Predictors of Dental Pain and General Anesthetic Receipt for Hospital Dental Procedures Among New Zealand Children

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Abstract

Objectives: *To predict experience of dental pain and hospital dental general anesthetic receipt among Mäori, Pacific and New Zealand European or Other (NZEO) children in New Zealand.* ***Methods:*** *Data were 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:*** *Some 3275 children participated; 37.4 % Mäori, 32.3 % Pacific and 30.3% NZEO. Mäori children had higher odds of dental pain experience than NZEO children after adjusting for age, sex and length of time lived in New Zealand and with addition of household SES or physical factors. There were no differences in Pacific and NZEO child dental pain experience when the same factors were accounted for. The prevalence of dental general anesthetic receipt was similar among Mäori, Pacific and NZEO children after adjusting for demographic, lifestyle, dietary, food security and dental factors in separate models. When such factors were investigated together, Pacific children were less likely to have received a dental general anesthetic than NZEO children.* ***Conclusions:*** *Mäori children were more likely to experience dental pain and Pacific children were less likely to have received a dental general anesthetic than NZEO children after accounting for various behavioral and material factors. The latter may reflect issues pertaining to access and culturally insensitive services rather than demand for care per se.*

Key Words: Mäori, Pacific, children, dental pain, dental general anesthetic, hospital

Introduction

There has been increased interest in oral-health-related-quality-of-life in relation to children in recent times (1–3). Of the various tools developed to measure such a paradigm, experience of dental pain is usually a component (4). Dental discomfort is often an indication of caries presence, with severity and duration of pain generally increasing with progressing lesion growth (5). Extreme pain may occur when bacteria creating the carious lesion reach a tooth's nerve system, with the resulting pulpitis usually requiring a pulpotomy/pulpectomy or for the tooth to be extracted (6). Such pain may then manifest in other aspects of daily life, including problems with eating, sleeping, general health, concentration and behavior (3). The measure of oral discomfort may be problematic among children, however, many may not verbalize feelings of pain due to immaturity or inability to connect general feelings of unwellness with toothache (2).

The need for dental care under a general anesthetic is a less-considered factor in measures of oral-health-related-quality-of-life, although the literature suggests that the life quality of children may improve markedly once such care has been received (7). Children may be referred for dental care under a general anesthetic due to high dental disease levels, the need for complex procedures, medical complications or poor cooperation in the dental chair (8). The advantage of oral rehabilitation under general anesthesia is that it allows treatment in a single visit, provides immediate relief of pain and requires little or no cooperation by the child (9). It should be noted, however, that such care carries the usual medical risks of general anesthetic for any individual and a small but real mortality risk. For those children who are fearful or phobic of dental procedures, the use of general anesthetic may also be associated with enhancement of fear over time (10).

Ethnic group, household socioeconomic status (SES) and past caries experience have all been identified as risk factors for both experience of dental pain and need for a dental general anesthetic. As depicted in Figure 1, these all have a relationship with individual-level effects (such as life-course factors), which are influenced, in turn, by health interventions, resources and systems. Experience of dental pain and need for a dental general anesthetic are also related, with the former often giving rise to (and being associated with) the latter (7).

The largest ethnic proportions in the New Zealand child population are New Zealand European or Others (NZEO; 66.2% of 0-14-year-old population), followed by Mäori (the Indigenous group; 23.2% of child population) and Pacific (Cook Island, Western Samoan, Niuen, Tongan, Tuvaluan, Tokelaun or Fijian) children (10.6% of child population) (11). Pacific children are the fastest growing group, with a 39% population increase between the 1991 and 2001 Censuses (11). It is likely that oral-health-related-quality-of-life is not equally distributed among New Zealand's child population. Mäori and Pacific children may be less socially advantaged than their NZEO counterparts (11), experience poorer general health, be more likely to be hospitalized and carry a disproportionate amount of the oral disease

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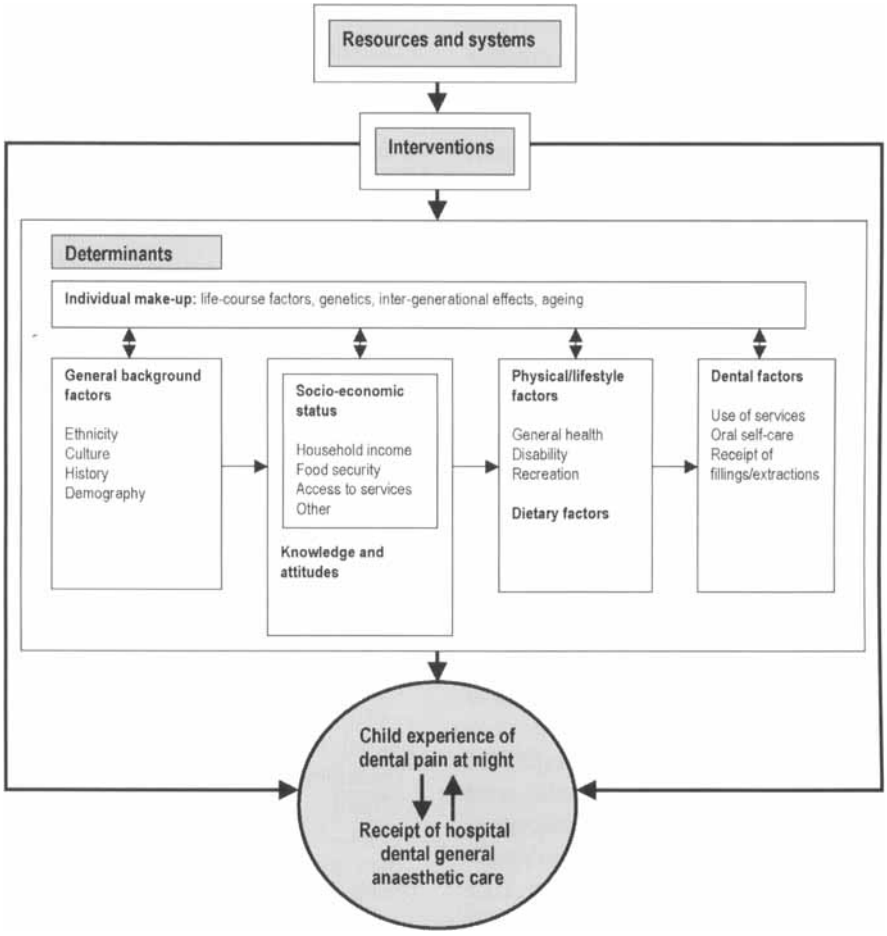
burden; all factors known to have a negative impact on life quality.

The purpose of this study was to explore demographic, SES, physical/lifestyle, dietary, household food security and dental factors affecting experience of dental pain and receipt of a hospital dental general anesthetic in a representative sample of New Zealand children partaking in the 2002 National Child Nutrition Survey (NCNS), utilizing the conceptual framework shown in Figure 1. The hypotheses were that Mäori and Pacific children would have a higher prevalence of dental pain and dental general anesthetic receipt than their NZEO counterparts when the various behavioral and material factors were accounted for.

Figure 1
A hypothetical framework for child experience of dental pain at night and receipt of hospital dental general anaesthetic



Methods

The NCNS utilized a stratified two-stage survey design, specific details of which are described elsewhere (12). Different sampling measures were used for Mäori, Pacific and NZEO children to ensure approximately equal numbers of children 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, and sub-scapular and triceps skinfold thickness; and blood and urine samples to assess iron, zinc, lipid and iodine levels. Caregivers conveyed information for all children aged 5–6 years and 92.3% of children aged 7–10 years. Children aged 11–14 years responded to the items themselves. Caregivers completed all questions pertaining to household income and food security. In the few cases where the caregiver was not part of the child's household, the head-of-household deferred to the more knowledgeable caregiver, e.g., grandparent, day care professional.

The dental items were based on those used in previous studies (13, 14). Focus group methodology was used to test the appropriateness of the items with Mäori and Pacific groups (15). The dental items were also clinically validated (16). Questions pertaining to dental pain included "has pain in your teeth or mouth ever kept you awake at night?" while the item exploring dental general anesthetic use was "have you ever been put to sleep in hospital to have dental treatment?'" Participants were asked to provide one of four answers: "yes," "no," "can't remember" and "don't know."

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, physical/lifestyle, dietary, food security or dental groups as required for the study's *a priori* conceptual model (see Figure 1), which was guided by the literature. These were then entered into logistic regression models to produce weighted population estimates. Individual items that comprised a given conceptual group were entered as covariates.

Correlation tests confirmed the existence of moderate associations between items in a given group of variables (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 amount of variability explained by a given model. Basic models were constructed to assess the association between experience of dental pain/receipt of a dental general anesthetic and ethnicity adjusted for age group, gender and time lived in New Zealand.

Results

Over 3000 (3275) children were included in the analyses; 37.4% Mäori, 32.3% Pacific and 30.3% NZEO. Nearly six hundred (588) had experienced dental pain at night and 170 had received a dental care under a hospital general anaesthetic. Of the children who reported experiencing dental pain at night, 13.8% were aged 5-6 years, 46.8% were aged 7-10 years and 39.4% were aged 11-14 years (P=0.01).

A higher prevalence of children aged 7-10 years or who were Maori had experienced dental pain at night (Table 1). Household income was the only SES measure that was significantly associated with dental pain at a bivariate level and presence of a disability was the only physical/lifestyle factor. Dietary factors that were significant at a bivariate level included eating breakfast on the way to school and purchasing lunch at a dairy (small shop selling convenience food).

Table 1
Experience of dental pain and receipt of hospital dental general anaesthetic by selected characteristics (weighted row percentages; critical value of r = 0.034)

	n	Dental pain kept awake at night	Correlation (r)*	Receipt of dental general anesthic	Correlation (r)*
Demographic factors					
Age-group		†	-0.008		0.015
5-6 years	692	11.9		4.8	
7-10 years	1425	19.2		5.7	
11-14 years	1158	16.5		5.0	
Gender			-0.003		0.011
Male	1697	16.2		5.4	
Female	1578	17.3		5.1	
Ethnicity		†	0.056		0.013
Mäori	1224	20.2		5.8	
Pacific	1058	16.8		4.8	
NZEO	993	15.5		5.1	
Live in NZ			0.042	‡	0.036
Always	2811	17.2		5.6	
Not always	464	13.8		2.8	
Household factors					
Household income		‡	0.042		0.024
<$20,000	577	22.8		5.2	
$20-50,000	1210	16.0		6.1	
$50,000	912	15.1		4.3	
Physical/lifestyle factors					
Disability		‡	0.035		0.040
Yes	905	19.5		6.3	
No	2370	15.6		4.8	
How many hours watch tv on school day?			-0.011	‡	-0.015
<2 hours	1933	17.0		4.4	
>2 hours	1342	16.3		6.5	
Play active games last week			0.025	‡	0.013
Yes	2447	18.5		3.4	
No	828	16.2		5.8	
Dietary factors					
Breakfast on way to school		‡	0.036	‡	0.032
Yes	842	20.9		7.6	
No	2433	16.0		4.8	
Lunch bought dairy		†	0.041		0.012
Yes	1192	22.2		5.4	
No	2083	14.1		5.2	
Food security factors					
Can afford to eat properly		†			0.008
Always	1931	15.0	-0.055	4.9	
Sometimes or never	1004	22.1		6.9	
Food runs out due to lack of money		†	-0.059		-0.013
Often or sometimes	1041	22.5		6.9	
Never	1899	14.9		4.9	
Eat less because of lack of money		†	0.061	†	0.008
Often or sometimes	879	23.5		9.1	
Never	2051	15.0		4.5	
Food variety limited due to lack of money	‡	0.036	‡	0.015	
Often or sometimes	1318	19.3	7.2		
Never	1618	15.1	4.3		

(Table 1 - Continued)

	n	Dental pain kept awake at night	Correlation (r)*	Receipt of dental general anesthetic	Correlation (r)*
Rely on others to provide food/money for food when our household runs out		†	0.043		-0.017
Often or sometimes	585	24.2		7.4	
Never	2353	15.6		5.1	
Use food grants/food banks when not enough money for food		†	0.055		0.008
Often or sometimes	445	23.7		5.9	
Never	2492	15.8		5.3	
Feel stressed because of not having enough money for food		†	0.067	†	0.022
Often or sometimes	1028	21.3		8.4	
Never	1904	15.0		4.3	
It is stressful because we can't provide the food we want for social occasions		†	0.056	†	0.007
Often or sometimes	844	17.4		8.5	
Never	2080	8.4		4.6	
Dental factors					
Received dental care before?		†	0.052		0.027
Yes	2995	17.4		5.4	
No	280	8.4		2.7	
How many times brush teeth yesterday?		‡	0.044		0.020
None	481	22.0		5.7	
Once or more	2758	16.0		5.1	
Filling		†	0.176	†	0.069
Yes	2118	21.2		6.6	
No	1157	8.8		2.7	
Extraction		†	0.279	†	0.345
Yes	565	43.9		24.1	
No	2710	12.0		1.9	
Pain at night			†		0.142
Yes	588			13.4	
No	2687			3.6	
Hospital dental general anaesthetic		†	0.142		
Yes	170	42.9			
No	3105	15.3			

†P<0.01; ‡ P<0.05; Pearson Chi-Square Test
*if r>critical value of r (0.034) the correlation is statistically significant at the 0.05 level

Food security items that were significant at a bivariate level included being unable to afford to eat properly, running out of food due to lack of money, eating less because of lack of money, having limited food variety due to 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 due to funding shortages. The dental factors significantly associated with experience of dental pain were receipt of dental care, low brushing frequency or receipt of restoration, extraction or dental care under a general anesthetic.

Children who had received dental care under a general anaesthetic were more prevalent among those who had always lived in New Zealand (Table 1). There were no household SES measures significantly associated with dental general anaesthetic receipt at a bivariate level, while significant lifestyle factors included more than two hours of television watched on a school day and not playing active games the previous week. Dietary factors significantly associated with dental general anaesthetic receipt at a bivariate level were eating breakfast on the way to school, while food security items included eating less because of lack of money, food variety limited due to financial shortages, feeling stressed because not enough money for food and feeling stressed because food for social occasions was not able to be provided due to funding shortages. The dental factors associated with dental general anaesthetic care included receipt of restoration, receipt of extraction or dental pain experienced at night.

Using multivariate analyses in a basic model (Table 2, Model 1), Mäori children were 1.4 times as likely as NZEO children to experience dental pain after adjusting for age, sex and period of time living in New Zealand. There were no statistically significant differences between Pacific and NZEO children. The addition of household SES and physical factors to the basic model caused virtually no change in adjusted odds ratios for Mäori experience of dental pain compared with NZEO children (Table 2, Models 2 and 3), while adjusting the basic model by dietary factors resulted in the excess risk of Maori child dental pain experience being no longer statistically different (Table 2, Model 4). Adding food security and dental items to the basic model also made the adjusted odds ratios of Mäori child experience of dental pain at night no longer statistically different to NZEO children (Table 2, Models 5 and 6). The basic model adjusted by household, lifestyle, dietary, food security and dental factors resulted in Mäori children having 1.2 times the odds of experiencing dental pain in comparison to NZEO children (Table 2, Model 7). Addition of the household SES, lifestyle, dietary, food security and dental factors to the basic model, ei-

Table 2
Adjusted odds ratios with 95% confidence intervals (95% CI) for the association between dental pain at night and ethnicity (weighted data)

	Model 1[a] Odds ratio (95% CI)	Model 2[b] Odds ratio (95% CI)	Model 3[c] Odds ratio (95% CI)	Model 4[d] Odds ratio (95% CI)	Model 5[e] Odds ratio (95% CI)	Model 6[f] Odds ratio (95% CI)	Model 7[g] Odds ratio (95% CI)
Ethnicity							
Mäori	1.35 (1.08-1.70)*	1.34 (1.04-1.74)*	1.34 (1.07-1.69)*	1.17 (0.91-1.50)	1.13 (0.87-1.47)	1.19 (0.93-1.54)	1.18 (1.03-1.34)*
Pacific	1.12 (0.88-1.43)	0.96 (0.72-1.27)	1.14 (0.89-1.45)	0.92 (0.69-1.21)	0.75 (0.54)	1.02 (0.79-1.33)	0.98 (0.79-1.17)
NZEO	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Variables included	Demographic factors	Model 1 + household factors	Model 1 + physical factors	Model 1 + dietary factors	Model 1 + food security factors	Model 1 + dental factors	All Models

[a]Nagelkerke R^2 = 0.081
[b]Nagelkerke R^2 = 0.142
[c]Nagelkerke R^2 = 0.113
[d]Nagelkerke R^2 = 0.181
[e]Nagelkerke R^2 = 0.204
[f]Nagelkerke R^2 = 0.190
[g]Nagelkerke R^2 = 0.223
*P<0.05

ther individually or combined, had no statistical effect on the odds ratios of Pacific experience of dental pain in comparison with NZEO children.

There were no differences by ethnicity in receipt of a dental general anaesthetic in the basic model or when lifestyle, dietary, household food security or dental factors were accounted for. When all models were considered together, Pacific children were less likely to have received a dental general anesthetic than NZEO children (OR: 0.44, 95% CI: 0.24–0.82). Food security factors contributed the most to this outcome (Nagelkerke R^2=0.193).

Discussion

This cross-sectional study of a nationally-representative child sample from New Zealand showed that more Mäori children experienced dental pain and, when various behavioral and material models were considered together, Pacific children had lower odds of having received a hospital dental general anesthetic than NZEO children.

That Maori children experienced more dental pain than their NZEO counterparts was unsurprising given that Maori children are known to have higher prevalence and severity of dental disease (although it should be borne in mind that the practical significance of an odds ratio of 1.2 is limited). What was less expected was that the prevalence of Pacific children's experience of dental pain would be similar to their NZEO counterparts (Table 2, Models 1–7), given that clinical measures of decayed, missing and filled teeth among Pacific children are also reported as being higher (17, 18).

It is acknowledged that pain is a difficult construct to measure among children due to its subjectivity, especially when the instrument is in a language dissimilar to a participant's first language. Nearly half of the Pacific children in our study spoke a language other than English in their home environment (unpublished observations). Further bias may have been introduced by some carers who provided information on Pacific children not living in a close enough proximity to know if the child's sleeping patterns had been disrupted because of dental pain or not. Carers providing information in this study ranged from parents, siblings, aunts and uncles, grandparents or close family friends (12). It is also possible that some Pacific carers responding on behalf of children may have underestimated the child's experience of dental pain at night.

There may be a number of reasons why Pacific and NZEO child experience of dental pain was similar when Pacific children are known to have greater dental disease prevalence: (1) social desirability bias (Pacific children or their carers reporting the socially-acceptable answer in response to the experience of dental pain item, with Pacific culture placing a strong emphasis on "saving face") (19); (2) the pain thresholds of Pacific children being greater than their NZEO counterparts (20); or (3) Pacific children having their teeth regularly checked, meaning any necessary treatment occurred without onset of pain. Had the dental pain item been more loosely termed (for example, "have you *ever* experienced tooth pain" as opposed to "have you ever experienced tooth pain *at night*") the disparities may have also been more pronounced.

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) (12) on child dental health outcomes is a relatively unexplored paradigm in oral epidemiology. 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 (21). The findings of this study suggest that food security may also be associated with oral-health-related-quality-of-life among Mäori children, with most of the variance be-

tween Mäori and NZEO child experience of dental pain becoming non-significant when food security items were accounted for (Table 2, Model 5). Food security items also contributed to most of the variance in Pacific child dental general anesthetic receipt. Food is a central social construct in Mäori and Pacific culture and being unable to provide food for social occasions may lead to feelings of anxiety, stress or shame (22). A carer who is stressed about household food issues may not have the mental or emotional capacity to make their child's oral health needs a priority. It is also reflective of household SES, with higher household SES equating to greater food security (21). The relationship between low household SES and poor child oral health is established (23).

That Mäori or Pacific children did not have a higher prevalence of dental general anesthetic receipt than NZEO children was counter to the hypothesis of the study's authors, but is perhaps more a reflection of issues pertaining to physical access or culturally acceptable service provision than demand for hospital dental care *per se*. Children requiring hospital dental general anesthetic care are usually referred to large city centres and findings from the New Zealand Health Survey indicate that proportionally more Mäori and Pacific people live geographically further from city hospitals than their NZEO counterparts (24). Navigating around a new city and finding accommodation may be near-impossible for those relying on public transport and with limited incomes or social support (19). Undergoing hospital-based dental care under a general anesthetic also requires adherence to a number of strict protocols such as fasting up to 12 hours before the procedure and having a carer present for admission and discharge phases (8, 25). The hospital and theatre environment may be intimidating to those not well integrated into mainstream health services or for whom English is a second language.

Further barriers in Mäori and Pacific child utilization of hospital-based dental services include hospital theatre waiting rooms being generally designed for efficiency and not adequately accommodating large groups of people. Large group attendance for health care play important roles in Mäori and Pacific culture, particularly among those with limited education (19, 22). These factors, together with fear of pain, negative dental experiences, beliefs that hospitals are linked with death and institutionalized racism (19, 22), suggest the low prevalence of Mäori or Pacific children's receipt of a dental general anaesthetic in this study may be an inaccurate portrayal of the actual need for such care. These speculations are supported by Cunningham *et al.* (26) who found that a high prevalence of Indigenous children were placed on general anesthetic lists in Australia but did not receive care for reasons of access, unfamiliarity with hospital environments and non-compliance with pre-operative procedures. Similarly the Institute of Medicine in the United States (27) statement that there were fewer general anesthetic procedures among disadvantaged groups such as African-Americans, despite there being more demand for care by such people, provides foundation for this interpretation. Public health implications of this study's findings include the need to make hospital services, specifically general anesthetic services, more accessible and culturally oriented toward those needing it, specifically disadvantaged populations.

There are a number of shortcomings of this study. All measures were collected at an individual level with no accounting for contextual factors such as access to hospitals, service provision, provider bias, cultural beliefs and customs, social and economic conditions in a community, housing and social or geographic isolation (28). Durie (29) has commented that contextual factors offer a more valid explanation for health disparities among ethnic groups. It may be that multi-level studies (those that investigate community-level characteristics after adjusting for individual factors) are required to more fully elucidate factors impacting on dental pain and dental general anaesthetic receipt among New Zealand children.

In summary, the findings of this study have shown that more Mäori children experienced dental pain than non-Mäori children in a nationally-representative child sample and that Pacific children received less dental care under a hospital general anesthetic when various material and behavioral factors were accounted for (although the latter may reflect issues pertaining to access as opposed to demand for care *per se*). These findings may be a useful guide for public health policy makers in improving, promoting and protecting the oral health status of New Zealand children, especially in ensuring that instruments used in the assessment of child pain take into account cultural aspects such as "loss of face" and that hospital services are more culturally appropriate in regards to general anaesthetic use. Further research is required to explore factors contributing to child oral-health-related-quality-of-life among ethnic groups both in New Zealand and other countries so that more equitable and culturally appropriate oral health services and promotion strategies might be developed and implemented. Future investigations are also needed to assess (preferably using a validated scale approach) the impact of dental treatment under general anesthetic on child life quality.

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