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An assessment of the validity and reliability of dental self-report items used in a National Child Nutrition Survey

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Abstract – *Objectives:* To examine the clinical validity and reliability of dental self-report items used in a national child nutrition survey. *Methods:* The study involved completion of dental self-report questionnaires by 6–9-year-old children who attended one of the three schools with ethnic distributions, similar to schools in the national survey, and their care-givers. Children were then dentally examined. *Results:* Two hundred and four children (response rate 74.2%) returned questionnaires and were dentally examined. The highest degree of child and care-giver concordance for the self-reported dental items was for the 'has had an extraction due to dental caries' item (kappa = 0.92), while the lowest was for the 'brushes twice or more per day' item (kappa = 0.61). The prevalence of dental caries in the deciduous dentition was 67.6%. The mean dfs, mean DFS and mean number of missing primary teeth because of caries were 6.15 (SD 6.51), 0.83 (SD 1.28) and 0.30 (SD 0.82), respectively. Caries severity was higher in children who reported brushing infrequently, having received a filling, having had an extraction because of caries, having been kept awake at night because of dental pain or having had a general anaesthetic for dental treatment. Values for self-report and clinical reliability were above 0.80 in all instances. *Conclusions:* The dental self-report items showed a high level of concordance between child and care-giver, and appeared to be clinically valid. The findings suggest that using dental self-report measures for children may be valuable in dental epidemiological investigations.

Key words: validity; child self-report; care-giver self-report; dental

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Data in dental epidemiology have usually been obtained from clinical investigations (1, 2). However, as a result of rising resource constraints in this form of data collection, an increase in the use of self-report measures is occurring (1). There is a sound evidence base for the utility of self-report oral health data (3), and a number of self-report measures have been developed that assess subjective health states such as dental neglect, dental anxiety and oral health-related quality of life (4–6). Self-report measures that capture a child's dental experience have not been reported; however, such measures would be useful in situations where information on oral disease experience and health service usage is required, but resource or logistical constraints preclude dental examinations.

It has been suggested that, for maximum benefit, self-report items should be brief in their content, easy to interpret, not require complex training and be easily incorporated into clinical (or other) routines (7). Validity and reliability are also important aspects of self-report items, and it is necessary to test these as items are developed, and each time they are used to test new hypotheses (8). Validity is the extent to which self-report items measure what they purport to measure (9). Construct validity examines the relationship between the measure and underlying theoretical paradigm, and relies on a sound

theoretical basis for the particular measurement (8, 9). The assessment of concurrent validity involves comparison of a measure with a 'gold standard' or global item, while content validity concerns inferences that may be drawn from item findings, i.e. whether items measure what they set out to (9). It has been suggested that, fundamentally, all the three 'C's' of validity measure the same thing: the degree of confidence that can be placed on the inferences drawn from item findings (8).

The National Child Nutrition Survey (NCNS) was a nation-wide survey conducted in 2002–03 with a representative sample of European, Maori and Pacific Island schoolchildren throughout New Zealand. The main aims addressed the nutritional status and dietary habits of the sample, and self-report dental questions were also included. Clinical oral examinations were not possible because of funding and logistical constraints, and instead it was decided to use simple items that (it was hoped) would be clinically valid, as well as being sufficiently small in number, so as to minimise respondent burden. The dental self-report items were based on those used in previous studies (10, 11) and they focused on three types of outcome measures:

- oral self-care (brushing frequency);
- dental resource impact (use of the School Dental Service, experience of fillings and extractions and hospital-based dental treatment under general anaesthetic); and
- quality of life (asking children to compare their oral health with others of their age, and whether dental pain had kept them awake at night).

Qualitative pretesting of the dental items was undertaken to determine their acceptability for Maori and Pacific groups (the latter included Samoan, Niuean, Cook Island and Tongan people). The purpose was to identify any problems with each item in English and the particular group's language, improve the translations and ensure that the items' content and format were satisfactory. Pretesting involved face-to-face interviews and focus group discussions, and for each ethnic group, included participants from a range of ages and socioeconomic backgrounds. Findings from the pretesting indicated that the item asking children to compare their oral health with others of their age should be dropped (because it was deemed to be offensive), certain words should be improved for readability and comprehension, appropriate visual prompts should be utilised and bilingual versions for Maori and Pacific Island groups should be used where appropriate. However, the pretesting process did not address the clinical validity of the dental items, and this remained a critical issue.

The aims of this study were to examine the clinical validity and reliability of the dental self-report items used in the NCNS. It was hypothesised that the self-report answers provided by the children and care-givers would be valid indicators of the children's oral health.

Methods

Ethical approval for the study was granted by the Otago Ethics Committee. Three primary schools were selected by the Otago Principal Dental Officer (a Government-appointed dentist responsible for the local School Dental Service) on the basis of their ethnic and social mix approximating, as close as possible, that of children in the NCNS. All 6–9-year-old children who attended those schools were invited to take part in the study.

A covering letter, consent form and dental self-report questionnaire were sent home with each eligible child. The questionnaires were completed by care-givers at home, with a second copy completed by the child in the school dental clinic at the time of the dental examination. The questionnaire items are presented in Table 1. The dental examinations were conducted by L.M.J. (who had been previously calibrated) in school dental clinics, and they followed standard World Health Organisation procedures (12).

Tooth status was recorded as 'present', 'missing' or 'deciduous', and each tooth surface was recorded as 'sound', 'decayed', 'filled', 'filled with decay' or 'extracted due to caries'. Data were analysed using SPSS, and the level of statistical significance was set at $P < 0.05$. Kappa was used to measure concordance, the Pearson's chi-square test was used for categorical dependent variables and analysis of

Table 1. Dental self-report items (for child)

1. How old are you?
2. Are you a boy or a girl?
3. Do you go to the school dental clinic or dentist?
4. How many times did you brush your teeth yesterday?
5. Have you ever had a filling or a dressing?
6. Has pain in your teeth or mouth ever kept you awake at night?
7. Have you ever had teeth taken out because of a hole, gum-boil or infection?
8. Have you ever been put to sleep in hospital to have dental treatment?
9. Which ethnic group do you identify with?

variance (ANOVA) was used when the dependent variable was continuous.

To investigate reliability, a random sample of 10% of the care-givers and children completed a second copy of the questionnaire, and every 10th child was examined.

Results

Of a total of 275 eligible children, 60 did not return a signed consent form and 11 were absent on the day of examination, leaving 204 participants (74.2%). Fewer than one-fifth of the sample was aged 6 years, less than one-quarter was aged 7 and 8 years, respectively, and over 35% was aged 9 years. There was an approximately equal proportion of males (49.0%) and females (51.0%). Just over 60% of the sample identified themselves as European, over one-fifth as Maori, 14% as Pacific Islanders and fewer than 5% as 'other' (mainly Asian).

Data on the child dental characteristics reported by child and care-giver are presented in Table 2. Owing to the 'attends School Dental Service' and 'has had a general anaesthetic' items having a greater than 90% or less than 10% split, respectively, between child and care-giver responses, no dependable concordance test was possible. These items are consequently not reported in the table. Almost all reported that the child used the School Dental Service and fewer than half reported that the child brushed two or more times each day. Approximately two-thirds reported that the child had had experience of restorative dentistry. While one-quarter of children reported being kept awake at night because of dental pain, fewer than 15% of care-givers reported that it had occurred. Fewer than one-fifth of the sample reported that the child had had an extraction because of caries, and under 10% reported that the child had received dental treatment under a general anaesthetic. The concordance between child and adult ratings for the 'brushes 2+ times per day' and 'dental pain kept awake at night' variables were 'acceptable', while that for the 'had a filling before' item was 'moderate' (modified by Landis & Koch; 13). With the 'has had extraction due to caries' item, the concordance was 'almost perfect' (modified by Landis & Koch; 13).

The prevalence of dental caries in the deciduous dentition was 67.6% ($N = 138$), and the mean dfs, DFS and number of missing primary teeth because of caries were 6.15 (SD 6.51), 0.83 (SD 1.28) and 0.30 (SD 0.82), respectively. The children's self-reported frequency of brushing and past experience of fillings is presented in Table 3 by caries prevalence and severity. Almost all children who reported not

Table 2. Child dental characteristics reported by child and care-giver, and their concordance ($N = 204$; percentages in paranthesis)

	Child	Care-giver	Kappa	Strength of agreement[a]
Brushes twice or more per day	82 (40.2)	99 (48.5)	0.61	'Acceptable'
Has previously had a filling	141 (69.1)	137 (68.5)	0.72	'Moderate'
Dental pain kept awake at night	53 (26.1)	29 (14.5)	0.66	'Acceptable'
Has had extraction due to caries	39 (19.2)	37 (18.7)	0.92	'Almost perfect'

[a]According to modified Landis & Koch (1977) (13).

Table 3. Child self-reported frequency of brushing and presence of filling by caries prevalence and severity ($N = 204$)

	Brushing			Filling	
	Doesn't brush	Brushes once per day	Brushes 2+ times per day	Had filling	Not had filling
Frequency (%)	13 (6.4)	109 (53.4)	82 (40.2)	141 (69.1)	63 (30.9)
Number with caries experience in primary dentition (%)	11 (84.6)	81 (74.3)	45 (56.1)[a]	127 (90.1)	11 (17.5)[b]
Mean dfs (SD)	6.69 (7.81)	6.93 (6.71)	5.04 (5.93)	8.71 (6.30)	0.43 (1.04)[c]
Mean DFS (SD)	1.69 (1.75)	0.84 (1.25)	0.67 (1.20)[d]	1.14 (1.40)	0.13 (0.49)[c]
Mean missing primary teeth because of decay (SD)	0.38 (0.77)	0.55 (0.50)	0.23 (0.81)	0.43 (0.95)	0.03 (0.25)[c]

[a]Chi-square $P < 0.005$.
[b]Chi-square $P < 0.001$.
[c]ANOVA $P < 0.001$.
[d]ANOVA $P < 0.05$.

Table 4. Child self-reported frequency of dental pain keeping awake at night, extraction because of caries and dental care under general anaesthetic by caries prevalence and severity ($N = 204$)

	Has pain kept child awake?		Previous extraction?		Previous general anaesthetic?	
	Yes	No	Yes	No	Yes	No
Frequency (%)	53 (26.1)	150 (73.9)	39 (19.2)	164 (80.8)	14 (6.9)	189 (93.1)
Number with caries experience in primary dentition (%)	47 (88.7)	90 (60.0)[a]	33 (84.6)	104 (63.4)[a]	12 (85.7)	125 (66.1)
Mean dfs (SD)	10.19 (6.72)	4.65 (5.76)[b]	10.18 (6.76)	5.13 (6.04)[b]	11.86 (6.87)	5.67 (6.27)[b]
Mean DFS (SD)	1.36 (1.48)	0.64 (1.15)	1.26 (1.62)	0.73 (1.17)[c]	1.71 (1.77)	0.76 (1.22)[c]
Mean missing primary teeth because of decay (SD)	0.94 (1.29)	0.08 (0.38)[b]	1.41 (1.31)	0.04 (0.28)[b]	1.79 (1.58)	0.20 (0.62)[b]

[a]Chi-square $P < 0.005$.
[b]ANOVA $P < 0.001$.
[c]ANOVA $P < 0.005$.

brushing or having had a filling had caries experience in either dentition. Children who reported 'never' brushing had higher mean DFS than those who brushed regularly. Children who reported having had a filling had higher mean dfs and DFS scores, and more primary teeth missing because of caries than those who reported not receiving restorative care.

The children's self-reported frequency of dental pain keeping them awake at night, extraction as a result of caries and dental care under general anaesthetic is presented in Table 4 by caries prevalence and severity. Over 90% of children who reported being kept awake at night, having had an extraction or having had a general anaesthetic had had dental disease experience. The mean dfs and number of primary teeth missing because of caries were higher in children who reported that pain had kept them awake at night. Children who reported having had an extraction had higher caries experience than those who had not had an extraction. Similarly, caries experience and tooth loss were higher in those who reported having had a general anaesthetic.

The kappa values obtained in measures of child–child and adult–adult self-reporting, and intraclass correlation coefficient values (alpha) obtained in measures of clinical reliability are presented in Table 5. Values were above 0.80 in all instances.

Table 5. Self-report and clinical reliability ($N = 20$)[a]

Self-report item	Kappa[a]
Child–child	
Attends School Dental Service	1.00
Brushes twice or more per day	0.93
Has previously had a filling	0.96
Dental pain kept awake at night	0.89
Has had extraction due to caries	0.91
Has had a general anaesthetic	0.93
Adult–adult	
Attends School Dental Service	1.00
Brushes twice or more per day	0.96
Has previously had a filling	0.96
Dental pain kept awake at night	0.93
Has had extraction due to caries	0.91
Has had a general anaesthetic	0.93
Clinical reliability	Intra-class correlation coefficient (alpha)
Mean dfs	0.97
Mean DFS	0.99

[a]Kappa values and 'strength of agreement' (modified by Landis & Koch (1977) (13)): <0.40, 'poor'; 0.41–0.50, 'slight'; 0.51–0.60, 'fair'; 0.61–0.70, 'acceptable'; 0.71–0.80, 'moderate'; 0.81–0.90, 'substantial'; 0.91–1.00, 'almost perfect'.

Discussion

This study used information obtained from a cross-sectional survey carried out to evaluate the clinical validity and reliability of child dental self-report items used in a nation-wide nutrition survey. There was a high level of concordance between child and care-giver self-reporting, and children's self-report information was positively correlated with their clinically measured oral health. Although concurrent validity could not be examined (because the global rating item was dropped in the pretesting phase), the self-report items were found to have both construct and content validity. That is, there was a clear relationship between clinical dental disease experience and self-reported oral health behaviour/treatment, and self-report answers from child and care-givers were, on the whole, largely similar.

Interviewing children about aspects of oral health and use of dental services has been considered difficult. Pal (14) suggested that a reason for the lack of self-report measures for children in the health field may be because of the complex issues sur-

rounding item construction. He also argued that it was pointless collecting self-report information if it was unknown whether children actually understood what the items were asking (14). In the current study, difficulties with item interpretation and understanding were confronted and dealt with in the qualitative pretesting phase. This proved to be an essential step in item development, as it allowed ambiguous and inappropriate wording to be highlighted and amended accordingly. The value of qualitative techniques in self-report item construction has been reported elsewhere (15).

Through a series of clinical examples, Landis & Koch (13) described the issues of interobserver bias (in the case of our paper, the issue of concordance between child and care-giver self-reporting) in terms of the relative 'strength of agreement' (indicated by particular values of the kappa statistic). However, the measures were designed for social science purposes and, in order to make the values more dentally relevant, they were slightly modified by the authors (see footnote to Table 5). According to the modified values, the level of concordance between child and care-giver self-report in the current study ranged from 'acceptable' to 'almost perfect'. This indicates that children in our sample were capable of providing answers that were largely similar to their care-givers, and suggests that child self-reports may be used without parental informants in some circumstances (although it would be a prudent practice to collect information from both sources where possible).

Child developmental psychologists consider that the age of 6 years marks the beginning of abstract thinking and the ability of children to compare their physical features with peers, while a child's ability to evaluate his or her behaviour and the concept of time develops through to the age of 10 (16–18). That the 6–9-year-old children in the current study were capable of providing clinically valid and reliable responses to the dental self-report items tested suggests that children in that age group may have the cognitive ability to provide accurate self-responses to items of a straight-forward dental nature. However, this may vary with different child samples, and further investigations are necessary.

Where general health is concerned, it has been suggested that care-givers' knowledge of their children may be limited, and that parental and child self-reports of childrens' health may not always correspond (16–19). This was reflected in our study, where differences occurred for the 'brushes twice or more per day' (parents reported more) and 'dental pain kept awake at night' (children reported more) items. This may be because care-givers are more influenced by societal pressure to report the number of times their children are 'supposed' to brush each day, or children may not always inform care-givers if they are kept awake at night because of toothache (8). A considerably larger sample size in our study may have allowed more meaningful oral health comparisons to be made for children whose self-ratings did or did not concur with those of their care-givers.

Children in our study who reported poor oral self-care (toothbrushing), having utilised dental resources (received a filling or extraction, had dental treatment under a general anaesthetic) or had a reduced quality of life as a result of dental problems (toothache kept awake at night) had consistently higher caries prevalence and severity than their counterparts who reported more favourable oral self-care, use of dental services and oral health impact on life experiences. This supports the findings of other investigations (20–25).

In summary, the dental items used in the NCNS were found to be clinically valid and reliable when tested on a child population. The findings suggest that self-report measures in future epidemiological investigations may be a convenient method of obtaining dental health information for children. This is of particular importance in countries where clinical oral health investigations are unable to be regularly conducted because of resource or other constraints, and may, in turn, help in the developing, testing and monitoring of oral health preventive programmes and encourage more appropriate distribution of oral health resources.

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