children attending private dental clinics; they are also likely to prescribe, in addition home care topical fluoride as well (Teo *et al* 1997). There may also been low compliance and over-reporting of supplements use. Medcalf and O'Grady (1983) reported that there was no significant difference in the caries experience between children who used fluoride supplements sometimes and those who had never done so. Since those

who used fluoride supplements in the current study did not have less caries experience, the place of fluoride supplements in caries prevention should be re-evaluated.

In our multivariate analysis (Table 7.2 and Table 8.2), the type of food consumed during the day and at one hour before bed played a significant role in the caries experience of children. For the deciduous dentition, the children were more at risk of caries if they had consumed more cordial drinks (OR=1.4) and fruit (OR=1.4) within one hour before the bed-time or had more cola drinks during the day (OR=1.5). This can be attributed to the intake of sugar, sticky deposits in pit/fissures and lowering of oral pH level from the above food sources, which would encourage the progression of caries experience. In the permanent dentition, the survey found that more chocolate consumed during the day would increase the chance of having caries (OR=1.2). As Seow *et al* (1996) found that diet high in refined sugars can pose as an important caries risk factor. Sivanewaran and Barnard (1993) found there was a direct correlation between caries experience and the consumption of sugar in refined form. In another study by Mazengo *et al.* (1996), he reported that caries experience was significantly associated with the number of snacks per day. However, other more extensive studies demonstrated that overall frequency of eating and frequency of ingestion of sugary foods between meals does not correlate to caries experience as strongly as the total weight of sugar intake (Rugg-Gunn 1984, Burt 1988). Our survey found that there were some food sources that acted protectively to the dentition; the consumption of milk and dried fruit in a usual day (OR=0.8-0.9) lead to reduced caries experience. This may indicate that there were some protective actions from the nutrient intakes of calcium, phosphate, vitamin and fibre. The finding also suggests that parents should promote eating of healthy foods to their children and take an active role in deciding what children consume at certain times of the day.

Children who used infant formula were shown to have less deciduous dentition caries experience (OR= 0.7) in our result. This may be attributed to the high concentration of fluoride during the reconstitution of infant formula with fluoridated water. Silva and Reynolds (1996) showed that infant formula reconstituted with fluoridated water can

provide a daily fluoride intake that is two- to three-fold the recommended fluoride limit, therefore, the amount of fluoride intake from this particular source should not be ignored as the combination of fluoride intake from other sources is additive.

Our survey found a strong association between caries experience and the duration since last dental visit. One would assume that frequent dental visits would be associated with less caries experience. We found that when compared to the children who had never visited a dentist, those who last visited a dentist less than six months ago had more caries experience. As was the case with children who had received topical fluoride application, it is likely that children who needed frequent dental visits were in a worse dental condition to begin with, and they were referred to the dental clinics by the School Dental Service. Our survey showed that children who had no history of prior dental visits either had a low level of caries experience or they were caries free. Another explanation may also be that children who visited a dentist regularly had a higher caries experience due to the placement of small preventive fillings; therefore an increase in the filled component would result in an increase in overall dmft/DMFT score.

Similarly, attendance for dental care was strongly associated with permanent caries experience (Table 8.2 and Table 8.3); the children who had attended for care at public dental clinics or private practices were more likely to have caries experience than those who never had dental care (OR=3.5-4). The children who never had dental care had little need to visit the dentist due to their low levels of caries experience. They were also those of parents who elected not to arrange for dental care in the private sector and were otherwise not referred to a public clinic by the School Dental Service because they had no treatment needs. It may indicate that children who visited private dental clinic were from families in higher social classes which were usually associated with less caries experience (Evans *et al*, 1984; Slade *et al*, 1996). The above observations would need to be investigated further through individual interviews with those children who had frequent dental visit and those who visited public dental clinics to ascertain the cause of higher caries experience. Among the children who had received dental care approximately half received care in the private sector and half in the public sector. The

received care in the private sector and half in the public sector. The two-fold higher caries experience of those treated in the public sector most probably reflects social factors.

Child age was shown to be a significant permanent dentition caries risk (OR=1.4) in the multivariate regression analysis (Table 8.2). This would seem logical. As the permanent dentition becomes increasingly exposed to various caries risk factors for a longer period of time, the greater the chance of having caries experience. The same result was observed by the Australian Institute of Health and Welfare (1997), where it was noted that the mean DMFT score increased quite consistently with age from 0.01 for 5-year-olds to 0.83 for 14-year-olds.

The major findings from this study are that:

1. The current levels of caries experience (dmft/DMFT) in children living in Blue Mountains and Hawkesbury regions are no longer significantly different. The mean dmft score (5 and 6 year-olds) was 0.75 and 0.74 for the Blue Mountains and Hawkesbury regions respectively. The mean DMFT score (11 and 12-year-olds) was 0.39 and 0.27 for Blue Mountains and Hawkesbury regions respectively.
2. Since fluoridation was introduced in the Blue Mountains region, the total number of decayed and filled primary teeth for 5- to 11-year-olds has fallen by 50% and the proportion of caries freedom has increased from 50 to 70%.
3. High levels of clinical caries freedom were found in both regions. Seventy-one percent of 6-year-olds and 84% of 12-year-olds had no caries experience in their primary and permanent dentition respectively in both the Blue Mountains and Hawkesbury regions.
4. The burden of caries experience in the permanent dentition was carried by only 16% of children at age 12.
5. 70% of the children examined had lifelong exposure to fluoridated water.
6. Longer periods of exposure to fluoridated water were associated with lower caries experience even in today's low caries experience environment.

7. Seventy percent of children had commenced tooth brushing with toothpaste before the age of 2 years.
8. Only a small proportion of children used fluoride supplements.
9. High intake of cordial and cola drinks increased caries risk by 40 to 50%.
10. Children who visited dentists more frequently had up to five times higher caries experience than those who never visited a dentist. This most probably reflects referrals for care by the School Dental Services and social factors

It is concluded that the introduction of water fluoridation in the Blue Mountains region achieved its purpose of bringing about a reduction in dental disease. The use of fluoridated toothpaste also contributed to this reduction. In view of the overall low caries experience among children, the focus of future oral health program should be to reduce the caries experience of children in the socially disadvantaged and higher caries experience groups.

Recommendations from the survey:

1. Water fluoridation should be continued as the cornerstone of oral public health policy.
2. Fluoridated toothpaste should be used in conjunction with water fluoridation to maximize protection to both the primary and permanent dentitions.
3. Oral hygiene instruction programs, concerning the correct use of oral hygiene aides, should be developed and delivered to children and their parents.
 - Children should be encouraged to start toothbrushing early in life.
 - Parents should dispense fluoridated toothpaste used by young children.
 - A low fluoride formulation toothpaste should be used by children under the age of 6.
 - Small headed toothbrushes should be used by children.
 - A minimum of twice daily brushing should be the norm.

4. Use of fluoride supplements discouraged because (1) of the risk of fluorosis and (2) the children who might benefit are unlikely to be reached or supervised appropriately.
5. Consumption of sugary and sticky food from dietary sources should be supervised, particularly just before bed time.
6. Regular dental visits are recommended but care should be taken by the health professionals to minimise invasive treatment and to advance intensive preventive options.
7. Follow up surveys should be conducted at regular intervals to monitor the oral health of the children.

Table 9.1: Deciduous dentition caries experience among 5 and 6-year-old children in New South Wales by region

Region	Children	Decayed (d)		Missing (m)		Filled (f)		dmft		dmft=0
	n	mean	SD	mean	SD	mean	SD	mean	SD	%
Blue Mountains*	204	0.50	1.34	0.02	0.23	0.23	0.83	0.75	1.69	74.0%
Hawkesbury*	194	0.35	0.89	0.02	0.23	0.38	1.00	0.74	1.54	70.0%
Central Coast**	3876	0.72	1.62	0.03	0.40	0.19	0.74	0.94	1.92	69.0%
Central Sydney**	3922	0.69	1.58	0.04	0.41	0.25	1.01	0.98	2.03	70.0%
Hunter**	5636	0.55	1.30	0.04	0.48	0.19	0.80	0.79	1.69	70.8%
Illawarra**	2412	0.54	1.33	0.04	0.46	0.12	0.58	0.71	1.60	73.5%
Northern Sydney**	6133	0.41	1.18	0.02	0.29	0.20	0.88	0.63	1.56	76.8%
S. Eastern Sydney**	6163	0.52	1.37	0.02	0.22	0.18	0.78	0.71	1.65	74.8%
S. Western Sydney**	8234	0.73	1.63	0.04	0.43	0.14	0.67	0.92	1.88	69.4%
Wentworth**	706	0.92	1.70	0.02	0.27	0.18	0.66	1.13	1.93	61.3%
Western Sydney**	8485	0.84	1.85	0.05	0.45	0.17	0.74	1.05	2.12	66.6%

*current study ** data from the Child Dental Health Survey NSW 2000

Table 9.2: Permanent dentition caries experience among 11 and 12-year-old children in New South Wales by region

Region	Children	Decayed (D)		Missing (M)		Filled (F)		DMFT		DMFT=0
		n	mean	SD	mean	SD	mean	SD	mean	
Blue Mountains*	171		0.11	0.50	0.00	0.00	0.27	0.69	0.39	77.7%
Hawkesbury*	253		0.07	0.34	0.00	0.00	0.20	0.69	0.27	84.9%
Central Coast**	2879		0.27	0.76	0.01	0.16	0.25	0.75	0.54	74.3%
Central Sydney**	2672		0.26	0.76	0.01	0.15	0.21	0.69	0.48	76.7%
Hunter**	4562		0.22	0.60	0.01	0.09	0.21	0.65	0.44	74.8%
Illawarra**	1856		0.24	0.65	0.02	0.20	0.24	0.70	0.50	74.1%
Northern Sydney**	3801		0.15	0.60	0.01	0.13	0.23	0.76	0.39	80.7%
S. Eastern Sydney**	4772		0.25	0.72	0.01	0.11	0.22	0.71	0.47	77.2%
S. Western Sydney**	6167		0.25	0.71	0.01	0.16	0.21	0.69	0.47	75.9%
Wentworth**	562		0.44	0.95	0.01	0.11	0.25	0.69	0.71	65.3%
Western Sydney**	9574		0.25	0.75	0.02	0.23	0.21	0.70	0.48	75.4%

*current study ** data from the Child Dental Health Survey NSW 2000

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 - b. www.hawkesbury.nsw.gov.au

Appendices

Appendix A: Map of Blue Mountains and Hawkesbury

Appendix B: Ethics approval

Appendix C: Letter for school principals

Appendix D: Information package for parents

Appendix E: Questionnaire

Appendix F: ABS classification of occupation

Appendix G: Kappa value calculation tables

Appendix H: Sample excel data sheet

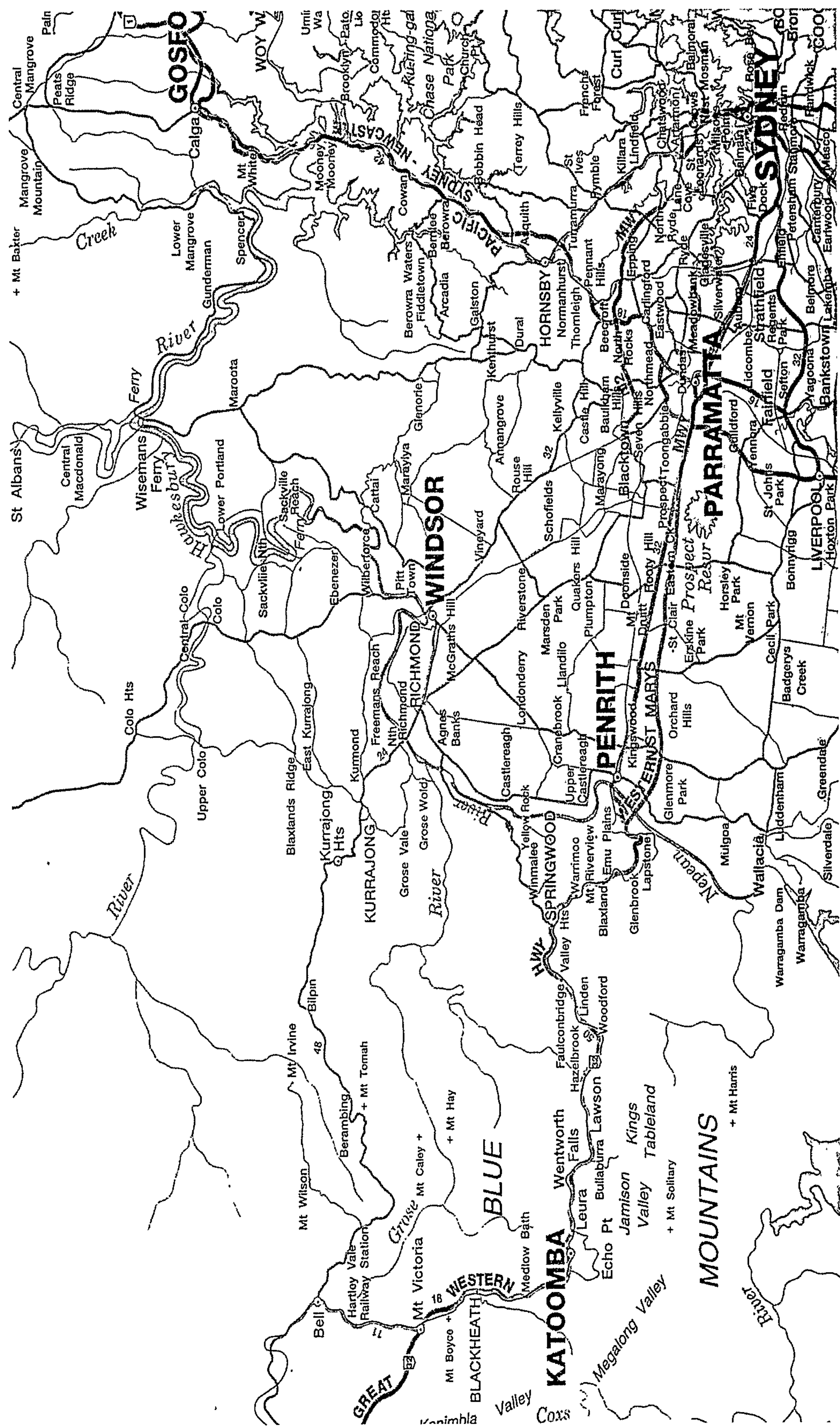
Appendix I: Data codes for clinical survey

Appendix J: Potential explanatory variables category table

Appendix K: Table of dmft/DMFT distribution by tooth type and age

Appendix A: Map of Blue Mountains and Hawkesbury

Map of Blue Mountains and Hawkesbury



Appendix B: Ethics approval



The University of Sydney

NSW 2006 Australia

24 March 2003

Dr W Evans
Community Oral Health and Epidemiology
Faculty of Dentistry
Westmead Centre for Oral Health
C24

Dear Dr Evans

Thank you for your correspondence dated 19 March 2003 addressing comments made to you by the Committee. After considering the additional information, the Executive Sub-Committee at its meeting on 20 March 2003 approved your protocol on the study below subject to the following condition. Please note that subject to annual monitoring returns, the approved protocol is valid for five years.

Title: *Child Oral Health Survey of the Blue Mountains and Hawkesbury Regions*
Ref No: 6725
Approval Period: 20 March 2003 – 20 March 2004
Authorised Personnel: Dr Wendell Evans
Dr Peter Dennison
Dr Shanti Sivaneswaran

Condition

- Approval from the Department of Education is required before the commencement of the study.

The additional information will be filed with your application.

In order to comply with the *National Statement on Ethical Conduct in Research Involving Humans*, and in line with the Human Research Ethics Committee requirements the Chief Investigator's responsibility is to ensure that:

- (1) The individual researcher's protocol complies with the final and Committee approved.
- (2) Modifications to the protocol cannot proceed until such approval is obtained in writing.

Human Research Ethics Committee

Manager:

Mrs Gail Briody

Telephone: (02) 9351 4811

(02) 9351 4474

Facsimile: (02) 9351 6706

Email: gbriody@mail.usyd.edu.au

Rooms L4.14 & L4.13 Main Quadrangle A14

Human Secretariat

Telephone: (02) 9036 9309

(02) 9036 9308

Facsimile: (02) 9036 9310

Email: r.todd@reschols.usyd.edu.au

m.williams@reschols.usyd.edu.au

- (3) The confidentiality and anonymity of all research subjects is maintained at all times, except as required by law.
- (4) All research subjects are provided with a Participant Information Sheet and Consent Form, unless otherwise agreed by the Committee.
- (5) The Participant Information Sheet and Consent Form are to be on University of Sydney letterhead and include the full title of the research project and telephone contacts for the researchers, unless otherwise agreed by the Committee.
- (6) The following statement must appear on the bottom of the Participant Information Sheet. *Any person with concerns or complaints about the conduct of a research study can contact the Manager of Ethics Administration, University of Sydney, on (02) 9351 4811.*
- (7) The standard University policy concerning storage of data and tapes should be followed. While temporary storage of data or tapes at the researcher's home or an off-campus site is acceptable during the active transcription phase of the project, permanent storage should be at a secure, University controlled site for a minimum of five years.
- (8) A progress report should be provided by the end of each year. Failure to do so will lead to withdrawal of the approval of the research protocol and re-application to the Committee must occur before recommencing.
- (9) A report and a copy of any published material should be provided at the completion of the Project.

Yours sincerely



Associate Professor Stewart Kellie
Chairman, Human Research Ethics Committee

(encl. 2)



Wentworth Area Health Service

HUMAN RESEARCH ETHICS COMMITTEE

ETHICS COMMITTEE

Mr. George Truman
Prof. Lesley Wilkes
Br. Julian Liddiard
Mr. Vittorio Cintio
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CLINICAL TRAILS SUB-COMMITTEE

Dr. Jenny Shannon
Prof. Jim Wiley
Mr. George Truman
Dr. Jim Kalantar
Ms. Hannah Liao-Loon
Ms. Sally O'Brien
Dr. Ian Seppelt

1st May, 2003

A/Prof. Wendell Evans
Faculty of Dentistry
C24 Westmead Centre for Oral Health
Westmead NSW 2145

Dear Prof. Evans,

03/018

**Child Oral Health Survey of the Blue
Mountains and Hawkesbury Regions - A/Prof.
Wendell Evans, Dr. Peter Dennison, Dr. Shanti
Sivaneswaran**

Thank you for your response dated April 12th, addressing the queries of the Committee and making the required amendments.

I am pleased to inform you that your project has now been approved.

This approval is valid for a period of 12 months from the date of this letter.

Conditions of this approval are that the Committee be kept informed of:

1. Any serious or unexpected adverse events involving participants;
2. Changes to the research protocol (including if the project is not commenced, or is delayed in commencement by more than six months from the date of this letter; or is discontinued and giving reasons)
3. All current Nepean Hospital/Area policies pertaining to the project must be fully complied with. *These policies include, Duty of Care, Infection Control and Occupational Health and Safety.*

In addition, the Committee is to be provided with immediate reports of any unforeseen events that might affect the ethical acceptability of the project.

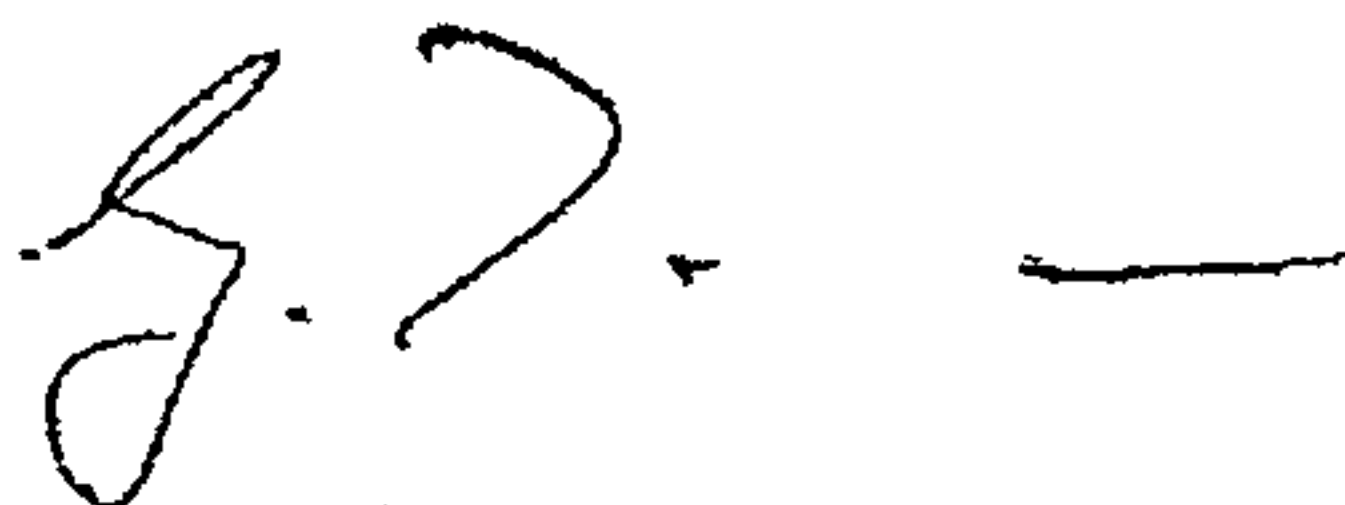
Please note that twelve-monthly Progress Reports should also be submitted to the Committee.

The project approval becomes operative when the attached copy of this letter is signed, dated and returned to Marietta Coutinho, Area Ethics Officer, Court Building, WAHS.

Should you have any queries, please contact Marietta Coutinho, WAHS Ethics Officer, on 47 34 3441.

The Committee wishes you success in the project.

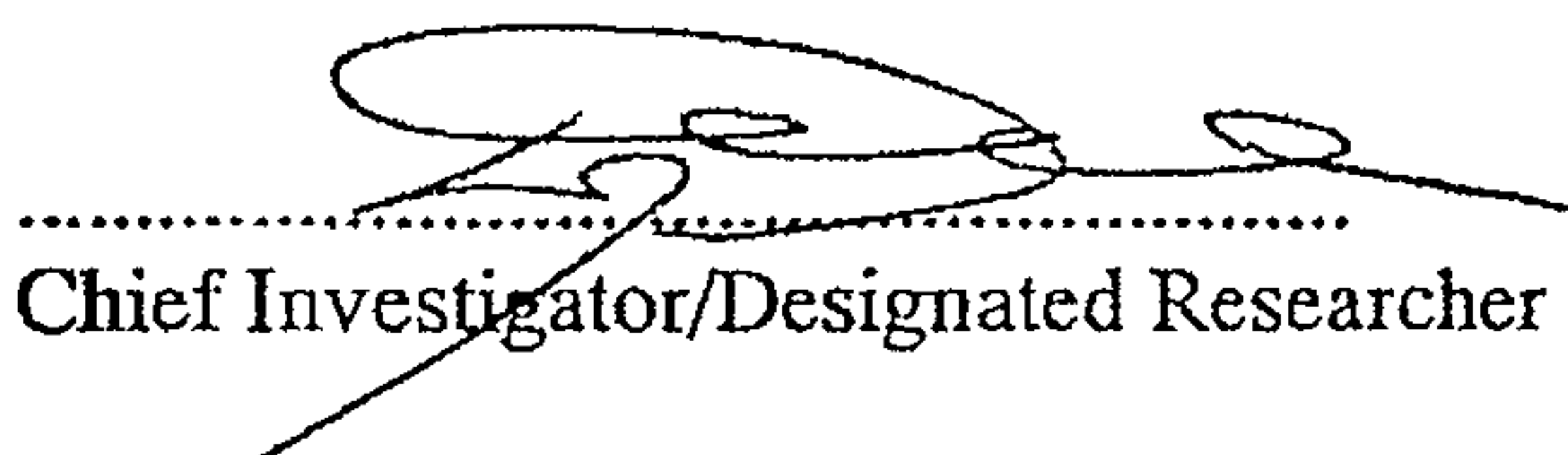
Yours sincerely,



George Truman
Chairperson WAHS Ethics Committee

CC: Dr. Peter Dennison, Faculty of Dentistry, C24 Westmead Centre for Oral Health, Westmead NSW 2145
Ms. Marie Wheatley, WAHS Oral Dental Health Clinic.

I accept, acknowledge and will comply with the conditions of approval for this project.


.....
Chief Investigator/Designated Researcher

2-5-02
.....
(Date)



Associate Professor Wendall Evans
Community Oral Health and Epidemiology
Westmead Oral Health Centre
Westmead Hospital
WESTMEAD NSW 2145

Dear Associate Professor Evans

SERAP Number: 03.39

I refer to your application to conduct a research project in NSW government schools entitled *Survey of child oral health in the Blue Mountains and Hawkesbury Regions*. I am pleased to inform you that your application has been approved. You may now contact the Principals of the nominated schools to seek their participation.

This approval will remain valid until 19/05/2004.

You should include a copy of this letter with the documents you send to schools. I draw your attention to the following requirements for all researchers in NSW government schools:

- School Principals have the right to withdraw the school from the study at any time. The approval of the Principal for the specific method of gathering information for the school must also be sought.
- The privacy of the school and the students is to be protected.
- The participation of teachers and students must be voluntary and must be at the school's convenience.
- Any proposal to publish the outcomes of the study should be discussed with the Research Approvals Officer before publication proceeds.

When your study is completed please forward your report marked to Strategic Research Directorate, Department of Education and Training, Level 6, 35 Bridge Street, Sydney, NSW 2000.

Yours sincerely

Dr Paul Brock
Director of Strategic Research
20 May 2003

Appendix C: Letter for school principals



The University of Sydney



**Faculty of Dentistry
College of Health Sciences**

Wendell Evans, MDS DDSc
Associate Professor
Community Oral Health and Epidemiology
Westmead Centre for Oral Health
Phone 9845 7537
E-mail: w.evans@dentistry.usyd.edu.au

**Oral Health Services
School Assessment Program**

Marie Wheatley
Area Director
Ph 4734 3380
E-mail: wheatlm@wahs.nsw.gov.au

May 2003

NAME AND ADDRESS OF SCHOOL HERE

Dear Principal

Child Oral Health Survey of the Blue Mountains and Hawkesbury Regions

On behalf of the Faculty of Dentistry, University of Sydney, and the Wentworth Area Health Service we are writing about a survey of children's dental health in the Blue Mountains and Hawkesbury regions. Your school has been selected again to participate in this survey to follow up the original one 10 years ago which involved a random sample of schools.

Since then, water fluoridation has been introduced into the Blue Mountains to help prevent tooth decay. The purpose of this follow-up survey is to monitor the changes that have occurred in the oral health of children in Blue Mountains and Hawkesbury regions over the last decade.

The survey, which will be conducted according to World Health Organisation guidelines, has been approved by the Human Ethics Committee of the University of Sydney, the Ethics Committee of Wentworth Area Health Service, and by the Strategic Research Unit of the NSW Dept. of Education.

Please take a few minutes to read the material in the attached pack which is intended for parents of children at your school. The survey relies on the cooperation of the participating schools in two ways: -

1. To distribute a survey pack for each child at the school to parents and receive signed consent forms back in sealed labeled envelopes to maintain confidentiality.
2. To provide a suitable space for the survey for the short time that researchers are at the school. All equipment needed will be provided and meet OHS requirements.

If you have any questions about the survey, please do not hesitate to contact me on Ph 02-9845-7537. One of the researchers will contact you within the next week about this letter to discuss what is involved in more depth.

We look forward to working with you on this study, and acknowledge that before it can proceed your agreement in writing will be required.

Yours sincerely,

Dr Wendell Evans
Associate Professor and Principal Investigator

Graham Jenkins.....
CEO WAHS

Appendix D: Information package for parents



The University of Sydney

**Faculty of Dentistry
College of Health Sciences**

Wendell Evans, MDS DDSc
Associate Professor
Community Oral Health and Epidemiology

Westmead Centre for Oral Health
Westmead Hospital
Australia NSW 2145

Tel: +61 2 9845 7537 Fax: +61 2 9845 8306
E-mail: w.evans@dentistry.usyd.edu.au

May 2003

Dear Parent/Guardian,

**Child Oral Health Survey of the Blue Mountains
and Hawkesbury Regions**

Welcome to the survey of children's oral health in the Blue Mountains and Hawkesbury regions. Your child's school is one of those selected to participate. Details of this survey are described in the Information Statement.

The last survey of children's oral health in your region was undertaken 10 years ago and since then water fluoridation has been introduced into the Blue Mountains to help prevent tooth decay. The purpose of this follow-up survey is to monitor the changes that have occurred in the Hawkesbury and Blue Mountains regions since then.

The survey, which will be conducted under my direction according to World Health Organisation guidelines, has been approved by your School Principal, and the Ethics Committees of the NSW Department of Education, University of Sydney, and Wentworth Area Health Service.

Please take a few minutes to read the Information Statement, the enclosed questionnaire, and the consent forms.

I hope that you will consent to the dental health survey and fill out the attached questionnaire. If your child participates in the survey you will receive a report of your child's dental health needs.

If you have any questions about the survey, please do not hesitate to contact me on 02 9845 7537.

Yours sincerely,

Dr Wendell Evans
Associate Professor and Principal Investigator



The University of Sydney

Wendell Evans, MDS DDSc
Associate Professor
Community Oral Health and Epidemiology

**Faculty of Dentistry
College of Health Sciences**

Westmead Centre for Oral Health
Westmead Hospital
Australia NSW 2145

Tel: +61 2 9845 7537 Fax: +61 2 9845 8306
E-mail: w.evans@dentistry.usyd.edu.au

Child Oral Health Survey of Blue Mountains and Hawkesbury Regions

Dear Parent/Guardian,

Thank you for agreeing to participate in the Blue Mountains and Hawkesbury Child Oral Health Survey. Please fill in the CONSENT below and the QUESTIONNAIRE and CONSENT enclosed. All information you provide will be strictly confidential. Please return the QUESTIONNAIRE and CONSENT to your child's school and keep this copy for your own records.

CHILD ORAL HEALTH SURVEY PARENTAL (OR GUARDIAN) CONSENT FORM

CHILD'S FIRST NAME: **CHILD'S SURNAME:**

DATE of BIRTH/...../.....
day month year

SEX: Male Female
(Circle one)

ADDRESS: **TOWN/SUBURB:**

STATE: **POSTCODE:** **TELEPHONE:** ()
(Area code) (Number)

SCHOOL: **YEAR LEVEL:**

1. I (Please PRINT name) agree and permit my child (as documented above) to participate in the dental survey as described in the INFORMATION STATEMENT TO PARENTS on the back of the letter sent to me.
2. I acknowledge that I have read this INFORMATION STATEMENT which describes the purpose of the survey and the nature of the dental examination. I understand this and that a photograph of my child's front teeth will be taken but that this will not include his/her face.
3. Before signing this CONSENT FORM, I have been given the opportunity to ask any questions and I have received satisfactory answers. My consent is freely given.
4. I understand that I can withdraw my child from the survey at any time without prejudice to my of my child's relationship to the University.
5. I agree that research results based on the survey information obtained may be published provided that neither my child nor I may be identified.
6. I understand that if I have any questions relating to my child's participation in this research, I may contact Dr Wendell Evans on telephone 02 9845 7537 who will be happy to answer them.
7. I acknowledge that I have a copy of the INFORMATION STATEMENT TO PARENTS (OR GUARDIANS) and a signed copy of the CONSENT FORM.

Signature of parent or guardian: **Date:**

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**PLEASE KEEP THIS COPY OF THE CONSENT FORM FOR YOUR
RECORDS**



The University of Sydney

**Faculty of Dentistry
College of Health Sciences**

Wendell Evans, MDS DDSc
Associate Professor
Community Oral Health and Epidemiology

Westmead Centre for Oral Health
Westmead Hospital
Australia NSW 2145

Tel: +61 2 9845 7537 Fax: +61 2 9845 8306
E-mail: w.evans@dentistry.usyd.edu.au

INFORMATION STATEMENT TO PARENTS AND GUARDIANS

Child Oral Health Survey of the Blue Mountains and Hawkesbury Regions

An oral health survey of school children will be conducted by dentists from the Dental School at Sydney University. Approval to conduct this survey has been granted by your school principal, the NSW Department of Education, The University of Sydney, and the Wentworth area Health Service. The purpose of the survey is to monitor the oral health of children living in the Blue Mountains and Hawkesbury regions. In 1993, a similar survey was conducted, and this provided valuable information to assist the planning of a more effective health service and research into establishing effective ways of preventing oral diseases for children residing in these areas.

What is involved

With your permission, we will conduct an oral examination of your child at school according to World Health Organisation criteria. This oral examination, using a dental mirror and a non-sharp ball-ended tooth explorer, will identify any treatment need for tooth decay. We will also record tooth cleanliness, the number of fillings and missing teeth (if any). In addition, we will take a photograph of your child's front teeth as a record of tooth colour and shape (the photograph will not include your child's face). This photograph will be stored and used to compare tooth colour in future studies. No x-rays will be taken.

You are also asked to complete the enclosed questionnaire and return it to your child's school in the envelope provided. Finally, you will be advised of any need to arrange for dental care.

Confidentiality

Only the University dentists will have access to the oral examination and questionnaire information. This information will be put in a computer for analysis and the examination and questionnaire forms will be destroyed. Your name and your child's name *will not* be put in the computer.

The survey results will be published and a report will be sent to your school. The report will not include names or other information that could identify you or your child.

Your participation and consent

Your participation will make an important contribution to knowledge about oral health of school children in your region.

We would be grateful if you would read and complete the **QUESTIONNAIRE**. There are two copies of the **CONSENT FORM**. Please complete and sign both of them. Keep the completed **CONSENT FORM** on the back of this **INFORMATION STATEMENT** for your reference, and return the other copy and completed questionnaire to your child's school.

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Any person with concerns or complaints about the conduct of a research study can contact the Manager for Ethics Administration, University of Sydney on (02) 9351 4811.



The University of Sydney



**Faculty of Dentistry
College of Health Sciences**

Wendell Evans, MDS DDSc
Associate Professor
Community Oral Health and Epidemiology
Westmead Centre for Oral Health
Phone 9845 7537
E-mail: w.evans@dentistry.usyd.edu.au

**Oral Health Services
School Assessment Program**

Marie Wheatley
Area Director
Ph 4734 3380
E-mail: wheatlm@wahs.nsw.gov.au

May 2003

Dear Parent/Guardian,

**School Dental Assessment Program 2003
&
Child Oral Health Survey of the Blue Mountains and Hawkesbury Regions**

On behalf of the Wentworth Area Health Service, dentists from the University of Sydney under my direction will conduct the 2003 School Dental Assessment Program for children in kindergarten, and in years 2, 4, and 6. To do this we need you to sign the usual consent and return it to your child's school. In addition, I would be grateful if you would give us permission to include your child in the survey of children's dental health in the Blue Mountains and Hawkesbury regions.

The last survey of children's oral health in your region was undertaken 10 years ago and since then water fluoridation has been introduced into the Blue Mountains to help prevent tooth decay. The purpose of this follow-up survey is to monitor the changes that have occurred in the Hawkesbury and Blue Mountains regions since then.

The survey, which will be conducted according to World Health Organisation guidelines, has been approved by your School Principal, and the Ethics Committees of the NSW Department of Education, University of Sydney, and Wentworth Area Health Service.

Please take a few minutes to read the Information Statement, the enclosed questionnaire, and the consent forms.

I hope that you will consent to the survey of children's dental health and fill out the attached questionnaire. If your child participates in the survey you will receive a report of your child's dental health needs.

If you have any questions about the survey, please do not hesitate to contact me on 9845 7537.

Yours sincerely,

Dr Wendell Evans
Associate Professor and Principal Investigator



Wentworth Area Health Service

Child Priority Oral Health Program Consent Form

Office Use Only
CODE:

CHILDS DETAILS/ ONE CHILD PER CONSENT FORM

Child's School:	Grade:	Class:
-----------------	--------	--------

Child's First Name:	Child's Family Name:	DOB:
---------------------	----------------------	------

Address:	Suburb:
Postcode:	
Phone After Hours:	Business Hours:
Mobile:	

Child's Country Of Birth:	Language Spoken:
Does your child speak another language? Yes/ No	
Please state language:	
Aboriginal or Torres Strait Islander: Yes/ No	

Does Your Child Require an interpreter?	Yes/ No
Which Language:	

Medicare Number:	
CONSENT:	
Please tick: Yes () Please check my child's teeth at school	
No () Thank you, I do not want my child's teeth checked	
Parent / Guardian Signature:	
Parent / Guardian Name:	Title:
Date:	

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Wentworth Area Health Service

Child Priority Oral Health Program 2003 SCHOOL ASSESSMENT PROGRAM

Dear Parent / Guardian,

As part of the Child Priority Oral Health program, a school based assessment program (SAP) is being conducted at identified schools within the Wentworth Area Health Service. Your child is eligible to have a free dental assessment at school from the Child Oral Health Services.

On return of the signed consent form to the school, arrangements will be made for your child's assessment at school. This will involve a dental examination of your child's teeth using a sterile mirror and blunt dental probe. No treatment will be given. A note will be sent home with your child to advise you of the outcome of the SAP assessment.

This year the SAP exam will be provided by staff from the University of Sydney Faculty of Dentistry who are conducting an oral health survey of school children in the Blue Mountains and Hawkesbury areas. Approval to conduct this survey has been granted by your school principal, the NSW Department of Education, the Wentworth Area Health Service and the University of Sydney.

I encourage you to also take part in the University of Sydney Child Oral Health Survey. It will provide valuable information on preventive measures in the community and assist the planning of a more effective oral health service in our region.

ALL INFORMATION IS STRICTLY CONFIDENTIAL

THIS IS A FREE SERVICE

Please fill out the attached consent form, put it in the envelope provided by the University of Sydney, and return it to the school as soon as possible.

CONTACT DETAILS

If further information regarding the assessment is required please contact your child's school.

For further information regarding the Child Priority Oral Health Program contact your local Oral Health Clinic.

**Marie Wheatley
Acting Area Director,
Oral Health Services
Wentworth Area Health Service**

Nepean Oral Health Clinic
Nepean Hospital
Somerset Street
Kingswood 2747
Phone: (02) 4734 2387

St Mary's Oral Health Clinic
Princess Marys Street
St Mary's 2760
Phone: (02) 9623 9942

Hawkesbury Oral Health Clinic
Community Health Building
Cnr Macquarie & Day Sts
Windsor 2756
Phone: (02) 4560 5756

Springwood Oral Health Clinic
Community Health Centre
288 – 292 Macquarie Road
Springwood 2777
Phone: (02) 4751 0120

PRIVACY PROTECTION GUIDELINES

PRIVACY INFORMATION SHEET FOR PERSONAL HEALTH INFORMATION COLLECTED FOR THE SCHOOL DENTAL RISK ASSESSMENT PROGRAM (SAP)

The Education Teaching Service your child/children attends will be acting as an agency to collect and disclose the personal health information you have provided about your child on this consent form to the Area Health Service. Purposes for the collection of this information includes:

- Service delivery
- Continuity of care
- Clinical productivity, or decision making
- Protection of public health
- Quality measurement, or management
- Funding and payment
- Research

This information is personal information for the purposes of the *Privacy and Personal Information Protection Act 1998*.

The intended recipients of the information are health care providers, who conduct the dental risk assessment at the School, and health workers involved in the management of the oral health information system.

The supply of your child's health information and consent for a dental risk assessment is voluntary.

Generally any person who has authorised access to health information is bound by a duty of confidentiality. The privacy and confidentiality of the personal information held about your child will be respected.

You are entitled to see information held about your child by the Area Health Service. You have the right to correct and amend personal information held about your child.

Further information about privacy protection is available in the NSW Health Privacy Management Plan at
<http://www.health.nsw.gov.au/fcsd/rmc/cib/circulars/2000/cir2000-62.pdf>

Your child's school is to be regarded as the agency collecting this information and Wentworth Area Health Service, Oral Health Service, P O Box 63, Penrith 2751 is to be regarded as the principal agency that is to hold this information.



The University of Sydney

**Faculty of Dentistry
College of Health Sciences**

Wendell Evans, MDS DDSc
Associate Professor
Community Oral Health and Epidemiology

Westmead Centre for Oral Health
Westmead Hospital
Australia NSW 2145

Tel: +61 2 9845 7537 Fax: +61 2 9845 8306
E-mail: w.evans@dentistry.usyd.edu.au

**Child Oral Health Survey of Blue Mountains and Hawkesbury
regions**

Reminder Notice

Dear Parent/Guardian,

A short time ago you should have received a letter, information sheet, and questionnaire as part of an invitation to participate in an important dental survey which will allow a better understanding of how to protect children's teeth against decay.

If you have already returned the consent form and questionnaire, please accept our thanks and ignore this notice. However, if you haven't done so, please fill and return the consent and questionnaire to your child's school today. Your cooperation will assist us to make this a useful one for the children of your region.

If by some chance, you did not receive the information package or it was misplaced, please contact the Research Team on 9845 7537.

Yours sincerely,

Associate Professor Wendell Evans
Principal Investigator

Appendix E: Questionnaire



The University of Sydney

Faculty of Dentistry
College of Health Sciences

Wendell Evans, MDS DDSc
Associate Professor
Community Oral Health and Epidemiology

Westmead Centre for Oral Health
Westmead Hospital
Australia NSW 2145

Tel: +61 2 9845 7537 Fax: +61 2 9845 8306
E-mail: w.evans@dentistry.usyd.edu.au

CHILD ORAL HEALTH SURVEY 2003

Dear Parent/Guardian,

Thank you for agreeing to participate in the Blue Mountains and Hawkesbury Child Oral Health Survey. Please fill in the forms below and the questionnaire. All information you provide will be strictly confidential.

CONSENT FORM

CHILD'S FIRST NAME: CHILD'S SURNAME:

ADDRESS: TOWN/SUBURB:

STATE: POSTCODE: TELEPHONE: ()
code) (Number) (Area)

SCHOOL: YEAR LEVEL:

I, *(please print your name in full)*, have read the accompanying cover letter and consent to provide information for the Blue Mountains and Hawkesbury Child Oral Health Survey.

In giving my consent I understand that:

- a) I am free to withdraw my consent at any time, and this will not affect dental advice or treatment in the management of my child's health, now or in the future;
- b) The study is for the purpose of research which, although designed to improve the dental health of children in Australia, may not directly benefit my child; and
- c) The confidentiality of information that I provide for the study will be safeguarded.
- d) I understand what my participation includes. It includes filling in one questionnaire and allowing that information from my child's regular dental examination and visits at the School Dental Service clinic to be used for research purposes only. My consent is given freely.
- e) I am aware that I can make a copy of this Consent Form and the attached information letter when completed.

In case we need to contact you in future for research purposes, it would be useful to know of a person who does not live with you and can help the researchers contact you. The researchers will contact that person only if you cannot be contacted.

GIVEN NAME: SURNAME:

ADDRESS: SUBURB:

STATE: POSTCODE: TELEPHONE: ()
(Area code) (Number)

Is this person your mother, brother, friend etc.?

CLINIC USE ONLY - All details must be completed

EXAMINATION

/ /

DATE OF

/ /

ID

/ /

PLEASE READ THIS BEFORE STARTING THE QUESTIONNAIRE

- All of the questions in the questionnaire that refer to 'your child' concern the child named on the Consent Form at the front of this booklet.
- All of your answers are valuable to us, so please complete all questions to the best of your knowledge. If you are uncertain about a question, please ring FREECALL 1800-333-370 for advice.
- Please ignore the small numbers next to boxes; they are for office use only.

EXAMPLES OF QUESTIONS

- Some questions require you to tick only one box. For example:

Has your child ever used mouthrinse?

(Tick one box only)

- ☒₁ Yes
☐₂ No
☐₃ Don't know

- Other questions may allow you to give multiple answers. For example:

When does your child usually brush his/her teeth?

(Tick as many boxes as applicable)

- ☒₁ Before breakfast
☐₂ After breakfast
☒₃ After lunch
☒₄ After dinner
☐₅ Immediately before bed
☐₆ At other times

- There will always be instructions next to the question telling you how many boxes you can tick. These instructions will be written in *italic* writing.
- Some of the questions ask for information about specific time periods of your child's life as in the following example. For questions like this, please tick one box for each time period as shown below unless indicated otherwise.

The child in this example brushed his/her teeth **less than once a day when he/she started brushing, once a day at age five and once a day now**. This child's details should be filled in as follows:

EXAMPLE QUESTION	WHEN HE/SHE STARTED BRUSHING	NOW
How often did/does your child brush his/her teeth with toothpaste?	☒ ₁ Less than once a day ☐ ₂ Once a day ☐ ₃ Twice a day ☐ ₄ More than twice a day	☐ ₁ Less than once a day ☒ ₂ Once a day ☐ ₃ Twice a day ☐ ₄ More than twice a day

- Some questions require a written answer, as in these examples:

At what age did your child start taking fluoride tablets?

8 6
---Years--- ---Months---

OR

What brand of infant formula did you use?

Enfamil

- The questions should take you around 20 minutes to complete. If you need help filling in the questionnaire, please don't hesitate to give us a call on FREECALL 1800-333-370.

PLEASE START THE QUESTIONNAIRE ON THE FOLLOWING PAGE:

CHILD ORAL HEALTH SURVEY 2003

Dental Practices

1a

Has your child ever brushed his/her teeth with toothpaste (with or without help from an adult)?
(Tick one box only)

☐₁ Yes

☐₂ No

→ GO TO QUESTION 5

1b

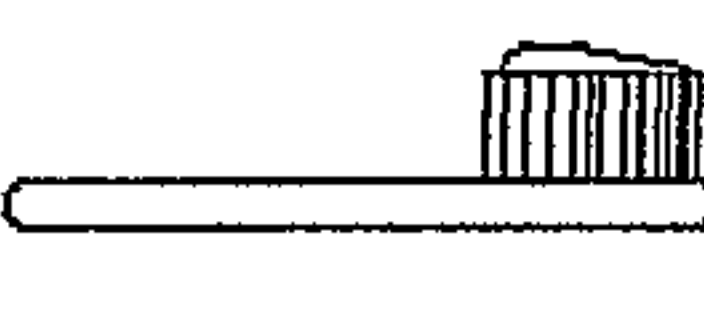
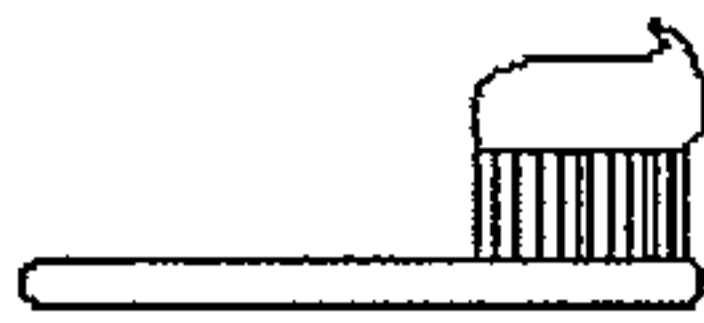
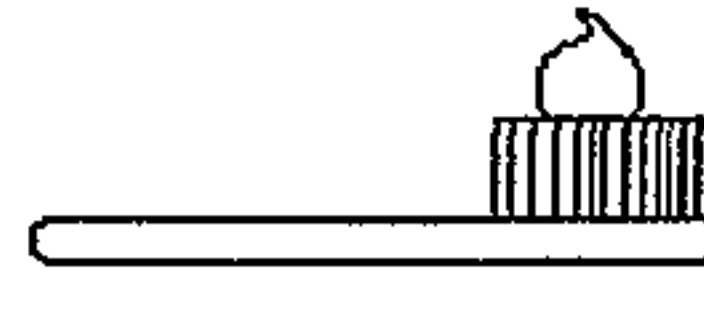
At what age did he/she start brushing with toothpaste (with or without help from an adult)?
(Write age)

.....
Years

.....
Months

2

For the following questions, please tick one box only for each time period in your child's life.

	WHEN YOUR CHILD STARTED BRUSHING	NOW
a) How often did/does your child brush his/her teeth with toothpaste?	☐ ₁ Less than once a day ☐ ₂ Once a day ☐ ₃ Twice a day ☐ ₄ More than twice a day	☐ ₁ Less than once a day ☐ ₂ Once a day ☐ ₃ Twice a day ☐ ₄ More than twice a day
b) What type of toothpaste did/does your child use?	☐ ₁ Standard fluoride toothpaste ☐ ₂ Children's toothpaste ☐ ₃ Non-fluoridated paste ☐ ₄ Don't know/not sure	☐ ₁ Standard fluoride toothpaste ☐ ₂ Children's toothpaste ☐ ₃ Non-fluoridated paste ☐ ₄ Don't know/not sure
c) Have you noticed your child eating or licking toothpaste?	☐ ₁ Often ☐ ₂ Sometimes ☐ ₃ Never	☐ ₁ Often ☐ ₂ Sometimes ☐ ₃ Never
d) What size of toothbrush did/does your child use?	(If your child uses an electric toothbrush, please tick 'Small size')	
	☐ ₁ Small size ☐ ₂ Regular size	☐ ₁ Small size ☐ ₂ Regular size
e) After tooth brushing did/does your child usually...	☐ ₁ just swallow ☐ ₂ rinse and swallow ☐ ₃ rinse and spit ☐ ₄ just spit ☐ ₅ other ☐ ₆ don't know	☐ ₁ just swallow ☐ ₂ rinse and swallow ☐ ₃ rinse and spit ☐ ₄ just spit ☐ ₅ other ☐ ₆ don't know
f) How much toothpaste did/does your child (or do you) use on his/her toothbrush?	☐ ₁  ☐ ₂  ☐ ₃ 	☐ ₁  ☐ ₂  ☐ ₃ 

3

How did/do you assist your child to brush his/her teeth? (Tick one box only for each time period)

WHEN YOUR CHILD STARTED BRUSHING	NOW
☐1 Applied toothpaste & brushed teeth ☐2 Put toothpaste on his/her brush only ☐3 Just watched and gave advice ☐4 Helped him/her in a different way ☐5 Did not help him/her brush	☐1 Applied toothpaste & brushed teeth ☐2 Put toothpaste on his/her brush only ☐3 Just watched and gave advice ☐4 Helped him/her in a different way ☐5 Did not help him/her brush

4

When did/does your child usually brush his/her teeth?
(Tick as many boxes as applicable for each time period)

WHEN YOUR CHILD STARTED BRUSHING	NOW
☐1 Before breakfast ☐2 After breakfast ☐3 After lunch ☐4 After dinner ☐5 Immediately before bed ☐6 At other times	☐1 Before breakfast ☐2 After breakfast ☐3 After lunch ☐4 After dinner ☐5 Immediately before bed ☐6 At other times

5

Has your child ever taken fluoride tablets or drops? (Tick one box only)

☐1 Yes, fluoride tablets only

☐2 Yes, fluoride drops only

☐3 Yes, fluoride tablets and fluoride drops

☐4 No

☐5 Don't know

GO TO QUESTION 11

GO TO QUESTION 11

6

At what age did your child ...

start taking fluoride tablets or drops?
(Write age or '0' if used since birth)

.....
Years

.....
Months

stop taking fluoride tablets or drops?
(Write age or 'still taking')

.....
Years

.....
Months

7

How many fluoride tablets or drops did/does your child take at a time?
e.g. ½ tablet, 2 drops.
(Write number of tablets or drops or '0' if not taken at this age)

BIRTH – 6 MONTHS	6 MONTHS – 4 YEARS	OVER 4 YEARS
..... tablet/s	 tablet/s	 tablet/s
..... drop/s	 drop/s	 drop/s

8

How often did /does your child take the number of tablets or drops you wrote in Question 7?
(Tick one box only for each age group)

BIRTH – 6 MONTHS	6 MONTHS – 4 YEARS	OVER 4 YEARS
☐1 More than once a day ☐2 Once a day ☐3 5 to 6 times a week ☐4 2 to 4 times a week ☐5 Once a week ☐6 Infrequently/varied	☐1 More than once a day ☐2 Once a day ☐3 5 to 6 times a week ☐4 2 to 4 times a week ☐5 Once a week ☐6 Infrequently/varied	☐1 More than once a day ☐2 Once a day ☐3 5 to 6 times a week ☐4 2 to 4 times a week ☐5 Once a week ☐6 Infrequently/varied

9

What time of day did/does your child usually take fluoride tablets or drops?

(Tick as many boxes as applicable)

BIRTH – 6 MONTHS	6 MONTHS – 4 YEARS	OVER 4 YEARS
☐ ₁ Before breakfast	☐ ₁ Before breakfast	☐ ₁ Before breakfast
☐ ₂ After breakfast	☐ ₂ After breakfast	☐ ₂ After breakfast
☐ ₃ After lunch	☐ ₃ After lunch	☐ ₃ After lunch
☐ ₄ After dinner	☐ ₄ After dinner	☐ ₄ After dinner
☐ ₅ In the hour before bed	☐ ₅ In the hour before bed	☐ ₅ In the hour before bed
☐ ₆ At other times	☐ ₆ At other times	☐ ₆ At other times

10

How did/does your child usually take fluoride tablets or drops? *(Tick as many boxes as applicable)*

☐₁ Swallowing

☐₂ Chewing and swallowing

☐₃ Dissolved in a glass of water

☐₄ Dissolved in a litre of water

☐₅ Taken in another way

11

Has your child ever used fluoride mouthrinse? *(Tick one box only)*

Please note that not all mouthrinses contain fluoride. If possible, check the ingredients on the bottle.

☐₁ Yes

☐₂ No → GO TO QUESTION 14

☐₃ Don't know → GO TO QUESTION 14

12

At what age did your child ...

start using fluoride mouthrinse?
(Write age or '0' if used since birth)

.....
Years

.....
Months

stop using fluoride mouthrinse?
(Write age or 'still taking')

.....
Years

.....
Months

13

How often did/does your child use fluoride mouthrinse at the following times?
(Tick one box only for each time period)

When he/she started using it	Now or when he/she stopped using it
☐ ₁ Every day	☐ ₁ Every day
☐ ₂ A few times a week	☐ ₂ A few times a week
☐ ₃ Once a week	☐ ₃ Once a week
☐ ₄ Infrequently	☐ ₄ Infrequently

14

Has your child ever had fluoride gel applied to his/her teeth? *(Tick one box only in each column)*

School Dental Service	Private dental practice	Home application
☐₁ Yes <i>(write number of times)</i> → times ☐₂ No ☐₃ Don't know	☐₁ Yes <i>(write number of times)</i> → times ☐₂ No ☐₃ Don't know	☐₁ Yes <i>(write number of times)</i> → times ☐₂ No ☐₃ Don't know

Birth Place & Residential Movements

15 Please read the example below and then complete the table on the next page.

Write the name of each suburb, town or location your child has lived in, and the years that he/she lived there. You are able to list one residence more than once if your usual source of water has changed over time. Only include places where your child has lived for six months or more.

Then tick a box to indicate your child’s usual source of drinking water at home and at school, and the water used in cooking food for your child.

PLEASE NOTE:

We refer to two different types of filtered water in the table below: carbon/charcoal and osmosis/distillation.

Carbon/charcoal filtered: Refers to carbon or charcoal filters (e.g. ‘Pura Tap’, ‘Aqua Pure’)
Osmosis/distillation filtered: Refers to reverse osmosis or distillation systems

EXAMPLE:

- This is an example of a child who has lived at their current address in Unley, SA since 1995 where she has used unfiltered tap water at home and for cooking. At school she drank spring water.
- Prior to that she lived for two months in Mount Barker. As she lived there for less than six months it is not included in the table.
- Prior to that she lived for nine months in Gawler where she used filtered tap water from a bench top charcoal filter (Carbon/charcoal filtered) at home and tank water for cooking.
- This child only lived in Gawler for part of a year, so the same year has been written in the “From” and “To” boxes.
- Her details would be filled in as follows:

Suburb, town or location (Start at current residence of 6 months or more)	Country/ Australian State or Territory	Years of residence		(Please tick one box only below in each column where applicable)			
		From	To	What was your child’s usual source of water?	At home	At school	For cooking
1. Unley	SA	1995	2002	Tap/mains 1	✓		✓
				Carbon/charcoal filtered			
				Osmosis/distillation filtered 3			
				Tank			
				Spring/mineral 5		✓	
				Bore			
				Don’t know 7			
2. Gawler	SA	1994	1994	Tap/mains 1			
				Carbon/charcoal filtered	✓		
				Osmosis/distillation filtered 3			
				Tank			✓
				Spring/mineral 5			
				Bore			
				Don’t know 7			

If you have any trouble filling this table in, please don’t hesitate to give us a call on the Child Oral Health Study Hotline: 1800-333-370. We would be more than happy to help you fill it in!

We have given you enough spaces for six residences/entries. If you run out of spaces please attach an extra sheet of paper following the same format as in our table.

You are able to list one residence more than once if your usual source of water has changed over time.

Suburb, town or location (Start at current residence of 6 months or more)	Country/ Australian State or Territory	Years of residence		(Please tick one box only below in each column where applicable)			
		From	To	What was your child's usual source of water?	At home	At school	For cooking
1.				Tap/mains 1			
				Filtered			
				Tank 3			
				Bottled			
				Bore 5			
				Don't know			
2.				Tap/mains 1			
				Filtered			
				Tank 3			
				Bottled			
				Bore 5			
				Don't know			
3.				Tap/mains 1			
				Filtered			
				Tank 3			
				Bottled			
				Bore 5			
				Don't know			
4.				Tap/mains 1			
				Filtered			
				Tank 3			
				Bottled			
				Bore 5			
				Don't know			
5.				Tap/mains 1			
				Filtered			
				Tank 3			
				Bottled			
				Bore 5			
				Don't know			
6.				Tap/mains 1			
				Filtered		155	
				Tank 3			
				Bottled			
				Bore 5			

Dietary Intake

16

At each residence you listed on the previous page, how much of the total amount of fluids drunk was tap/mains water?

Please complete the table below. (Tick one box only for each residence/ entry you stated on the previous page)

In our example below more than half of what this child drank was tap water.

	Almost none ₁	Less than half ₂	About half ₃	More than half ₄	Almost all ₅
EXAMPLE→				✓	
Residence/ entry 1 on previous page					
Residence/ entry 2 on previous page					
Residence/ entry 3 on previous page					
Residence/ entry 4 on previous page					
Residence/ entry 5 on previous page					
Residence/ entry 6 on previous page					

17

Was your child ever fed infant formula? (Tick one box only)

- ☐₁ Yes
- ☐₂ No → GO TO QUESTION 22
- ☐₃ Don't know → GO TO QUESTION 22

18

What did you usually add to the infant formula for your child? (Tick one box only)

- ☐₁ Tap water – mains supply
- ☐₂ Carbon/charcoal filtered tap water
- ☐₃ Osmosis/distillation filtered tap water
- ☐₄ Mineral/Spring water
- ☐₅ Tank water
- ☐₆ Unknown

In the table below, please write the number of serves of food your child eats in a usual day, AND how many serves he/she usually eats in the last hour before bed. Please use the standard serves as listed below.

EXAMPLE: In our example below this child eats 3 serves of fruit in a usual day, with 1 of these 3 serves of fruit eaten in the last hour before the child goes to bed.

Enter the number of serves your child eats of each food or '0' if he/she does not usually eat the food.

	In a usual..... ↓ day (total) ↓	How many of those eaten in a usual day are eaten in the last ↓ hour before bed ↓
EXAMPLE FOR FRUIT →	3	1
Fruit e.g., apples, oranges		
Pure fruit juices and fruit drinks, e.g., orange, apple		
Sweetened cordial drinks e.g., packet or bottled		
Fizzy drinks/sports drinks e.g., Lemonade, Gatorade		
Cola drinks e.g., Coke, Pepsi		
Plain Milk		
Sweetened dairy products e.g., yoghurt		
Chocolate and sugary lollies		
Muesli bars and health bars		
Dried fruits e.g., Roll-ups, dried apricots		

General Information

20 Was your child born prematurely? (i.e. before 37 weeks) (Tick one box only)

- ☐1 Yes
- ☐2 No
- ☐3 Don't know

21 What was the birth weight of your child? (Tick one box only and write weight in spaces provided)

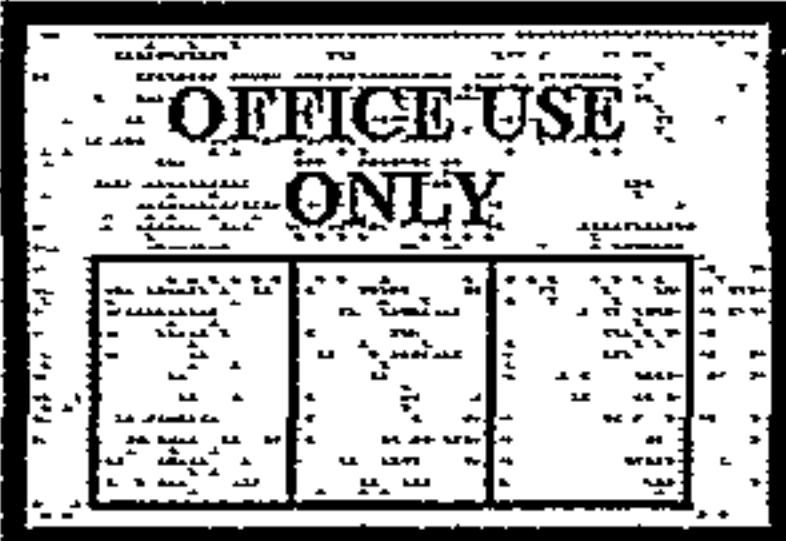
- ☐1 _____ Kilograms (e.g. 3.2 kg) OR _____ pounds _____ ounces
- ☐2 Don't know

Characteristics of the Household

The following questions are about your household. These questions will help to decide if different methods of preventing dental problems work equally well for all groups within the community and to ensure that the researchers obtain an accurate cross-section of households.

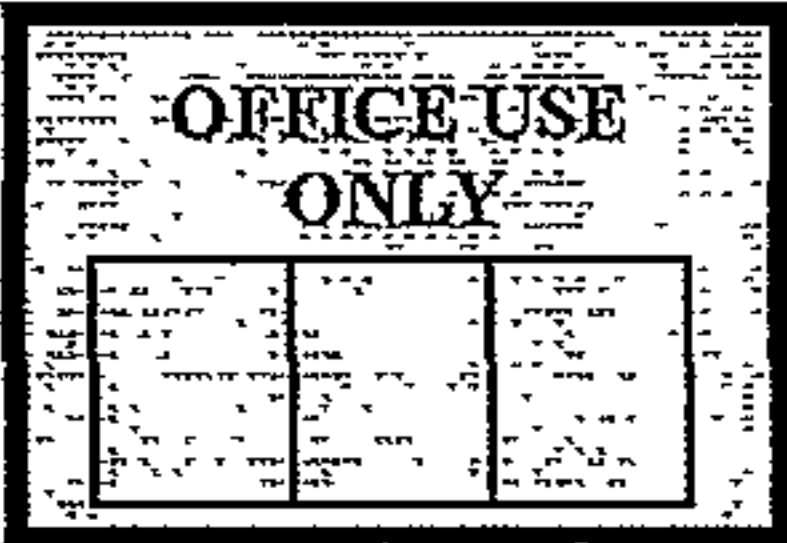
22 In which country was your child born?

(Write name of country)



23 In which country was mother born?

(Write name of country)



24 Is English the main language spoken at home?

- ☐1 Yes
- ☐2 No

25 Is your child of Aboriginal or Torres Strait Islander origin? (Tick one box only)

- ☐1 No
- ☐2 Yes, Aboriginal
- ☐3 Yes, Torres Strait Islander
- ☐4 Yes, Aboriginal and Torres Strait Islander

26 Does your child live in a one-parent household? (Tick one box only)

- ☐1 Yes
- ☐2 No

Please complete the table below.

If your child lives in a one-parent household, please fill in one column for yourself. If he/she lives in a two-parent household, please fill in both columns for yourself and your partner.

QUESTION	↓ Parent or Guardian (A)	↓ Parent or Guardian (B)
a) What is <u>your</u> age?	 Years	 Years
b) What is your sex?	☐ ₁ Male ☐ ₂ Female	☐ ₁ Male ☐ ₂ Female
c) In which country were you born? (<i>Write country</i>)		
d) Are you of Aboriginal or Torres Strait Islander origin? (<i>Tick one box only</i>)	☐ ₁ No ☐ ₂ Yes, Aboriginal ☐ ₃ Yes, Torres Strait Islander ☐ ₄ Yes, Aboriginal & Torres Strait Islander	☐ ₁ No ☐ ₂ Yes, Aboriginal ☐ ₃ Yes, Torres Strait Islander ☐ ₄ Yes, Aboriginal & Torres Strait Islander
e) What is the highest level of education you have? (<i>Tick one box only</i>)	☐ ₁ Some high school ☐ ₂ Completed high school ☐ ₃ Some vocational training (i.e. trade) ☐ ₄ Completed vocational training ☐ ₅ Some University or College ☐ ₆ Completed University or College	☐ ₁ Some high school ☐ ₂ Completed high school ☐ ₃ Some vocational training (i.e. trade) ☐ ₄ Completed vocational training ☐ ₅ Some University or College ☐ ₆ Completed University or College
f) What is your usual occupation? (<i>Write description, e.g. Accounts clerk</i>)		
g) Please write a brief description of your usual type of work, (<i>e.g. in charge of invoicing, supervisor in a large firm, mowing lawns</i>)		
h) Do you currently have full time or part time work of any kind? (<i>Tick one box only</i>)	☐ ₁ Yes, full-time ☐ ₂ Yes, part-time ☐ ₃ No, not currently working	☐ ₁ Yes, full-time ☐ ₂ Yes, part-time ☐ ₃ No, not currently working
i) How many teeth have you had pulled out due to tooth decay?	(<i>Write number</i>)	(<i>Write number</i>)
j) How many fillings do you have in your mouth?	(<i>Write number</i>)	(<i>Write number</i>)

Which category does your total household income (before tax) fall into? Include any salaries, pensions, allowances, benefits, etc from all persons in the household.
(*Tick one box only*)

- Household income per year
- ☐₁ Up to \$20,000
 - ☐₂ \$20,001 to \$40,000
 - ☐₃ \$40,001 to \$60,000
 - ☐₄ \$60,001 to \$80,000
 - ☐₅ \$80,000 to \$100,000
 - ☐₆ Over \$100,000

OFFICE USE ONLY		
C1		
C2		
F1		
F2		

How many people are dependent on this total household income, including yourself?

30

Do you have private dental insurance ?

Yes

☐1

No

☐2

31

How long is it since your child had a dental visit?
(Tick one box only)

☐1 Less than 6 months

☐2 Between 6 and 12 months

☐3 Between 1 and 2 years

☐4 More than 2 years ago

☐5 Never

☐6 Don't know

32

Where did your child go for the last dental visit?
(Tick one box only)

☐1 Private Dentist

☐2 Public Hospital Dental Clinic

☐3 Public Child Dental Clinic

☐4 Never had dental care

33

Why did you last seek dental treatment for your child?
(Tick one box only)

☐1 Pain relief

☐2 Check-up

☐3 Filling

☐4 Crooked teeth

☐5 Other

☐6 Never had care

C

34

The following questions are general statements regarding the dental health of your child.
The answers are on a five-point scale, where 1 means 'Definitely yes' and 5 'Definitely no'.
(Circle one number for each row)

Please answer the following statements and circle one number	Definitely Yes	Definitely No
a) My child practises acceptable home dental behaviour.	1 ----- 2 ----- 3 ----- 4 ----- 5	
b) My child receives adequate dental care.	1 ----- 2 ----- 3 ----- 4 ----- 5	
c) My child needs dental care, but I put it off.	1 ----- 2 ----- 3 ----- 4 ----- 5	
d) My child needs dental care, but he/she puts it off.	1 ----- 2 ----- 3 ----- 4 ----- 5	
e) My child brushes his/her teeth well.	1 ----- 2 ----- 3 ----- 4 ----- 5	
f) My child controls between-meal snacking well.	1 ----- 2 ----- 3 ----- 4 ----- 5	

Your Comments

Thank you. Your contribution to this study is greatly appreciated. Please take a moment to check that you have answered each question and have signed the consent form, then post the completed questionnaire and consent form in the **reply paid envelope** provided to:

Child Oral Health Study 2002/2003
ARCPOH – Dental School
The University of Adelaide
Reply Paid 498
Adelaide SA 5001

If you have any comments, please feel free to write them in the space below.

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Thank you for your support!

Appendix F: ABS classification of occupation

Australian Bureau of Statistics

Occupation classification: Major And Sub-Major Groups

- 1 Managers And Administrators
 - 11 Generalist Managers
 - 12 Specialist Managers
 - 13 Farmers and Farm Managers

- 2 Professionals
 - 21 Science, Building and Engineering Professionals
 - 22 Business and Information Professionals
 - 23 Health Professionals
 - 24 Education Professionals
 - 25 Social, Arts and Miscellaneous Professionals

- 3 Associate Professionals
 - 31 Science, Engineering and Related Associate Professionals
 - 32 Business and Administration Associate Professionals
 - 33 Managing Supervisors (Sales and Service)
 - 34 Health and Welfare Associate Professionals
 - 39 Other Associate Professionals

- 4 Tradespersons And Related Workers
 - 41 Mechanical and Fabrication Engineering Tradespersons
 - 42 Automotive Tradespersons
 - 43 Electrical and Electronics Tradespersons
 - 44 Construction Tradespersons
 - 45 Food Tradespersons
 - 46 Skilled Agricultural and Horticultural Workers
 - 49 Other Tradespersons and Related Workers

- 5 Advanced Clerical And Service Workers
 - 51 Secretaries and Personal Assistants
 - 59 Other Advanced Clerical and Service Workers

- 6 Intermediate Clerical, Sales And Service Workers
 - 61 Intermediate Clerical Workers
 - 62 Intermediate Sales and Related Workers
 - 63 Intermediate Service Workers

- 7 Intermediate Production And Transport Workers
 - 71 Intermediate Plant Operators
 - 72 Intermediate Machine Operators
 - 73 Road and Rail Transport Drivers
 - 79 Other Intermediate Production and Transport Workers

- 8 Elementary Clerical, Sales And Service Workers
 - 81 Elementary Clerks
 - 82 Elementary Sales Workers
 - 83 Elementary Service Workers

- 9 Labourers And Related Workers
 - 91 Cleaners
 - 92 Factory Labourers
 - 99 Other Labourers and Related Workers

Appendix G: Kappa value calculation tables

Inter-examiner kappa value at the beginning of the survey

The FREQ Procedure

Table of DMFT by DMFTProf

DMFT(DMFT)		DMFTProf(DMFTProf)					
Frequency							
Col Pct		0	1	2	3	4	Total
0	97 100.00	5 45.45	0 0.00	0 0.00	0 0.00		102
1	0 0.00	6 54.55	0 0.00	0 0.00	0 0.00		6
2	0 0.00	0 0.00	5 100.00	0 0.00	0 0.00		5
3	0 0.00	0 0.00	0 0.00	1 100.00	0 0.00		1
4	0 0.00	0 0.00	0 0.00	0 0.00	5 100.00		5
Total	97	11	5	1	5		119

Statistics for Table of DMFT by DMFTProf

Test of Symmetry	
Statistic (S)	5.0000
DF	10
Pr > S	0.8912

Kappa Statistics				
Statistic	Value	ASE	95% Confidence Limits	
Simple Kappa	0.8566	0.0626	0.7339	0.9794
Weighted Kappa	0.9321	0.0329	0.8675	0.9967

Sample Size = 119

Inter-examiner kappa value towards the end of the survey

The FREQ Procedure

Table of DMFT by DMFTProf

DMFT(DMFT)		DMFTProf(DMFTProf)					
Frequency	Col Pct	0	1	2	3	4	Total
0		100 100.00	2 25.00	0 0.00	0 0.00	0 0.00	102
1		0 0.00	6 75.00	0 0.00	0 0.00	0 0.00	6
2		0 0.00	0 0.00	5 100.00	0 0.00	0 0.00	5
3		0 0.00	0 0.00	0 0.00	1 100.00	0 0.00	1
4		0 0.00	0 0.00	0 0.00	0 0.00	5 100.00	5
Total		100	8	5	1	5	119

Statistics for Table of DMFT by DMFTProf

Test of Symmetry

Statistic (S)	2.0000
DF	10
Pr > S	0.9963

Kappa Statistics

Statistic	Value	ASE	95% Confidence Limits	
Simple Kappa	0.9384	0.0433	0.8536	1.0232
Weighted Kappa	0.9720	0.0205	0.9318	1.0123

Sample Size = 119

Intra-examiner kappa value at the beginning of the survey

The FREQ Procedure

Table of DMFT by DMFTProf

DMFT (DMFT)		DMFTProf (DMFTProf)					
Frequency	Col Pct	0	1	2	3	4	Total
0		71 100.00	2 28.57	0 0.00	0 0.00	0 0.00	73
1		0 0.00	5 71.43	0 0.00	0 0.00	0 0.00	5
2		0 0.00	0 0.00	2 100.00	0 0.00	0 0.00	2
3		0 0.00	0 0.00	0 0.00	1 100.00	0 0.00	1
4		0 0.00	0 0.00	0 0.00	0 0.00	3 100.00	3
Total		71	7	2	1	3	84

Statistics for Table of DMFT by DMFTProf

Test of Symmetry

Statistic (S)	2.0000
DF	10
Pr > S	0.9963

Kappa Statistics

Statistic	Value	ASE	95% Confidence Limits	
Simple Kappa	0.9079	0.0644	0.7816	1.0342
Weighted Kappa	0.9557	0.0332	0.8906	1.0208

Sample Size = 84

Intra-examiner kappa value towards the end of the survey

The FREQ Procedure

Table of DMFT by DMFTProf

DMFT(DMFT)		DMFTProf(DMFTProf)				
Frequency						
Col Pct		0	1	2	3	4
0	72 100.00	1 16.67	0 0.00	0 0.00	0 0.00	73
1	0 0.00	5 83.33	0 0.00	0 0.00	0 0.00	5
2	0 0.00	0 0.00	2 100.00	0 0.00	0 0.00	2
3	0 0.00	0 0.00	0 0.00	1 100.00	0 0.00	1
4	0 0.00	0 0.00	0 0.00	0 0.00	3 100.00	3
Total	72	6	2	1	3	84

Statistics for Table of DMFT by DMFTProf

Test of Symmetry

Statistic (S)	1.0000
DF	10
Pr > S	0.9998

Kappa Statistics

Statistic	Value	ASE	95% Confidence Limits	
Simple Kappa	0.9522	0.0476	0.8588	1.0455
Weighted Kappa	0.9775	0.0233	0.9319	1.0231

Sample Size = 84

Appendix H: Sample excel data sheet

Sample Data Entry Table for Excel Worksheet

Name	ID	School	DOB	Sex	Exa	Exa	17	16	15	14	13	12	11	21	22	23	24	25	26	27
	0		ddmm/yyyy						0	0	0	0	0	0	0	0	0	0		
Exam code 1 = primary, 2 = duplicate																				
Examiners																				
1 Peter 6 Ayako																				
2 Ikreet 7 Yee Ying																				
3 Wendell 8 Afsana																				
4 Yasmin 9 Akash																				
5 Andy																				
					Occlusal		0	0	0	0	0	0	0	0	0	0	0	0		
					Mesial		0	0	0	0	0	0	0	0	0	0	0	0	0	0
					Distal		0	0	0	0	0	0	0	0	0	0	0	0	0	0
					Buccal		0	0	0	0	0	0	0	0	0	0	0	0	0	0
					Lingual		0	0	0	0	0	0	0	0	0	0	0	0	0	0
					Treatment need		0	0	0	0	0	0	0	0	0	0	0	0	0	0
					DDE Index		0	0	0	0	0	0	0	0	0	0	0	0	0	0
					Plaque Index		0						0						0	0

	37	36	35	34	33	32	31	41	42	43	44	45	46	47	Flur Today's date
ddmmyyy			0	0	0	0	0	0	0	0	0	0			
	(0)	(0)	0	0	0	0	0	0	0	0	0	0	(0)	(0)	Occlusal
	(0)	(0)	0	0	0	0	0	0	0	0	0	0	(0)	(0)	Mesial
Distal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	(0)	(0)	0	0	0	0	0	0	0	0	0	0	(0)	(0)	Buccal
	(0)	(0)	0	0	0	0	0	0	0	0	0	0	(0)	(0)	Lingual
Treatment need	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
DDE Index	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Plaque Index	0						0						0		

Appendix I: Data codes for clinical survey

Survey Data Codes

Tooth codes

- 1 primary tooth
- 2 permanent tooth

Plaque index codes

- Buccal uppers
- Lingual lowers
- 0 none visible
- 1 visible on probe
- 2 visible
- 3 wow

Status codes

- 0 sound
- S sealed
- 1 primary caries
- 2 secondary caries
- F filled and sound
- C crowned
- M missing due to caries
- X missing (ortho or trauma)
- T trauma, both filled or not
- 8 unerupted
- A arrested (primary teeth)

Treatment codes

- 0 none
- s sealant
- 1 1 surface restoration
- 2 2 surface restoration
- 3 3 or more surface complex restoration
- E endo (pulpotomy)
- X extraction
- 9 other-specify

Fluorosis codes

- 0 normal
- 1 questionable
- 2 very mild
- 3 mild
- 4 moderate
- 5 severe

Appendix J: Potential explanatory variables category table

Table 1: Table of potential explanatory variables within respective variable categories.

Variable categories	Potential explanatory variables
Demographic factors	KBORN Country where child born
	MBORN Country where mother born
	ENG English mainly spoken at home
	ABTS Child of Aboriginal or Torres Strait Islander origin
	SINGLE Child in a one-parent household
	ABTSM Father/male guardian Aboriginal or Torres Strait Islander
	ABTSF Mother/female guardian Aboriginal or Torres Strait Islander
Socioeconomic factors	EDM Father/male guardian's education
	EDF Mother/female guardian's education
	JOBM Father/male guardian's job
	JOBF Mother/female guardian's job
	WORKM Father/male guardian's work condition
	WORKF Mother/female guardian's work condition
	INC Total household income per year

continued over

Toothbrushing factors**TBEVER**Ever brushed his/her teeth with
toothpaste**TBAGE**

Age started brushing with toothpaste

TPTIMES1Frequency of brushing with toothpaste at age
when toothbrushing commenced**TPTIMES2**

Frequency of brushing with toothpaste now

TPTYPE1Type of toothpaste used when toothbrushing
commenced**TPTYPE2**

Type of toothpaste used now

TPCLICK1Ever noticed child eating or licking toothpaste
when toothbrushing commenced**TPCLICK2**Ever noticed child eating or licking toothpaste
now**TBSIZE1**Size of toothbrush when toothbrushing
commenced**TBSIZE2**

Size of toothbrush now

TBSPIT1What child did after toothbrushing when
toothbrushing commenced**TBSPIT2**

What child does after toothbrushing now

TPP1Amount of toothpaste used on his/her
toothbrush when toothbrushing commenced**TPP2**Amount of toothpaste used on his toothbrush now

continued over

Other fluoride exposure**FTAB**

Ever taken fluoride tablets or drops

FRIN

Ever used fluoride mouthrinse

TOF1Frequency of fluoride tablets or drops intake
Birth - 6 months**TOF2**Frequency of fluoride tablets or drops intake
6 months - 4 years**TOF3**Frequency of fluoride tablets or drops intake
Over 4 years**ROF1**Frequency of fluoride mouthrinse use when
started using fluoride mouthrinse**ROF2**Frequency of fluoride mouthrinse use now or
when stopped using fluoride mouthrinse**FGEL1**Fluoride gel application by School Dental
Service**FGEL2**

Fluoride gel application at Private dental practice

FGEL3

Fluoride gel application at home

T1AGE

Age started taking fluoride tablets or drops

T2AGE

Age stopped taking fluoride tablets or drops

TAB1Fluoride tablets taken by child
Birth - 6 months**DROP1**Fluoride drops taken by child
Birth - 6 months

continued over

	TAB2 Fluoride tablets taken by child 6 months - 4 years
	DROP2 Fluoride drops taken by child 6 months - 4 years
	TAB3 Fluoride tablets taken by child Over 4 years
	DROP3 Fluoride drops taken by child Over 4 years
	RAGE1 Age started using fluoride mouthrinse
	RAGE2 Age stopped using fluoride mouthrinse
	FGEL1X Frequency of fluoride gel application by School Dental Service
	FGEL2X Frequency of fluoride gel application at Private dental practice
	FGEL3X Frequency of fluoride gel application at home
	WF Years spent in a water fluoridated area
Dietary factors	FRUIT1 Fruit intake in usual day
	FRUIT2 Fruit intaken 1hr before bed
	JUS1 Fruit juice and fruit drinks in usual day
	JUS2 Fruit juice and fruit drinks 1hr before bed
	CORD1 Sweetened cordial drinks in usual day

continued over

CORD2
Sweetened cordial drinks 1hr before bed

FIZ1
Fizzy drinks/sport drinks in usual day

FIZ2
Fizzy drinks/sport drinks 1hr before bed

COLA1
Cola drinks in usual day

COLA2
Cola drinks 1hr before bed

MILK1
Plain milk in usual day

MILK2
Plain milk 1hr before bed

YOG1
Sweetened dairy products in usual day

YOG2
Sweetened dairy products 1hr before bed

CHOC1
Chocolate and sugary lollies in usual day

CHOC2
Chocolate and sugary lollies 1hr before bed

MUES1
Muesli bar and health bars in usual day

MUES2
Muesli bar and health bars 1hr before bed

RAISIN1
Dried fruit in usual day

RAISIN2
Dried fruit 1hr before bed

Variables not otherwise categorised

FORM
Child fed infant formula

continued over

FORMIX
Water added to infant formula
PREM
Child born prematurely

BW
Known birth weight

BWK
Birth weight

INSURE
Private insurance

VISIT
Last dental visit

VISWHERE
Place of last dental visit

VISWHY
Why did you last seek treatment for child

EXOM
Father/male guardian's number of past teeth
extracted.

EXOF
Mother/female guardian's number of past
teeth extracted.

FILLM
Father/male guardian's number of fillings.

FILLF
Mother/female guardian's number of fillings.

Appendix K: Table of dmft/DMFT distribution by tooth type and age

Deciduous central incisors (1s)

The FREQ Procedure

Table of weedmft by Age

weedmft		Age				
Frequency						
Col Pct	10	11	12	13	5	Total
0	273 100.00	235 100.00	189 100.00	7 100.00	74 98.67	1940
1	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	8
2	0 0.00	0 0.00	0 0.00	0 0.00	1 1.33	15
Total	273	235	189	7	75	1963
(Continued)						

Table of weedmft by Age

weedmft		Age			
Frequency					
Col Pct	6	7	8	9	Total
0	308 95.36	266 97.44	297 100.00	291 100.00	1940
1	7 2.17	1 0.37	0 0.00	0 0.00	8
2	8 2.48	6 2.20	0 0.00	0 0.00	15
Total	323	273	297	291	1963

Deciduous lateral incisors (2s)

The FREQ Procedure

Table of weedmft by Age

weedmft		Age				
Frequency						
Col Pct	10	11	12	13	5	Total
0	273 100.00	235 100.00	189 100.00	7 100.00	74 98.67	1942
1	0 0.00	0 0.00	0 0.00	0 0.00	1 1.33	14
2	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	7
Total	273	235	189	7	75	1963
(Continued)						

Table of weedmft by Age

weedmft		Age			
Frequency					
Col Pct	6	7	8	9	Total
0	313 96.90	264 96.70	297 100.00	290 99.66	1942
1	8 2.48	4 1.47	0 0.00	1 0.34	14
2	2 0.62	5 1.83	0 0.00	0 0.00	7
Total	323	273	297	291	1963

Deciduous canines (3s)

The FREQ Procedure

Table of weedmft by Age

weedmft Age

Frequency Col Pct	10	11	12	13	5	Total
0	270 98.90	235 100.00	187 98.94	7 100.00	74 98.67	1932
1	2 0.73	0 0.00	2 1.06	0 0.00	0 0.00	23
2	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1
3	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2
4	1 0.37	0 0.00	0 0.00	0 0.00	1 1.33	5
Total (Continued)	273	235	189	7	75	1963

Table of weedmft by Age

weedmft Age

Frequency Col Pct	6	7	8	9	Total
0	318 98.45	263 96.34	292 98.32	286 98.28	1932
1	4 1.24	7 2.56	4 1.35	4 1.37	23
2	0 0.00	1 0.37	0 0.00	0 0.00	1
3	0 0.00	2 0.73	0 0.00	0 0.00	2
4	1 0.31	0 0.00	1 0.34	1 0.34	5
Total	323	273	297	291	1963

Deciduous first molars (4s)

The FREQ Procedure

Table of weedmft by Age

weedmft		Age				
Frequency						
Col Pct	10	11	12	13	5	Total
0	219 80.22	198 84.26	179 94.71	7 100.00	66 88.00	1592
1	28 10.26	18 7.66	6 3.17	0 0.00	4 5.33	183
2	14 5.13	10 4.26	3 1.59	0 0.00	3 4.00	103
3	7 2.56	8 3.40	1 0.53	0 0.00	1 1.33	63
4	5 1.83	1 0.43	0 0.00	0 0.00	1 1.33	22
Total	273	235	189	7	75	1963
(Continued)						

Table of weedmft by Age

weedmft		Age			
Frequency					
Col Pct	6	7	8	9	Total
0	267 82.66	219 80.22	215 72.39	222 76.29	1592
1	27 8.36	20 7.33	45 15.15	35 12.03	183
2	17 5.26	22 8.06	14 4.71	20 6.87	103
3	7 2.17	9 3.30	19 6.40	11 3.78	63
4	5 1.55	3 1.10	4 1.35	3 1.03	22
Total	323	273	297	291	1963

Deciduous second molars (5s)

The FREQ Procedure

Table of weedmft by Age

weedmft		Age					Total
Frequency	Col Pct	10	11	12	13	5	
0		218 79.85	183 77.87	161 85.19	7 100.00	65 86.67	1582
1		30 10.99	27 11.49	13 6.88	0 0.00	2 2.67	181
2		12 4.40	17 7.23	9 4.76	0 0.00	6 8.00	125
3		8 2.93	3 1.28	2 1.06	0 0.00	2 2.67	41
4		5 1.83	5 2.13	4 2.12	0 0.00	0 0.00	34
Total		273	235	189	7	75	1963
(Continued)							

Table of weedmft by Age

weedmft		Age				Total
Frequency	Col Pct	6	7	8	9	
0		265 82.04	220 80.59	241 81.14	222 76.29	1582
1		28 8.67	23 8.42	27 9.09	31 10.65	181
2		17 5.26	20 7.33	15 5.05	29 9.97	125
3		6 1.86	7 2.56	11 3.70	2 0.69	41
4		7 2.17	3 1.10	3 1.01	7 2.41	34
Total		323	273	297	291	1963

Permanent central incisors (1s)

The FREQ Procedure

Table of DMFT by Age

DMFT	Age					Total
Frequency Col Pct	10	11	12	13	5	
0	269 98.53	233 99.15	186 98.41	7 100.00	75 100.00	1952
1	3 1.10	2 0.85	2 1.06	0 0.00	0 0.00	9
2	1 0.37	0 0.00	1 0.53	0 0.00	0 0.00	2
Total (Continued)	273	235	189	7	75	1963

Table of DMFT by Age

DMFT	Age				Total
Frequency Col Pct	6	7	8	9	
0	322 99.69	273 100.00	297 100.00	290 99.66	1952
1	1 0.31	0 0.00	0 0.00	1 0.34	9
2	0 0.00	0 0.00	0 0.00	0 0.00	2
Total	323	273	297	291	1963

Permanent lateral incisors (2s)

The FREQ Procedure

Table of DMFT by Age

DMFT	Age					
Frequency						
Col Pct	10	11	12	13	5	Total
0	272 99.63	235 100.00	186 98.41	7 100.00	75 100.00	1957
1	1 0.37	0 0.00	2 1.06	0 0.00	0 0.00	5
2	0 0.00	0 0.00	1 0.53	0 0.00	0 0.00	1
Total	273	235	189	7	75	1963
(Continued)						

Table of DMFT by Age

DMFT	Age				
Frequency					
Col Pct	6	7	8	9	Total
0	323 100.00	272 99.63	297 100.00	290 99.66	1957
1	0 0.00	1 0.37	0 0.00	1 0.34	5
2	0 0.00	0 0.00	0 0.00	0 0.00	1
Total	323	273	297	291	1963

Permanent canines (3s)

The FREQ Procedure

Table of DMFT by Age

DMFT	Age					
Frequency						
Col Pct	10	11	12	13	5	Total
0	273 100.00	234 99.57	188 99.47	7 100.00	75 100.00	1961
1	0 0.00	0 0.00	1 0.53	0 0.00	0 0.00	1
2	0 0.00	1 0.43	0 0.00	0 0.00	0 0.00	1
Total	273	235	189	7	75	1963

(Continued)

Table of DMFT by Age

DMFT	Age				
Frequency					
Col Pct	6	7	8	9	Total
0	323 100.00	273 100.00	297 100.00	291 100.00	1961
1	0 0.00	0 0.00	0 0.00	0 0.00	1
2	0 0.00	0 0.00	0 0.00	0 0.00	1
Total	323	273	297	291	1963

Permanent first premolars (4s)

The FREQ Procedure

Table of DMFT by Age

DMFT	Age					
Frequency						
Col Pct	10	11	12	13	5	Total
0	272 99.63	230 97.87	189 100.00	7 100.00	75 100.00	1957
1	1 0.37	5 2.13	0 0.00	0 0.00	0 0.00	6
Total	273	235	189	7	75	1963
(Continued)						

Table of DMFT by Age

DMFT	Age				
Frequency					
Col Pct	6	7	8	9	Total
0	323 100.00	273 100.00	297 100.00	291 100.00	1957
1	0 0.00	0 0.00	0 0.00	0 0.00	6
Total	323	273	297	291	1963

Permanent second premolars (5s)

The FREQ Procedure

Table of DMFT by Age

DMFT	Age					
Frequency						
Col Pct	10	11	12	13	5	Total
0	269 98.53	232 98.72	187 98.94	7 100.00	75 100.00	1954
1	4 1.47	3 1.28	2 1.06	0 0.00	0 0.00	9
Total	273	235	189	7	75	1963
(Continued)						

Table of DMFT by Age

DMFT	Age				
Frequency					
Col Pct	6	7	8	9	Total
0	323 100.00	273 100.00	297 100.00	291 100.00	1954
1	0 0.00	0 0.00	0 0.00	0 0.00	9
Total	323	273	297	291	1963

Permanent first molars (6s)

The FREQ Procedure

Table of DMFT by Age

DMFT	Age					
Frequency	10	11	12	13	5	Total
Col Pct						
0	231 84.62	199 84.68	164 86.77	6 85.71	75 100.00	1792
1	21 7.69	19 8.09	13 6.88	1 14.29	0 0.00	84
2	12 4.40	9 3.83	9 4.76	0 0.00	0 0.00	50
3	6 2.20	4 1.70	2 1.06	0 0.00	0 0.00	22
4	3 1.10	4 1.70	1 0.53	0 0.00	0 0.00	15
Total	273	235	189	7	75	1963
(Continued)						

Table of DMFT by Age

DMFT	Age				
Frequency	6	7	8	9	Total
Col Pct					
0	318 98.45	267 97.80	274 92.26	258 88.66	1792
1	3 0.93	3 1.10	10 3.37	14 4.81	84
2	2 0.62	2 0.73	8 2.69	8 2.75	50
3	0 0.00	1 0.37	3 1.01	6 2.06	22
4	0 0.00	0 0.00	2 0.67	5 1.72	15
Total	323	273	297	291	1963

Permanent second molars (7s)

The FREQ Procedure

Table of DMFT by Age

DMFT	Age					
Frequency						
Col Pct	10	11	12	13	5	Total
0	273 100.00	234 99.57	186 98.41	7 100.00	75 100.00	1959
1	0 0.00	1 0.43	2 1.06	0 0.00	0 0.00	3
2	0 0.00	0 0.00	1 0.53	0 0.00	0 0.00	1
Total	273	235	189	7	75	1963
(Continued)						

Table of DMFT by Age

DMFT	Age				
Frequency					
Col Pct	6	7	8	9	Total
0	323 100.00	273 100.00	297 100.00	291 100.00	1959
1	0 0.00	0 0.00	0 0.00	0 0.00	3
2	0 0.00	0 0.00	0 0.00	0 0.00	1
Total	323	273	297	291	1963