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Factors associated with restoration and extraction receipt among New Zealand children

L.M. Jamieson[1] and P.I. Koopu[2]

[1]*Australian Research Center for Population Oral Health, The University of Adelaide University, South Australia 5005, Australia.* [2]*Oral Health Service, Dental Department, Wellington Hospital, Private Bag 7902, Wellington, New Zealand*

Objectives: To assess the relative contribution of demographic socioeconomic, physical/lifestyles, dietary, food security and dental factors to self-reported restoration or extraction receipt among New Zealand children. ***Basic Research Design*:** Cross-sectional study of nationally representation data using a two-stage random clustered sampling procedure and complex sampling analysis. ***Participants*:** Mäori, Pacific and New Zealand European or Other (NZEO) children aged 5–14 years. ***Results*:** Of the 3,275 participants 37.4 % were Mäori, 32.3 % Pacific and 30.3% NZEO. Mäori children had higher odds of having received a restoration than NZEO children after adjusting for age, gender and length of time lived in New Zealand (OR: 1.87) and with addition of household SES (OR: 1.58), lifestyle (OR: 1.92), dietary (OR: 1.64), food security (OR: 1.79) or dental factors (OR: 1.89). By contrast, Pacific children had higher odds of having received an extraction than NZEO children when age, gender and length of time lived in New Zealand were taken into account (OR: 1.69), and with addition of household SES (OR: 1.48), lifestyle (OR: 1.71), dietary (OR: 1.52), food security (OR: 1.21) or other dental factors (OR: 1.93). ***Conclusions*:** Mäori children were more likely to have received a restoration, and Pacific children more likely to experience an extraction, than NZEO children after adjusting for behavioural and material factors. Household SES contributed to most of the variance in Mäori child restoration receipt, while food security items explained most of the variance in Pacific child experience of extraction.

Key words: children, extractions, restorations, Mäori, Pacific

Introduction

There is evidence that demographic, socio-economic, physical/lifestyle, environmental and dietary factors play a role in child oral health disparities. The impact of food security (the ready availability of nutritionally adequate foods and ability of people to acquire personally acceptable foods in a socially acceptable way) on child dental health outcomes is a less explored paradigm, but one that may be a useful proxy measure of socio-economic status (SES) when investigating groups for whom more traditional SES instruments are culturally inappropriate. It is important that pathways through which these factors may influence child oral health are explored so that appropriate interventions may be designed and implemented.

The main ethnic child groups in New Zealand include New Zealand European or Others (NZEO), representing 66.2 percent of the 0–14-year-old population, Mäori (the Indigenous group; 23.2 percent of child population) and Pacific (Cook Island, Western Samoan, Niuen, Tongan, Tuvaluan, Tokelaun or Fijian) children; 10.6 percent of child population (Statistics New Zealand, 2002). Mäori and Pacific children do not enjoy the same social advantage as their NZEO counterparts, with over 60 percent of Mäori or Pacific children living in government-subsidised housing and one-third of Mäori or Pacific adults receiving a benefit (Statistics New Zealand, 2002).

Mäori and Pacific children do not also fare well in terms of oral health. The mean number of decayed, missing and filled teeth for Mäori children was 30 percent higher than other ethnic groups in a national survey of 8- and 9-year-olds (Hunter, 1985) and in a sample of nearly 3,300 5-year-old children from the Manuwatu-Wanganui (lower west coast region of New Zealand's North Island), Mäori children were three times more likely to have caries than their non-Mäori counterparts (Thomson, 1993). In a study which investigated the oral health of 5-year-olds in the greater Wellington area, Pacific children were found to have consistently higher caries prevalence and severity than their non-Pacific counterparts (Thomson *et al.,* 2002) and Whyman *et al.* (1996) found that nearly half the patients requiring emergency dental services in Auckland city were of Pacific origin.

Dental services for New Zealand children are provided through the School Dental Service (SDS), which was established in 1921. The marked reduction in untreated dental decay in the child population has been attributed to the SDS, along with exposure to fluoride and increased public awareness. Dental therapists employed by the SDS perform a range of services, without fee, in school-based dental clinics, including provision of restorations to primary and permanent teeth, and pulp treatments and extractions to primary teeth (MOH, 2006). Disparities in SDS enrolment and service provision do exist, however, with children from socially-disadvantaged or minority groups being those least likely to be benefit from the service (MOH, 2003a).

Self-report techniques are a cost-effective and efficient way of obtaining dental data, with self-reported oral health and clinical dental caries associations being well

Correspondence to: Dr. Lisa M. Jamieson, Australian Research Center for Population Oral Health, The University of Adelaide University, South Australia 5005, Australia. E-mail: lisa.jamieson@adelaide.edu.au

documented (Jokovic *et al.,* 2004). The utility of self-report techniques in population health studies has received increased interest in recent times, with the organisation of clinical dental health investigations, particularly at a national level, becoming increasingly difficult due to the cuts in dental health resources experienced by many nations. While self-report findings may not be as objective as data from clinical investigations, they may still provide valuable information for policy planners and highlight areas that warrant further investigation.

Receipt of restorations and extractions in children are usually an indication of past caries experience. Findings from the literature suggest that, even when dental disease experience is equal, children from socially-deprived backgrounds receive more extractions and less restorations or preventive care than their more affluent counterparts (Tickle *et al*., 2002). The National Child Nutrition Survey (NCNS) was a cross-sectional study of a representative sample of Maori, Pacific and NZEO children aged 5–14 years which aimed to explore the impact of various material and behavioural factors on a range of child health outcomes. The aim of this paper is to identify associations at a multivariate level between self-reported extraction and restoration receipt among children involved in the NCNS with socio-demographic, household, physical/lifestyle, dietary, food security and other oral health factors. We aimed to test two hypotheses: (1) Maori and Pacific children would have a higher prevalence of self-reported restoration or extraction receipt; and (2) behavioural and material factors would account for most of these differences.

Methods

The NCNS utilized a stratified two-stage survey design, specific details of which are described elsewhere (MOH, 2003b). 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 percent 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, 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 care-giver 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, and sub-scapular and triceps skinfold thickness; and blood and urine samples to assess iron, zinc, lipid and iodine levels. Care-givers were requested to convey the information for children aged 5–9 years while children aged 10–14 years completed the questionnaires themselves. Care-givers completed all items pertaining to household income and food security.

The dental items were based on those used in previous studies (Walker *et al.,* 2000; Gregory *et al.,* 2000) and focus group methodology was used to test the appropriateness of the items with Mäori and Pacific groups (Thomson and Drummond, 2001). The dental items were also clinically validated (Jamieson *et al.*, 2004). Items pertaining to restoration receipt included 'have you/has your child ever had a restoration or dressing?' while the question exploring extraction receipt was 'have you/has your child ever had a tooth (or teeth) taken out because of a hole (tooth decay), a 'gum-boil' (abscess) or infection?' Children were divided into three age-groups consistent with their stages of tooth development: 5–6 years (primary dentition); 7–10 years (mixed dentition); 11–14 years (permanent dentition).

Statistical analyses were carried out using the complex sampling module in SPSS 13.0. This software package takes into account the clustered sampling design to yield unbiased standard error estimates and design effects. Factors that were significant at a bivariate level were classified into demographic, household SES (or proxies for household SES), lifestyle, dietary, food security or dental groups, which were guided by the literature. These factors were then entered into logistic regression models and used to produce weighted population estimates. Adjusted odds ratios were considered statistically significant when p-values derived from the Wald statistic were ≤ 0.05 and the Nagelkerke R^2 statistic was used to express the amount of variability explained by a given model.

Results

A total of 3,275 children were included in the analyses; 1,224 (37.4 percent) Mäori, 1,058 (32.3 percent) Pacific and 993 (30.3 percent) NZEO. Around 20 percent of the Maori, Pacific and NZEO groups were aged 5–6 years, approximately 40 percent were aged 7–10 years and the remainder were aged 11-14 years. There was an equal distribution of Maori, Pacific and NZEO children by gender.

Household SES measures that were significantly associated with receipt of a restoration at a bivariate level included household income, rental status, number of children in household or number of children aged <5 years in household; lifestyle factors were how many school days television was watched, if computer games were played on school days or if computer games were played the previous week; 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 chocolate bars, sweets, Coca-Cola® or other softdrinks the previous month or adding sugar to milo (a hot chocolate milk drink), tea or coffee. Food security factors included food running out due to lack of money or feeling stressed because not enough money for food; and dental items were attendance for dental care, brushing frequency, receipt of extraction, experience of dental pain at night or receipt of dental general anaesthetic.

Household SES measures that were significantly associated with receipt of an extraction at a bivariate level included household income while lifestyle factors were presence of a medical condition or physical disability. Dietary factors included purchasing lunch at a dairy, or frequency of consuming sweets or Coca-Cola® the previous month. Food security factors were food running out due to lack of money, eating less because of lack of money, food variety limited by financial constraints, feeling stressed because of not having enough money for food or feeling stressed because food unable to be provided for social occasions. Dental items included attendance for dental care, receipt of filling, experience of dental pain at night or receipt of a dental general anaesthetic.

Correlation tests confirmed the existence of associations between items in a given group (Pearson's correlation coefficient range 0.1–0.4) and where correlation was too high (meaning items are essential measuring the same construct) one was dropped. This was the case with the lifestyle variables 'play computer games on school days' and 'play computer games last week' in the model assessing ethnic differences by restoration receipt; the latter had the lower p value in the bivariate analyses and was not included in the multivariate model.

Using multivariate analyses in a basic model (Table 1, Model 1), Mäori children had 1.9 times the odds of having received a restoration after adjusting for age, gender and period of time living in New Zealand than NZEO children. The addition of household SES factors to the basic model caused a 16% decrease in adjusted odds ratios for Mäori receipt of restoration compared with NZEO children (Table 1, Model 2), while adding lifestyle factors resulted in the excess risk of restoration receipt for Mäori children being virtually the same (Table 1, Model 3). Adjusting the basic model by dietary factors resulted in a 12% reduction in adjusted odds ratios for Mäori child restoration receipt compared with NZEO children (Table 1, Model 4), while adding food security items accounted for a 4% decrease in the odds ratios (Table 1, Model 5). When dental factors were included in the basic model, the odds ratios of Mäori children having received a restoration were virtually unchanged in comparison with NZEO children (Table 1, Model 6), while adjusting the basic model by household, lifestyle, dietary, food security and dental factors resulted in excess risk of Mäori children having received a restoration decreasing by 11% (Table 1, Model 7). Addition of the household SES, lifestyle, dietary, food security and dental factors to the basic model, both individually and all combined, had no statistically significant effect on the odds ratios of Pacific child receipt of restoration in comparison with NZEO children.

Pacific children had 1.7 times the odds of NZEO children of receiving an extraction in a basic model where age, gender and length of time lived in New Zealand were accounted for (Table 2, Model 1). Adding household SES factors to the model caused a 12% reduction in adjusted odds ratios for Pacific child receipt of an extraction compared with NZEO children (Table 2, Model 2), while addition of the physical factor 'disability' caused essentially no change in Pacific children's odds ratios (Table 2, Model 3). Adjusting the basic model by dietary factors resulted in the excess risk of extraction receipt being reduced by approximately 10% in Pacific children in relation to NZEO children (Table 2, Model 4), and when food security items were added, the odds ratios of extraction receipt of Pacific children were reduced by 28% (Table 2, Model 5). Adding dental factors to the basic model caused a 13% increase in adjusted odds ratios for Pacific children in terms extraction receipt compared with NZEO children (Table 2, Model 6), and when household, lifestyle, dietary, food security and dental factors were all added to the basic model, the odds ratios of Pacific children decreased by 7% (Table 2, Model 7). Addition of the household SES, lifestyle, dietary, food security and dental factors to the basic model, both individually and all combined, had no statistically significant effect on the odds ratios of Mäori child receipt of extraction in comparison with NZEO children.

Discussion

This cross-sectional investigation of a nationally-representative child sample from New Zealand showed that Mäori children had greater odds of having received a restoration (with the variance being largely explained by household SES factors) and Pacific children had greater odds of having received an extraction (with the variance being largely explained by food security items) than NZEO children. The findings should be interpreted with a degree of caution, however, given that clinical dental data was not collected.

It was unsurprising that Mäori children received more restorations than their non-Mäori counterparts after adjustment of various behavioural and material factors, given evidence from the literature that suggests Mäori children have a higher prevalence of dental disease (MOH, 2003b). Mäori, as the Indigenous group, experience many of the same historical legacies as their counterparts in other developed countries, with loss of land, loss of language and policies encouraging cultural assimilation being a not-so-distant part of their history (King, 1997). Mäori people are generally more integrated into mainstream New Zealand life than Pacific groups 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 marginalisation and discrimination that may manifest in certain downstream factors such as restoration receipt (Blakely *et al.,* 2005).

The higher extraction prevalence among Pacific children may reflect residual cultural norms from the Islands, where extractions are often the preferred (and sometimes the only) treatment choice (Petelo *et al*., 2004). Provider bias and expectations may have also played a role, for it is apparent that, although decisions made by dental health professionals are complex, clinical considerations are not the only factors influencing treatment provision (Tickle *et al*., 2002). Moreover, expectations of carers may affect child dental service provision, with requests for teeth to be retained or removed influenced by familial access to dental services, child's compliance with oral hygiene, child's behaviour in the dental chair, past dental experience of child, oral health experience of other family members, priority of oral health to family members, cultural norms and familial dental health awareness (Tickle *et al.,* 2002). Hood *et al.* (1998) reported that care-givers of children from more affluent backgrounds were more likely to de-

Table 1. Adjusted odds ratios with 95% confidence intervals (95% CI) for the association between receipt of restoration 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]
	Odds ratio (95% CI)	*Odds ratio (95% CI)*	*Odds ratio (95% CI)*	*Odds ratio (95% CI)*	*Odds ratio (95% CI)*	*Odds ratio (95% CI)*	*Odds ratio (95% CI)*
Ethnicity							
Mäori	1.873 (1.545-2.269)*	1.579 (1.263-1.975)*	1.920 (1.467-2.512)*	1.639 (1.327-2.026)*	1.792 (1.456-2.205)*	1.893 (1.551-2.310)*	1.663 (1.161-2.382)*
Pacific	0.952 (0.787-1.151)	0.791 (0.612-1.023)	1.036 (0.761-1.357)	0.794 (0.618-1.021)	0.824 (0.657-1.034)	0.907 (0.744-1.105)	0.952 (0.584-1.50)
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 + SES factors (household income, rental, number of children in household, number of children <5 years in house)	Model 1 + lifestyle factors (how many school days watch tv, play computer games on school days)	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 and sweets last month, frequency of drinking Coca-Cola® and other softdrinks last month, adding sugar to milo, tea, and coffee)	Model 1 + food security factors (food runs out due to lack of money, eat less because of lack of money, feel stressed because of not having enough money for food)	Model 1 + dental factors (dental attendance, brushing frequency, experienced a dental extraction due to caries before, experienced dental pain at night, received a dental general anaesthetic)	All models

[a]Nagelkerke $R^2 = 0.097$
[b]Nagelkerke $R^2 = 0.171$
[c]Nagelkerke $R^2 = 0.111$
[d]Nagelkerke $R^2 = 0.110$
[e]Nagelkerke $R^2 = 0.099$
[f]Nagelkerke $R^2 = 0.118$
[g]Nagelkerke $R^2 = 0.230$

*$P<0.05$

Table 2. Adjusted odds ratios with 95% confidence intervals (95% CI) for the association between receipt of extraction 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]
	Odds ratio (95% CI)	*Odds ratio (95% CI)*	*Odds ratio (95% CI)*	*Odds ratio (95% CI)*	*Odds ratio (95% CI)*	*Odds ratio (95% CI)*	*Odds ratio (95% CI)*
Ethnicity							
Mäori	1.246 (0.977-1.591)	1.095 (0.835-1.436)	1.239 (0.971-1.581)	1.123 (0.867-1.456)	1.045 (0.794-1.375)	1.056 (0.798-1.397)	0.864 (0.610-1.224)
Pacific	1.685 (1.325-2.142)*	1.476 (1.124-1.939)*	1.707 (1.176-1.970)*	1.522 (1.176-1.970)*	1.205 (0.888-1.635)	1.931 (1.472-2.533)*	1.573 (1.090-2.271)*
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 + SES factors (household income)	Model 1 + lifestyle factors (disability)	Model 1 + dietary factors (lunch bought at dairy, frequency of eating sweets last month, frequency of drinking Coca-Cola® last month)	Model 1 + food security factors (food runs out due to lack of money, eat less because of lack of money, variety of food eaten limited by money, feel stressed because don't have enough money for food, is stressful because we can't provide the food we want for social occasions)	Model 1 + dental factors (dental attendance, receipt of filling, experienced dental pain at night, receipt of dental general anaesthetic)	All models

[a]Nagelkerke $R^2 = 0.091$
[b]Nagelkerke $R^2 = 0.110$
[c]Nagelkerke $R^2 = 0.123$
[d]Nagelkerke $R^2 = 0.147$
[e]Nagelkerke $R^2 = 0.204$
[f]Nagelkerke $R^2 = 0.172$
[g]Nagelkerke $R^2 = 0.236$

*$P<0.05$

mand conservative care rather than tooth removal, whereas parents from deprived backgrounds were more likely to accept extractions. Some Pacific families may also have preferred extractions to other treatment for their children so that no further pain or complications resulted; particularly if the family were mobile or likely to be travelling to the Islands (MOH, 2003a).

It is interesting that when food security items were accounted for, the differences in extraction receipt between Pacific and NZEO children became non-significant (Table 2, 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 (Casey *et al.,* 2005). Our findings suggest that food security may also be associated with poor oral health outcomes among Pacific children in New Zealand although (somewhat surprisingly) not among Mäori children (the difference in prevalence of restoration receipt between Mäori and NZEO children was reduced by only four percent when food security factors were adjusted for; Table 1, Model 5). Food is a central social construct in Pacific culture and is used as a measure of wealth or social status (MOH, 2004). Being unable to provide food for social occasions may lead to feelings of anxiety, stress or shame and a carer who is stressed about household food issues may not have the emotional capacity to make their child's oral health needs a priority.

Other factors that may have influenced our findings include the cultural-appropriateness of the New Zealand oral health workforce. There are important cultural constructs of both Mäori and Pacific societies that may impact on dental health care practises, such as not touching the head or neck (MOH, 2003a). Oral health professionals with limited knowledge of such concepts may unwittingly cause offence when providing care, leading to consequent avoidance of dental services and late presentation of oral health problems among Maori and Pacific children (MOH, 2003a). There are also few Mäori and Pacific dental health professionals in New Zealand, and although incentives to encourage such people into dental health programmes training exist, the numbers of current students remains low. It is recognised that ethnic groups respond best to health professionals who share the same culture and belief systems.

In summary, our findings have shown that Mäori children were more likely to have received a restoration, and Pacific children more likely to have received an extraction, than NZEO children when various material and behavioural factors were controlled for. More research is required to further explore factors that influence disparities in restoration and extraction receipt among children in New Zealand, for within any given ethnic group, heterogeneity will exist.

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