Community Dent Oral Epidemiol 2006; 34: 410–418

COMMUNITY DENTISTRY AND ORAL EPIDEMIOLOGY

Exploring factors that influence child use of dental services and toothbrushing in New Zealand

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Jamieson LM, Koopu PI. Exploring factors that influence child use of dental services and toothbrushing in New Zealand. Community Dent Oral Epidemiol 2006; 34: 410–418. © 2006 The Authors. Journal compilation © Blackwell Munksgaard, 2006

Abstract – *Objectives:* To explore factors contributing to dental service use and toothbrushing among Mäori, Pacific and New Zealand European or Other (NZEO) children in New Zealand. *Methods:* Data were obtained from the 2002 National Child Nutrition Survey. Models representing demographic, socio-economic status (SES), lifestyle, dietary, food security and oral health paradigms were tested using logistic regression. *Results:* Mäori and Pacific children were more likely to not attend for dental care (OR: 1.99 and 2.05 respectively) than NZEO children when age, sex and time lived in New Zealand were accounted for. The addition of household (OR: 1.93 and 2.05 respectively) or lifestyle (OR: 1.95 and 1.81 respectively) factors resulted in minimal OR changes for Mäori or Pacific child dental attendance, whereas addition of dietary (OR: 1.44 and 1.23 respectively) and food security (OR: 1.43 and 1.32 respectively) items reduced the ORs of Mäori and Pacific child dental attendance so they no longer differed significantly to NZEO children. Addition of dental factors increased the ORs of Mäori and Pacific children not utilizing dental services compared with NZEO children (OR: 2.30 and 2.13 respectively). Mäori and Pacific children were more likely to not brush teeth (OR: 3.86 and 1.49 respectively) than NZEO children when age, sex and time lived in New Zealand were accounted for. Addition of dietary factors resulted in a 36% OR reduction of Mäori children not brushing (OR: 2.57), while addition of household SES (OR: 1.06), lifestyle (OR: 1.14), dietary (OR: 0.71) or food security factors (OR: 1.19) reduced the ORs of Pacific children so they were no longer significantly different to NZEO children. *Conclusions:* Mäori and Pacific children were more likely to have not received dental care (variance largely explained by dietary and food security factors) and Mäori children were more likely to not brush their teeth (variance largely explained by dietary items) than NZEO children.

Key words: children; Mäori; Pacific; toothbrushing; use of dental services

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Submitted 11 October 2005;
accepted 13 December 2005

Oral health disparities at a clinical level exist between ethnic child groups throughout the world (1–4). However, there is little documentation of ethnic disparities in child use of dental services or toothbrushing frequency. Such behaviours may have a strong influence on oral health outcomes and oral-health-related-quality-of-life in due course (5–7). It is important that pathways through which ethnicity may influence child oral health are explored so that appropriate interventions may be designed and implemented.

There are many factors likely to be associated with ethnic child disparities in the use of dental services and toothbrushing. These include demographic (8), socio-economic status (SES) (9, 10), physical/lifestyle (11, 12), environmental (13), dietary (14, 15) and other dental items (16, 17). One conceptual approach to examining such determinants involves classifying variables as behavioural or material (18). Behavioural items (observable actions) have been extensively researched, usually follow a medical intervention model and tend to be

addressed at an individual level. By contrast, material factors (material life circumstances or assets) are often assessed at a community or societal level, are structural in nature, relatively resistant to change and tend to require political intervention (19). Such factors may arise from each other, for example, SES may influence lifestyle, which, in turn, may affect diet and toothbrushing behaviour, and consequent experience of dental disease.

The impact of food security is a less explored paradigm in child oral epidemiology. 'Food security' is an internationally recognized term that identifies the ready availability of nutritionally adequate foods and ability of people to acquire personally acceptable foods in a socially acceptable way (20). It is a useful proxy measure of household SES when investigating groups for whom more traditional household SES instruments (for example, caregiver education, occupation and income) are culturally inappropriate.

New Zealand is unique in having a population that is diverse and varied in its ethnic distribution. The majority of New Zealand children identify as New Zealand European or Other (NZEO; 66.2% of 0- to 14-year-old population), while 23.2% identify as Mäori (the Indigenous group) and 10.6% as Pacific (Cook Island, Western Samoan, Niuen, Tongan, Tuvaluan, Tokelaun or Fijian) (21). Pacific children are the fastest growing child group in New Zealand (with a 39% population increase between the 1991 and 2001 census) and there are now more Pacific children in New Zealand than in any other Pacific or other nation combined (21). It is becoming increasingly obvious to New Zealand policy makers that health surveys involving children need to take into account the varied – and in many cases marked influence of – culture on child habits and lifestyles that impact health outcomes. This is equally pertinent to policies pertaining to child oral health.

The National Child Nutrition Survey (NCNS) was a study that explored the effect of material and behavioural factors on a number of child health outcomes. The purpose of our investigation was to examine associations between the use of dental services and toothbrushing frequency with demographic, household SES, physical/lifestyle, dietary, food security and other dental factors among Mäori, Pacific and NZEO children involved in the NCNS. To the best of our knowledge, the study is the first to explore such paradigms in a nationally representative child sample with ethnic disparities as its primary focus.

Methods

The NCNS utilized a stratified two-stage survey design, specific details of which are described elsewhere (20). Different sampling measures were used for Mäori, Pacific and NZEO children to ensure approximately equal numbers in each ethnic group in the final survey sample. Children were selected according to the following proportions: Mäori 0.161, Pacific 0.410, NZEO 0.050, with the sampling proportions including an inflation factor to allow for a 70% response rate. Allowing for a design effect of 1.7 from weighting caused by differential ethnic sampling proportions and of 1.5 for school-based clustering (estimated from previous New Zealand school-based surveys), a sample of 1000 for each ethnic group was recruited under the study design. Each participant was assigned a survey weight to indicate how many population units that child was representing.

Consent forms and a cover letter explaining the study were sent home with each eligible child. The forms stressed that child and caregiver involvement was voluntary, and that participants could withdraw from the study at any stage with no consequent effect on their health care. Ethical approval was received from all 13 regional health ethics committees in New Zealand.

The survey employed a number of instruments to obtain data: a computer-based home interview that contained items pertaining to socio-demographic information, food intake, food habits, physical activity, food security and dental health; a food-frequency questionnaire; physical measures such as weight, height, mid-upper arm and waist circumference; sub-scapular and triceps skinfold thickness; and blood and urine samples to assess iron, zinc, lipid and iodine levels. Caregivers were requested to convey the information for children aged 5–9 years while children aged 10–14 years completed the questionnaires themselves. Caregivers completed all items pertaining to household income and food security.

The dental items were based on those used in previous studies (22, 23) and focus group methodology was used to test the appropriateness of the items with Mäori and Pacific groups (24). The dental items were also clinically validated (25). Questions pertaining to the use of dental services

included 'do you/does your child go to the school dental clinic or a dentist?' with the response options being 'yes', 'no', 'cannot remember' and 'do not know'. 'Irregular dental attendance' was defined by a 'no' response to this item. The item exploring toothbrushing frequency was 'how many times did you/your child brush your/his or her teeth yesterday?' with the response categories including 'none', 'once', 'twice' or 'three or more times'.

Statistical analyses were carried out using the complex sampling module in SPSS 13.0 (SPSS Inc., Chicago, IL, USA). This software package takes into account the clustered sampling design to yield unbiased standard error estimates and design effects (26). Factors that were significant at a bivariate level (L.M. Jamieson, P.I. Koopu, unpubl. obs.) were classified into demographic, household SES (or proxies for household SES), physical/lifestyle, dietary, food security or dental groups. These were then entered into logistic regression models to produce weighted population estimates.

Household SES measures that were significantly associated with irregular dental attendance (child has not attended for dental care) at a bivariate level included household income and home ownership status; lifestyle factors were hours of television watched the previous Saturday, number of school days television watched, hours television watched on a school day, playing computer games on a school day or being physically active the previous week; dietary factors included eating breakfast before school, eating breakfast on the way to school, purchasing lunch at a dairy (small shop selling convenience food) or a school canteen, frequency of consuming chocolate bars or Coca Cola® the previous month or adding sugar to tea or coffee; food security items were being able to afford to eat properly, running out of food because of lack of money, using food banks when not enough money for food, feeling stressed because not enough money for food or feeling stressed because food for social occasions was not able to be provided because of funding shortages. Dental factors included receipt of a filling or extraction, or experiencing dental pain at night.

Household SES measures that were significantly associated with not brushing teeth the previous day at a bivariate level included household income, rental status, number of adults in household, number of children in household, number of children aged <5 years in household and food cost per week; physical/lifestyle factors were medical or physical disability, body mass index, how many school days television was watched, number of hours television watched on a school day, how many school days computer games were played and making own physically active way to school; dietary factors included eating breakfast before school, eating breakfast on the way to school, purchasing lunch at a dairy or a school canteen, frequency of consuming apples, ice cream, sweets, Coca Cola® or other soft drinks the previous month or adding sugar to milo (a hot chocolate milk drink) or tea. Food security factors significant at a bivariate level were being able to afford to eat properly, running out of food because of lack of money, eating less because of lack of money, food variety limited because of financial shortages, relying on others to provide food or money, using food banks when not enough money for food, feeling stressed because not enough money for food and feeling stressed because food for social occasions was not able to be provided because of funding shortages. Dental items included experience of dental pain at night.

Correlation tests confirmed the existence of moderate associations between items in a given group (Pearson's correlation coefficient range 0.1–0.4) and adjusted odds ratios were considered statistically significant when *P*-values derived from the Wald statistic were ≤0.05. The Nagelkerke R^2 statistic was used to express the variance explained by a given model. Basic models were constructed to assess the association between irregular dental care/not brushing teeth the previous day and ethnicity adjusted for age group, gender and time lived in New Zealand.

Results

Some 3275 children were included in the analyses; 1224 (37.4%) Māori, 1058 (32.3%) Pacific and 993 (30.3%) NZEO. A higher proportion of children aged 11–14 years, who were Pacific or who had not always lived in New Zealand, utilized dental services irregularly. There was an equal distribution by sex. Of the children who reported not brushing their teeth the previous day, a higher proportion were aged 7–10 years, were male, Māori or had always lived in New Zealand.

Dental attendance

Using multivariate analyses in the basic model (Table 1, Model 1), Māori and Pacific children had

Table 1. Adjusted odds ratios with 95% confidence intervals (95% CI) for the association between irregular dental attendance (child has not attended for dental care) and ethnicity (weighted data)

	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]	Model 5[e]	Model 6[f]	Model 7[g]
Ethnicity							
Mäori	1.986 (1.372–2.875)*	1.934 (1.323–2.827)*	1.945 (1.171–3.321)*	1.439 (0.956–2.167)	1.434 (0.935–2.199)	2.299 (1.583–3.337)*	1.176 (0.591–2.341)
Pacific	2.046 (1.431–2.927)*	2.046 (1.416–2.956)*	1.806 (1.083–3.011)*	1.129 (0.719–1.772)	1.316 (0.849–2.041)	2.127 (1.485–3.047)*	1.030 (0.473–2.245)
NZEO	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Variables included	Age group, gender, live in New Zealand	Model 1 + household SES (household income, home ownership status)	Model 1 + lifestyle factors (hours watch television last Saturday, how many school days watch television, hours watch television on school day, play computer games on school days, play active games last week)	Model 1 + dietary factors (breakfast before school, breakfast on the way to school, lunch bought at dairy, lunch bought at school, frequency of eating chocolate bar last month, frequency of drinking Coca Cola® last month, adding sugar to tea or coffee)	Model 1 + food security factors (can afford to eat properly, food runs out because of lack of money, use food banks when do not have enough money for food, feel stressed because of not having nough money for food, is stressful because we cannot provide the food we want for social occasions)	Model 1 + dental factors (received a filling before, received a dental extraction, experienced dental pain at night)	All models

*$P < 0.05$.
[a]Nagelkerke $R^2 = 0.103$.
[b]Nagelkerke $R^2 = 0.116$.
[c]Nagelkerke $R^2 = 0.126$.
[d]Nagelkerke $R^2 = 0.191$.
[e]Nagelkerke $R^2 = 0.139$.
[f]Nagelkerke $R^2 = 0.114$.
[g]Nagelkerke $R^2 = 0.247$.

twice the odds of having irregular dental attendance after adjusting for age, sex and period of time living in New Zealand than NZEO children. The addition of household factors caused virtually no change in the adjusted odds ratios for irregular dental care and ethnicity (Table 1, Model 2). When physical/lifestyle factors were added, the excess risk of being an irregular dental attender stayed the same for Mäori children but was reduced by approximately 12% in Pacific children (Table 1, Model 3). Adjusting the basic model by dietary and food security items resulted in the odds ratios of irregular dental attendance of Mäori and Pacific children being no longer statistically different to NZEO children (Table 1, Models 4 and 5). When dental factors were added to the basic model, the odds ratio of Mäori children being irregular dental attenders compared with NZEO children increased by 14% while that of Pacific children stayed relatively the same (Table 1, Model 6). The basic model adjusted by household, lifestyle, dietary, food security and dental factors resulted in excess risk of irregular dental attendance by ethnicity being no longer statistically significant (Table 1, Model 7).

Toothbrushing

Mäori children had 3.9 times the odds and Pacific children 1.5 times the odds of not brushing teeth the previous day compared with NZEO children in a basic model where age, sex and length of time lived in New Zealand were accounted for (Table 2, Model 1). Adding household factors caused a 20% reduction in adjusted odds ratios for Mäori children and made the excess risk of not brushing the previous day for Pacific children no longer statistically significant in comparison with NZEO children (Table 2, Model 2). When lifestyle factors were added, the excess risk of not brushing teeth was reduced by approximately 15% in Mäori children and was no longer statistically different for Pacific children in relation to NZEO children (Table 2, Model 3). Addition of dietary factors resulted in the excess risk of not brushing teeth the previous day being reduced by approximately 36% in Mäori children and being no longer statistically different for Pacific children compared with their NZEO counterparts (Table 2, Model 4). The odds ratio of not brushing the previous day of Mäori children was reduced by 16% and was no longer statistically different for Pacific children in comparison with NZEO children when food security items were added to the basic model (Table 2, Model 5). Addition of the dental factor 'experiencing dental pain at night' resulted in essentially no change in adjusted odds ratios for both Mäori and Pacific children in terms of not brushing teeth the previous day compared with NZEO children (Table 2, Model 6). Adding household, lifestyle, dietary, food security and dental factors to the basic model resulted in a 50% decrease in the odds ratio of Mäori children not brushing, and for the odds ratio of Pacific children to be no longer significantly different, compared with NZEO children (Table 2, Model 7).

Discussion

This cross-sectional investigation of a nationally representative child sample from New Zealand showed that Mäori and Pacific children were more likely to have not received dental care (with the variance being largely explained by dietary and food security factors) and that Mäori children had greater odds of not brushing their teeth the previous day (with the variance being largely explained by dietary items) than NZEO children. That there were such differences by ethnicity indicates the very real impact of culture on dental health outcomes among the New Zealand child population. It is essential that these differences are taken into account if effective oral health promotional strategies and oral health education initiatives are to be implemented.

Although caution is required in interpreting our findings, it would appear that what affects Mäori children also affects Pacific children with regard to dental service utilization (Table 1). The main provision of dental care to children in New Zealand is through the School Dental Service (SDS); a system that has been operating since 1921 and employs dental therapists to provide dental care for children, without fee, at their local school dental clinic (27). Overall participation in the SDS is high but disparities in enrolment exist, with those not participating being more likely to be Mäori or Pacific (27). The Public Health Advisory Committee suggested that such differences in enrolment were most likely because of cultural or access factors (28). It is not uncommon for some Mäori and Pacific children to be highly mobile and to attend a number of different schools in a given time period (28). SDS staff are also highly mobile across schools, implying that some Mäori or Pacific children may miss out on dental care for extended

Table 2. Adjusted odds ratios with 95% confidence intervals (95% CI) for the association between not brushing teeth yesterday and ethnicity (weighted data)

	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]	Model 5[e]	Model 6[f]	Model 7[g]
Ethnicity							
Mäori	3.862 (2.925–5.100)*	3.076 (2.210–4.280)*	3.281 (2.431–4.427)*	2.566 (1.883–3.496)*	3.245 (2.380–4.425)*	3.817 (2.889–5.043)*	1.915 (1.309–2.802)*
Pacific	1.494 (1.084–2.059)*	1.057 (0.703–1.589)	1.144 (0.790–1.658)	0.714 (0.466–1.094)	1.190 (0.802–1.765)	1.483 (1.075–2.046)*	1.058 (0.858–1.211)
NZEO	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Variables included	Age group, gender, live in New Zealand	Model 1 + household SES (household income, rental status, number of adults in household, number of children in household, number of children <5 years in household, food cost per week)	Model 1 + lifestyle factors (disability, BMI, how many school days watch television, how many hours watch television on school day, how many school days do play computer games, walk to school)	Model 1 + dietary factors (breakfast before school, breakfast on the way to school, lunch bought at dairy, lunch bought at school, frequency of eating apple, ice cream or sweets last month, frequency of drinking Coca Cola® or other soft drinks last month, adding sugar to milo or tea)	Model 1 + food security factors (can afford to eat properly, food runs out because of lack of money, eat less because of lack of money, variety of food eaten limited by money, rely on others to provide food or money, use food banks when do not have enough money for food, feel stressed because of not having enough money for food, is stressful because we cannot provide the food we want for social occasions)	Model 1 + dental factors (experienced dental pain at night)	All models

*$P < 0.05$.
[a]Nagelkerke $R^2 = 0.102$.
[b]Nagelkerke $R^2 = 0.141$.
[c]Nagelkerke $R^2 = 0.139$.
[d]Nagelkerke $R^2 = 0.154$.
[e]Nagelkerke $R^2 = 0.118$.
[f]Nagelkerke $R^2 = 0.104$.
[g]Nagelkerke $R^2 = 0.231$.

periods. Further reasons for lower dental attendance rates among Mäori and Pacific children may be due to dental fear or cultural constructs (such as not touching the head or neck) that impact on healthcare beliefs and practices (28). Oral health professionals with limited knowledge of such concepts may unwittingly cause offence when providing care, leading to further avoidance of dental services (28). Ethnic groups respond best to health professionals who share the same cultural background and belief systems (29–31) but unfortunately there are minimal numbers of Mäori and Pacific employees in the New Zealand oral health service (32). Although there are incentives to encourage Mäori and Pacific students into dental health training programs, the proportions remain low (32). Such issues have also been identified in Australia, Canada and the USA (33–35).

It is interesting that when food security items were accounted for, the odds of Mäori and Pacific children not attending for dental care were no longer significantly different to NZEO children (Table 1, Model 5). Household food insecurity identifies a population of children at high risk and is associated with adverse child health outcomes such as hunger, poor mental health and non-optimal health-related-quality-of-life (36–38). Food is a central social construct in Mäori and Pacific cultures and is used as a measure of wealth or social status (39). Being unable to provide food for social occasions may lead to feelings of anxiety, stress or shame (40) and a carer who is stressed about household food issues may not have the mental or emotional capacity to make their child's oral health a priority. Food security is also reflective of household SES, and the association between low SES and irregular dental attendance is established (41).

The variations in toothbrushing prevalence when various behavioural and material factors had been accounted for were somewhat surprising (Table 2, Models 2–5) and may again be due to differences in culture. Pacific people are relatively new to New Zealand, with very few numbers prior to the 1960s (42, 43). Pacific culture, including language and customs, remain strong among New Zealand Pacific families, which may encourage regular brushing of teeth. In contrast, Mäori people are generally more integrated into mainstream New Zealand life and the effect of culture on some Mäori families may not be as firm. As a result, Mäori children may be more prone to the long-term effects of marginalization and discrimination that may manifest in certain downstream factors such as oral health behaviours (44).

It was unanticipated that dietary factors would contribute to most of the ethnic variance in the 'use of services' and 'toothbrushing' models, although such factors did include items that may not be conducive to positive oral health behaviours (for example, eating breakfast on the way to school). Mattilla et al. has suggested there are strong associations between child health actions and those of their carers (45), with many children under the age of 10 years having not yet developed to the level where their oral hygiene behaviours are autonomous (that is, that they brush their teeth independent of reminders) (46). Our findings indicate that Mäori and Pacific children in our study had greater dietary freedom (purchasing their lunch from a dairy or school canteen) than their NZEO counterparts. It is interesting to speculate on how this may have impacted oral health behaviours; perhaps they also had more liberty in the decision to attend for dental care or not, or to brush their teeth. Similar findings have been reported among Indigenous Australian children (47).

In general, the R^2 values for our models were low (range 0.10–0.25 in Table 1 and 0.10–0.23 in Table 2) indicating that other factors or specific Mäori/Pacific paradigms were impacting our 'use of services' or 'toothbrushing frequency' findings. Such paradigms may have included access to care, historical legacy, culturally insensitive oral health services, dental fear, intergenerational issues, social capital, community cohesion or neighbourhood trust (48). Durie has suggested that ethnic identity is far more than what can be described by scientific models or paradigms alone; allusive to measure but very much in existence and very much impacting the health outcomes of ethnic groups (49). It may be that multilevel studies (those that control for individual-level factors before examining contextual characteristics) are required to more fully explain causes of ethnic child oral health disparities. Contextual factors may also offer greater insight into the best types of community-level interventions and oral health promotional strategies to implement, with the common risk approach being perhaps the best framework within which to instigate such changes (50).

In summary, our findings have shown that disparities in Mäori and Pacific child use of dental services were largely explained by dietary and food security factors, while differences in toothbrush use were mostly explained by dietary factors.

Understanding the effects of culture on oral health may help identify positive policy options to reduce child oral health inequalities in New Zealand and elsewhere, while further studies that utilize more analytically robust measures of behavioural and material factors may help reveal greater insights into the ethnicity and child oral health relationship.

Acknowledgements

The authors are grateful to the New Zealand Ministry of Health for providing the NCNS data, and to Liana Luzzi and Anne Ellershaw for their assistance in data analyses.

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