

## Scientific Research Report

## The Prevalence and Impact of Dental Anxiety Among Adult New Zealanders



Ishani Sukumaran, Shay Taylor, W. Murray Thomson\*

Sir John Walsh Research Institute, Faculty of Dentistry, The University of Otago, Dunedin, New Zealand

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**Objective:** To describe the prevalence and impact of dental anxiety in the New Zealand adult population.

**Methods:** Secondary analysis of data from the 2009 New Zealand national oral health survey. Dental anxiety was measured using the Dental Anxiety Scale (DAS).

**Results:** The prevalence of dental anxiety was 13.3% (95% CI = 11.4, 15.6). On average, DAS scores were higher by 14% among females, lower among those in the oldest age group (55+), higher by 10% among those in the European/Other ethnic category, and higher by 10% among those residing in the most deprived neighbourhoods. Those who were dentally anxious had greater oral disease experience and were less likely to have visited a dentist within the previous 12 months. They also had poorer oral health-related quality of life, with the highest prevalence of OHIP-14 impacts observed in dentally anxious 35- to 54-year-olds.

**Conclusions:** Dental anxiety is a dental public health problem. It is an important contributor to poor oral health and care avoidance among New Zealanders. There is a need to develop both clinical and population-level interventions aimed at reducing the condition's prevalence and impact.

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## Introduction

Dental anxiety is heightened fear or anxiety in the dental setting. It is a public health concern because it is relatively common and adversely affects the oral health of sufferers.<sup>1</sup> General population estimates for the prevalence of dental anxiety in developed countries range from 4% to 20%, with at least some of that variation because of differences in the scales that have been used.<sup>2</sup> People with dental anxiety tend to have more missing teeth, more untreated carious tooth surfaces, and poorer oral health-related quality of life (OHR-QoL).<sup>1,3–5</sup> It also contributes to a vicious cycle of dental avoidance, with dentally anxious individuals having poorer dental attendance and more appointment cancellations leading to poorer oral health.<sup>1,5–9</sup> This burden is more apparent in females and younger individuals.<sup>1,6,7</sup>

A number of dental anxiety scales are available,<sup>9</sup> with the Dental Anxiety Scale (or DAS)<sup>10</sup> and the modified Dental Anxiety Scale (MDAS)<sup>11</sup> having been most frequently used, despite

their limitations. The IDAF-4C (Index of Dental Anxiety and Fear scale) was designed to overcome the limitations of the earlier scale and is more theoretically robust,<sup>5</sup> but its use in dental anxiety research is not yet extensive.<sup>9</sup> The DAS and MDAS scales remain the most commonly used.

Through the longstanding Dunedin Multidisciplinary Health and Development Study (DMHDS), New Zealand has made important contributions to knowledge of the antecedents, natural history and consequences of dental anxiety,<sup>2,12</sup> but the findings of that study are limited to a single birth cohort. Understanding of the prevalence and associations of dental anxiety in the wider New Zealand population requires surveys of nationally representative samples. Despite the country having had three national oral health surveys to date,<sup>13–15</sup> none has yet reported on dental anxiety. Current knowledge has come largely from surveys of subnational samples. The prevalence of dental anxiety among South Island West Coast residents was estimated to be 20% two decades ago,<sup>16</sup> and a more recent survey conducted in Dunedin by Ibrahim and colleagues observed a similar prevalence.<sup>9</sup> Dental anxiety was more common among women in the latter study, but there were no apparent differences by education level or socioeconomic status. Dentally anxious individuals had less favourable dental visiting patterns. Use of the self-report approach meant that neither that study nor the West

\* Corresponding author. W. Murray Thomson, Sir John Walsh Research Institute, Faculty of Dentistry, The University of Otago, Dunedin, New Zealand.

E-mail address: [murray.thomson@otago.ac.nz](mailto:murray.thomson@otago.ac.nz) (W.M. Thomson).

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Coast one was able to examine the clinical associations of dental anxiety.

The 2009 New Zealand Oral Health Survey (NZOHS) gathered self-report and clinical oral health-related information from New Zealand adults, including data on dental anxiety,<sup>15</sup> but the dental anxiety data have yet to be reported (largely due to resource constraints). Contemporary knowledge of the condition's prevalence and associations is essential for enabling adjustment of dental care services so that they are responsive to the needs of the many thousands of people who are dentally anxious.<sup>9</sup> Accordingly, this study aimed to describe the prevalence and impact of dental anxiety in the New Zealand adult population.

## Methods

Oral health data in the 2009 New Zealand Oral Health Survey (NZOHS) were collected between February and December 2009. The sampling frame for the 2009 NZOHS was households which had taken part in an earlier national health survey, the 2006/07 New Zealand Health Survey (NZHS), which surveyed the usually resident civilian population of all ages living in permanent private dwellings in New Zealand (and also collected some self-report oral health data). Only households that had given permission to be re-contacted for future health-related surveys were included. Of the 12,488 adults who took part in the 2006/07 survey, 84% consented to recontact for subsequent surveys. Of those, 3,475 took part, and 2,209 of those participated in clinical dental examinations. The weighted response rate for adults was 70% for the interview and 84% for the dental examination (of those who participated in the interview). Because the 2009 survey used the sampling frame from the 2006/07 NZHS (that had an adult response rate of 68%), its effective response rate was 49% for the interview and 41% for the examination, but there was no evidence of any non-response bias in respect of the oral health variables collected in the 2006/07 NZHS.<sup>17</sup>

Computer-assisted face-to-face interviews and dental examinations were conducted. Interviews included questions about oral health status, risk and protective factors and the utilisation of oral health services. Dental anxiety was measured using Corah's Dental Anxiety Scale (DAS),<sup>10</sup> which seeks responses to four questionnaire items, which are then scored from 1 (least anxious) to 5 (most anxious). A scale score of 13 or higher is considered dentally anxious. The 14-item Oral Health Impact Profile (OHIP-14)<sup>18</sup> was used as a measure of OHRQoL. Neighbourhood deprivation was categorised using the New Zealand Index of Deprivation 2006 (NZDep2006),<sup>19</sup> participants were allocated to a deprivation quintile from 1 (least deprived) to 5 (most deprived).

Information on oral disease (particularly dental decay and periodontal disease) was recorded during clinical examinations conducted by dental examiners. The 2009 NZOHS clinical team comprised a lead examiner and 22 dental examiners, including a gold-standard examiner. All dentists (including the lead examiner and gold-standard examiner) were fully qualified and registered, and held current Annual Practising Certificates. In total, the dental examiners completed 2,209 examinations of adults aged 18 years or more.

Further information on the NZOHS design can be found in the Ministry of Health's 2009 Oral Health Survey Methodology report.<sup>17</sup>

The NZOHS received ethical approval from the NZ Health and Disability Multi-Region Ethics Committee. Further ethical approval was not required for this secondary analysis because the data gathered from the original survey were accessed under the Ministry of Health's established confidentialised unit record files (CURF) protocol.

## Statistical analyses

The statistical programme Stata (version 15.1) for Windows (Stata Corp, College Station, TX, USA) was used in these secondary data analyses. Survey data weights were used. After calculating DAS scores by summing the responses to the four items, we examined first the occurrence of dental anxiety and then the consequences of it. Cross-tabulations were used in describing its prevalence, and analysis of variance was used to examine the associations using the DAS scale as a continuous score (representing the 'severity' of dental anxiety). After examining the sociodemographic associations of dental anxiety (that is, the DAS score continuous variable) at the bivariate level, we modelled its prevalence using negative binomial regression. We then examined the clinical and dental service-use consequences of dental anxiety within three key age groups (18–34 years, 35–54 years and 55+ years). All estimates are presented with 95% CIs.

## Results

Analyses in this paper are limited to the 2,209 adult New Zealanders (aged 18 years or older) who underwent the clinical dental examination.

**Table 1** summarises the prevalence of dental anxiety by sociodemographic characteristics. Overall, just over one in eight New Zealanders were dentally anxious. Dental anxiety was more prevalent among females, 35- to 54-year-olds, non-Māori and non-Pacific people, those educated to secondary school level, and those residing in the most deprived areas. Individuals in the lowest deprivation quintile were more dentally anxious than those in the most deprived quintile. Mean DAS scores were higher in females, 18- to 54-year-olds and in non-Māori and non-Pacific peoples. There was also a gradient by deprivation level, whereby mean DAS scores were highest among those who resided in the most deprived areas.

**Table 2** presents the outcome of the multivariate model for the DAS score. On average, DAS scores were higher by 14% among females, lower among those in the oldest age group (55+), higher by 10% among those in the European/Other ethnic category, and higher by 10% among those residing in the most deprived neighbourhoods.

Data on dental caries experience and periodontal status are presented by dental anxiety status in **Table 3**. With the exception of mean coronal FT and DMFT in those aged 55 or more, those who were dentally anxious had greater disease experience.

**Table 1 – Dental anxiety prevalence and mean DAS scores, by sociodemographic characteristics (brackets contain 95% CI)**

	Population proportion	Dental anxiety	
		Prevalence	Mean DAS
Sex			
Male	47.8 (46.9, 48.7)	9.8 (7.2, 13.3)*	7.8 (7.5, 8.1)*
Female	52.2 (51.3, 53.1)	16.5 (13.7, 19.9)	8.9 (8.6, 9.2)
Age group			
18–34	30.0 (28.6, 31.4)	16.1 (11.7, 21.8)	8.6 (8.1, 9.2)*
35–54	42.6 (40.8, 44.5)	13.8 (10.7, 17.6)	8.6 (8.3, 9.0)
55+	27.4 (26.1, 28.7)	9.5 (7.0, 12.9)	7.7 (7.3, 8.0)
Ethnicity			
Māori	11.1 (10.7, 11.5)	12.8 (10.2, 16.0)	8.2 (7.9, 8.6)
Pacific	5.3 (5.1, 5.5)	12.4 (6.9, 21.1)	8.0 (7.3, 8.6)
Other	82.1 (79.9, 84.1)	14.3 (11.9, 17.0)*	8.5 (8.2, 8.7)*
Education level			
Primary	9.7 (8.3, 11.4)	13.2 (8.4, 20.2)	8.2 (7.7, 8.8)
Secondary	68.6 (66.1, 71.0)	13.4 (11.2, 15.8)	8.3 (8.1, 8.6)
University	21.7 (19.4, 24.2)	13.3 (9.2, 18.7)	8.6 (8.2, 9.0)
Deprivation quintile			
Lowest	21.2 (19.4, 23.1)	11.5 (7.8, 16.7)	8.2 (7.7, 8.7)*
Second	21.9 (20.1, 23.9)	13.2 (9.0, 19.0)	8.3 (7.8, 8.8)
Third	19.2 (17.4, 21.2)	13.2 (9.0, 19.0)	8.3 (7.9, 8.8)
Fourth	20.2 (18.4, 22.0)	12.8 (9.1, 17.9)	8.3 (7.8, 8.7)
Highest	17.5 (16.0, 19.2)	16.4 (11.6, 22.7)	8.8 (8.3, 9.4)
All combined	100.0 (–)	13.3 (11.4, 15.6)	8.4 (8.2, 8.6)

\* P &lt; 0.05.

Table 4 presents data on dental attendance patterns by dental anxiety. Dentally anxious individuals were less likely to have visited the dentist within the previous 12 months. With the exception of those in the 18–34 age group, a higher proportion of dentally anxious individuals were episodic visitors. People aged 35 years or older were more likely to be episodic visitors.

The prevalence of OHIP-14 impacts was greater among those who were dentally anxious. Among 18- to 34-year-olds,

**Table 3 – Dental caries experience and periodontal status by dental anxiety category and age group**

	Not anxious	Anxious
18–34 years		
Mean coronal DT	1.0 (0.7, 1.18)	1.6 (0.5, 2.8)
Mean MT	0.6 (0.4, 0.8)	0.8 (0.2, 1.3)
Mean coronal FT	3.7 (3.1, 4.2)	4.2 (3.0, 5.3)
Mean coronal DMFT	5.3 (4.5, 6.0)	6.6 (4.8, 8.3)
% with 1+ missing teeth	23.3 (17.8, 29.9)	23.9 (12.4, 41.1)
% with 3+ missing teeth	9.2 (6.0, 13.9)	13.5 (5.6, 29.2)
% with 1+ sites with 6 mm AL	0.1 (0.0, 0.1)	0.0 (0.0, 0.0)*
35–54 years		
Mean coronal DT	0.8 (0.6, 0.9)	1.2 (0.8, 1.6)*
Mean MT	3.5 (3.1, 3.9)	5.0 (3.8, 6.2)
Mean coronal FT	9.3 (8.7, 9.9)	9.6 (8.1, 11.0)
Mean coronal DMFT	13.6 (12.9, 14.2)	15.8 (14.3, 17.3)*
% with 1+ missing teeth	63.6 (59.1, 67.8)	76.0 (66.0, 83.7)*
% with 3+ missing teeth	47.9 (43.5, 52.4)	60.4 (48.0, 71.6)
% with 1+ sites with 6 mm AL	12.3 (9.8, 15.2)	14.2 (7.4, 25.5)
55+ years		
Mean coronal DT	0.6 (0.4, 0.7)	0.8 (0.4, 1.2)
Mean MT	10.1 (9.4, 10.9)	11.4 (8.2, 14.6)
Mean coronal FT	12.5 (11.7, 13.2)	10.1 (7.7, 12.6)
Mean coronal DMFT	23.1 (22.6, 23.7)	22.4 (20.5, 24.3)
% with 1+ missing teeth	98.4 (96.5, 99.3)	99.3 (94.7, 99.9)
% with 3+ missing teeth	90.9 (87.7, 93.4)	86.2 (57.1, 96.7)
% with 1+ sites with 6 mm AL	19.0 (14.9, 24.1)	28.6 (18.0, 42.1)

\* P &lt; 0.05.

it was 15.8% (95% CI=10.8, 22.5) and 17.8% (95% CI=8.4, 33.7), respectively, in dentally anxious individuals and those who were not. Among 35- to 54-year-olds, those estimates were 15.6% (95% CI=12.5, 19.3) and 30.5% (95% CI=20.2, 43.2), respectively; in those aged 55 years or older, they were 13.3% (95% CI=10.2, 17.1) and 15.5% (95% CI=7.0, 31.2), respectively. The highest prevalence of OHIP-14 impacts was observed in dentally anxious 35- to 54-year-olds.

## Discussion

This investigation of the prevalence of dental anxiety among New Zealand adults has found that 13.3% are affected, and the condition is more common among females, highly deprived groups, 18- to 54-year-olds, and non-Māori and non-Pacific peoples. Dentally anxious individuals also had greater disease experience, with the exception of mean coronal FT and DMFT in those aged 55 or more. With the exception of 18- to 34-year-olds, dentally anxious individuals were more likely to be episodic visitors and less likely to have sought dental care during the previous 12 months. Furthermore, those who were dentally anxious had higher OHRQoL scores, on average.

Before considering the findings, it is important to acknowledge the limitations of this study. The cross-sectional design of the 2009 NZOHS means that the time ordering of the observed associations between dental anxiety and oral health, dental attendance patterns and OHRQoL remains unclear. However, the time ordering of similar associations

**Table 2 – Negative binomial regression model for the DAS score**

	IRR* (95% CI)	P value
Female†	1.14 (1.08, 1.21)	<0.001
Age group‡		
35–54	0.99 (0.92, 1.07)	0.882
55+	0.88 (0.81, 0.95)	0.002
Ethnicity		
European/other	1.10 (1.04, 1.16)	<0.001
Māori	0.96 (0.91, 1.02)	0.233
Pasifika	0.95 (0.86, 1.04)	0.223
Deprivation quintile§		
Second	1.01 (0.93, 1.10)	0.792
Third	1.01 (0.94, 1.09)	0.798
Fourth	1.02 (0.94, 1.10)	0.649
Highest	1.10 (1.00, 1.20)	0.049

\* Incidence rate ratio.

† Reference category = Male.

‡ Reference category = 18–34 years.

§ Reference category = Least deprived quintile.

**Table 4 – Dental attendance patterns in dentally and non-dentally anxious New Zealanders, by age group**

	Not anxious	Anxious	Both
18–34 years			
Episodic visitor	58.3 (49.9, 66.2)	58.1 (43.6, 71.3)	58.3 (50.9, 65.2)
Within previous year*	43.4 (36.7, 50.4)	33.1 (20.3, 48.9)	41.7 (35.3, 48.4)
35–54 years			
Episodic visitor	61.1 (56.5, 65.6)	77.2 (66.0, 85.6)	63.3 (59.1, 67.4)
Within previous year*	52.4 (47.8, 57.0)	43.2 (31.2, 56.0)	51.1 (47.2, 55.1)
55+ years			
Episodic visitor	47.4 (42.3, 52.5)	61.4 (41.8, 77.9)	48.7 (43.7, 53.8)
Within previous year*	64.6 (58.8, 69.9) <sup>†</sup>	36.2 (21.8, 53.7) <sup>†</sup>	61.9 (56.6, 66.9)
All ages			
Episodic visitor	56.4 (52.8, 60.0)	67.2 (59.2, 74.3)	57.8 (54.6, 61.0)
Within previous year*	53.3 (49.8, 56.7)	38.2 (30.0, 47.1) <sup>†</sup>	51.3 (48.0, 54.5)

\* Dental visit made during the previous year.

<sup>†</sup>  $P < 0.05$ .

observed in the longitudinal Dunedin Multidisciplinary Health and Development Study was able to be clarified,<sup>12</sup> and those are likely to hold here. Data on dental anxiety were collected using Corah's DAS. This scale has a number of limitations, including no clear conceptual basis and non-mutually exclusive response categories.<sup>5</sup> However, moderate-to-high correlations have been identified between scores on the IDAF-4C and the DAS in a New Zealand population,<sup>9</sup> supporting assertions about the scale's likely validity and bolstering the accuracy of the current study's estimates for dental anxiety. To date, the DAS and the MDAS remain the most widely used measures for recording dental anxiety. The study data are also somewhat dated, but they remain the most recent generalisable estimates for the New Zealand population; the delay in reporting is due to funding constraints (we are conducting such secondary analyses without funding). Despite these limitations, this study has some strengths. Its large and representative sample, comprehensive clinical data and use of a gold-standard OHRQoL measure mean that it was well placed to examine the prevalence and associations of dental anxiety among New Zealanders.<sup>15</sup> It is also the first study to investigate associations between dental anxiety and OHRQoL in New Zealand.

The 13.3% population prevalence estimate for dental anxiety is a little lower than those from studies of subnational samples in New Zealand that have used the DAS. For example, the prevalence of dental anxiety observed in the West Coast region of New Zealand's South Island was 20.8%.<sup>16</sup> The Dunedin Multidisciplinary Health and Development Study observed a prevalence rate of 21.1% among 26-year-olds, and 18.4% for the same cohort by the age of 32 years.<sup>12</sup> A more recent cross-sectional survey of a representative sample of the Dunedin adult population found the prevalence of dental anxiety to be 18.6%.<sup>9</sup> It should be noted, though, that all of those estimates for younger adults fall within the confidence interval for the prevalence estimate for the 18- to 34-year-old age group in the current study, suggesting that our overall estimate is not atypical.

That DAS scores were higher among females and younger people is consistent with the Australasian and international literature. It is noteworthy, however, that those living in the most deprived neighbourhoods had higher DAS scores, on average. They are also the group with less favourable

utilisation of dental services and higher rates of the common oral conditions.<sup>15</sup> Efforts to reduce inequities in dental service-use and inequalities in oral health will need to also consider ways of alleviating the burden of dental anxiety among vulnerable groups.

Looking globally, our prevalence estimate is similar to those from other developed countries, such as France (13.5%) and Australia (14.9%), but higher than in Sweden (9.2%) and Denmark (10.2%), and lower than in Germany (17%).<sup>1,3,6–8</sup> An almost universal finding in the dental anxiety literature—also confirmed in our study—has been the greater prevalence of dental fear among women and younger individuals, and that dental anxiety is associated with episodic dental attendance.<sup>9,12</sup> Studies in other countries also found that dentally anxious people have more missing and decayed teeth and poorer OHRQoL.<sup>1,3,4,5</sup>

Considering that New Zealand's most prevalent chronic oral condition is dental caries, identifying and analysing aetiological features such as dental anxiety is vital to inform efforts to improve oral health, general well-being and quality of life.<sup>9,12</sup> The data reported here are the most recent we have, despite having been collected a decade ago. A more recent nationwide survey would allow for not only more current New Zealand dental anxiety data but also the ability to identify time trends in dental anxiety. This could offer further insight into ways of ameliorating the poor oral health and unpleasant dental care experiences of dentally anxious people.<sup>20</sup> Further research in this field would inform efforts to reduce barriers faced by dentally anxious individuals in accessing oral health care.

## Conclusion

Dental anxiety affects one in eight New Zealanders and has adverse effects on oral health status, dental attendance patterns and OHRQoL. Understanding associations with dental anxiety in New Zealand will assist the development of policies and services that improve accessibility to dental care. The current study findings should be useful for guiding dental practitioners towards identifying dentally anxious patients and providing them with appropriately supportive care.

## Conflict of interest

The authors do not have any competing interests. Access to the data used in this study was provided by Statistics New Zealand under conditions designed to keep individual information secure in accordance with requirements of the Statistics Act 1975. The opinions presented are those of the authors and do not necessarily represent an official view of Statistics New Zealand.

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