Who is dentally anxious? Concordance between measures of dental anxiety


Abstract - Studies of the prevalence of dental anxiety in general population samples have produced estimates which range from a low of 2.6% to a high of 20.4%. It is not clear whether these reflect real differences among populations or whether they are the result of the use of different measures and different cut-off points. We undertook a large scale mail survey of dental anxiety in a random sample of the adult population living in Metropolitan Toronto designed to assess the performance of and agreement between three measures. These were Corah's DAS, the single item used by Milgrom and colleagues in Seattle and the ten-point fear scale used by Gatchel. These measures and their published cut-off points produced prevalence estimates of 10.9%, 21.4% and 8.2% respectively. While there was a significant association between scores on pairs of measures the agreement between them was far from perfect. Kappa values ranged from 0.37 to 0.56, indicating only fair to moderate agreement beyond chance. There was evidence to indicate that the dentally anxious subjects identified by each measure differed according to certain behavioural and other characteristics. The results of the study suggest the need to revisit the issue of measurement in studies of dental anxiety.

Key words: dental anxiety; prevalence; measures

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Given the significance of dental anxiety (1-4), investigators have invested considerable effort in studies of its prevalence and etiology. In order to facilitate this work, many have developed measures or scales for the identification of dentally anxious subjects and assessment of their level of dental anxiety. These range from single item indicators such as those used by Milgrom et al. (1) and Gatchel (5), to more comprehensive multi-item scales such as the Dental Fear Survey (6) and the Structured Interview for Assessing Dental Fear (7).

While there are some advantages to having a number of measures and scales from which to choose, it also has its disadvantages. For example, estimates of the prevalence of dental anxiety based on these scales vary from a low of 2.6% (8) to a high of 20.4% (1). Consequently, since investigators have used different scales and measures and different cut-offs in identifying who is and is not dentally anxious, it is not clear whether these estimates reflect real differences among populations or whether they are methodological in origin.

Only a few investigators have compared the performance of different measures by using them in the same study. Hakeberg et al. (9), in study of the Swedish population, used the Dental Anxiety Scale and the Gatchel 10-point Fear Scale and found that the prevalence of high dental anxiety was 6.7% according to the former and 5.4% according to the latter. Vassend (10) also used the same measures and reported prevalence rates of 4.2% and 7.1% for a population of Norwegian adults. Moore et al (11) used Corah's Dental Anxiety Scale (DAS) (12), the single item used by Milgrom et al. (1) in the Seattle study, and the final item from the Dental Fear Survey (6). The prevalence of dental anxiety obtained by each measure was 10.2%, 9.7% and 10.3% respectively. Correlations between scores on pairs of these measures ranged from 0.68 to 0.78. Same subject analyses also indicated a close association between the measures. For example, 78% of subjects responding "terriﬁed" or "very afraid" to the Seattle item had DAS scores of 15 or more.

However, although these investigators assessed the level of agreement between these different measures in terms
of prevalence, none assessed the level of agreement in terms of cases. This is important because the statistical concepts of association and agreement are very different. Consequently, even when prevalence estimates are close, it is possible that these measures identify different individuals as being dentally anxious. If this is the case, then the prevalence of dental anxiety may be underestimated and the results of studies of such issues as etiology may differ according to which sub-set of the dentally anxious population is identified.

Accordingly, we included three commonly-used measures of dental anxiety in a large scale study of Canadian adults in order to assess their association and agreement. The aims of this paper are as follows: 1) to identify the extent of similarities and differences in estimates of the prevalence of dental anxiety produced by different measures; 2) to assess the degree of agreement between measures and 3) to determine if there are differences in the characteristics of dentally anxious subjects identified by each measure.

Methods
The target population for the study was all adults 18 years and over living in the City of Etobicoke, one of five municipalities which comprise Metropolitan Toronto. Census data for 1991 showed that the city contained 256,390 persons aged 18 years and over. The sampling frame was the list of registered voters covering the city. This list is compiled by a household enumeration process and, as a result, has been estimated by Statistics Canada to contain the name and address of 97% of those eligible to vote.

A two-stage random start systematic sampling procedure was used in which primary sampling units were polling sub-divisions and secondary units were named persons. The sampling fractions were selected to give a final sample of 6360 subjects.

Data were collected by means of a four wave-mail survey. The questionnaire used in the study was comprehensive and included sections on aversive experiences, dental anxiety, dental visiting behaviours, attitudes towards dentists and fear of pain. A complete version of the questionnaire was used in the first and third mailings (the second consisted of a reminder post-card), while the fourth mailing contained a shortened version of the questionnaire in the hope of stimulating a response from hard-core non respondents.

The three measures of dental anxiety used in the study were chosen because they have recently been employed in studies of North American populations and because they have clear-cut-off points for classifying subjects as dentally anxious or not. The first was Corah’s DAS, a four item measure giving rise to scores of 4 to 20. Subjects with scores of 13 or above are considered to be dentally anxious (13). The second was the single item from the Seattle study in which subjects are asked “How do you rate your feelings toward dental treatment”. The response options were as follows: not at all afraid (1), a little afraid (2), somewhat afraid (3), very afraid (4) and terrified (5). Subjects with response options 3 to 5 were considered to be dentally anxious. The third was Gatchel’s 10-point fear scale (5). Subjects were asked to rate their fear of dentistry on this scale in which 1 indicates no fear, 5 moderate fear and 10 extreme fear. Subjects scoring 8 to 10 were considered to be highly anxious about dental treatment.

Other measures included on the questionnaire were the Dental Fear Survey (6) which includes questions on anxiety-invoking stimuli and self-perceived physiological responses. Subjects were also asked about negative dental experiences in the form of treatment that was painful, frightening or embarrassing. Other questions addressed the fear of pain and whether or not subjects considered themselves generally anxious and fearful.

The relationships between the measures of dental anxiety were assessed using correlation coefficients, chi-square tests and one-way analysis of variance. Agreement between pairs of measures was assessed using the kappa statistic. This gives an indication of the extent of the agreement beyond that which would be expected by chance (14).

Results
Response and representativeness of subjects – Of 6360 mailed questionnaires, 1254 were returned by the Post Office and a further 45 were returned because the subject had died, leaving 5961 subjects presumed to be alive, living at the listed address and, therefore, eligible for the study. Completed questionnaires were returned by 3055 persons, giving a response rate of 60.4%. The long version of the questionnaire was completed by 2729 subjects and the short version by 326. This paper is based on data from the former.

A comparison of the sociodemographic characteristics of the subjects from whom complete data were obtained and the target population from which they were drawn showed that, while study subjects were broadly representative of the target population, males, persons less than 30 years of age and those with lower levels of educational attainment were under-sampled.

Prevalence of dental anxiety – Table 1 shows the percentage of subjects categorized as dentally anxious by each of the three measures. There was a three-fold difference in the prevalence rate according to the measure used. This varied from 8.2% for the Gatchel FS to 23.4% for the Seattle item. The DAS gave a prevalence of 10.9%.

Table 1 also shows that all three measures revealed significant differences in dental anxiety by gender with women having rates almost twice as high as men. The pattern according to age was also similar for the three measures with the oldest age group less likely to be anxious than the younger age groups. Of some interest was the fact that all three revealed that those aged 18 to 29 years had a rate lower than those aged 30 to 49 years.

Association between the three measures – The Spearman rank correlation coefficients between the three measures were all high and significant (P<0.001) as follows: DAS vs Seattle – 0.78; DAS vs Gatchel – 0.77; Seattle vs Gatchel – 0.74. These close associations between scores on the three measures were also revealed in analyses using one-way analysis of variance and the chi-square test. For each pair of measures the association was significant at the P<0.0001 level.

Agreement between the measures – Although the associations between the three measures were highly significant,
they were far from perfect. For example, 17.1% of those responding “terri-
fied” to the Seattle item had DAS scores of 12 or less and were not categorized
as anxious on this measure. Similarly, 22.2% of these subjects were not classified
dentally anxious but agreement was only fair to moderate (14)

Table 1. Prevalence of dental anxiety according to three measures

<table>
<thead>
<tr>
<th>DAS</th>
<th>Seattle</th>
<th>Gatchel</th>
</tr>
</thead>
<tbody>
<tr>
<td>All subjects:</td>
<td>10.9</td>
<td>23.4</td>
</tr>
<tr>
<td>Sex:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>7.3***</td>
<td>17.5****</td>
</tr>
<tr>
<td>Females</td>
<td>13.7</td>
<td>28.1</td>
</tr>
<tr>
<td>Age:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-29 years</td>
<td>10.1**</td>
<td>23.1***</td>
</tr>
<tr>
<td>30-49 years</td>
<td>13.3</td>
<td>26.2</td>
</tr>
<tr>
<td>50-69 years</td>
<td>9.5</td>
<td>23.7</td>
</tr>
<tr>
<td>70 years and over</td>
<td>7.5</td>
<td>14.9</td>
</tr>
</tbody>
</table>

*P<0.05; **P<0.01; ***P<0.001; ****P<0.0001

Table 2. Agreement between measures of dental anxiety (n’s only)

A. DAS with Seattle Item

<table>
<thead>
<tr>
<th>Seattle Item</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAS</td>
<td>255</td>
<td>35</td>
</tr>
<tr>
<td>No</td>
<td>366</td>
<td>2002</td>
</tr>
<tr>
<td>% agreement</td>
<td>84.9%</td>
<td>k = 0.48</td>
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</tbody>
</table>

B. Gatchel FS with Seattle Item

<table>
<thead>
<tr>
<th>Seattle Item</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gatchel FS</td>
<td>188</td>
<td>30</td>
</tr>
<tr>
<td>No</td>
<td>440</td>
<td>1991</td>
</tr>
<tr>
<td>% agreement</td>
<td>82.3%</td>
<td>k = 0.37</td>
</tr>
</tbody>
</table>

C. DAS with Gatchel FS

<table>
<thead>
<tr>
<th>Gatchel FS</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAS</td>
<td>150</td>
<td>138</td>
</tr>
<tr>
<td>No</td>
<td>62</td>
<td>2294</td>
</tr>
<tr>
<td>% agreement</td>
<td>92.4%</td>
<td>k = 0.56</td>
</tr>
</tbody>
</table>

Totals vary due to missing values on some measures

Discussion

When used with the same population, three commonly-used measures of den-
tal anxiety produced very different prevalence rates, ranging from 8.2% to
23.4%. While they varied widely, the rates produced by the individual mea-
sures were similar to those reported in previous studies of North American
populations. Gatchel’s (5) study of a random sample of adults in Dallas
found that 11.2% were dentally anxious and MILGROM et al. (1) reported a rate
of 20.4% in their Seattle survey of a sample of the general population. No
recent study of North American adults has used the DAS. However, Locker et
al (15) reported a rate of 8.4% for a sample of Canadians aged 50 years and
over. In this study, the rate for this age group was 9.0%. This suggests that each
measure produces fairly stable estimates when used across populations. An
interesting exception to this observation is to be found in a study by MOORE et
al. (11) conducted in Denmark. In their study, the Seattle item produced a
prevalence estimate 10.2%, only half the rates reported by MILGROM et al. (1)
and observed here.

There are two reasons why the rates obtained by the three measures differ by
such a wide margin. The most obvious concerns the cut-off points each mea-
sure uses to distinguish between those who are and are not dentally anxious.

The Gatchel fear scale uses the most...
stringent cut-off point and the Seattle item the most liberal. The former is then likely to include only the most severe cases while the latter probably includes those with both moderate and high levels of anxiety about dental treatment.

The second reason concerns differences in the explicit or implicit constructs underlying these measures. The wording of three of the DAS items reflects both feelings and physiological responses (16). LINDSAY & JACKSON (17) have argued that this wording means that the DAS may miss or underestimate the anxiety levels of individuals who do not respond physically to dental treatment. The construct underlying the Seattle item appears to be behavioural rather than physiological in terms of anxiety response. According to MILGROM et al. (1), individuals who report being "somewhat afraid" of dental treatment should be included in the high fear group since clinical experience indicates that these individuals show behavioural patterns, such as cancellation of dental visits or avoidance of dental care, typical of dentally anxious individuals.

Another interesting observation was that the agreement between the measures of dental anxiety was at best fair to moderate. This was to be expected when measures resulted in very different prevalence rates but it remained the case when measures producing broadly similar prevalence rates were compared. In this situation, the measures agreed on less than half the cases they identified.

In the absence of any "gold standard" against which the performance of the measures can be judged, this raises the question of who should be considered to be dentally anxious. Is it the 145 subjects so classified by all three measures or the 679 classified by at least one? The former gives a prevalence rate of 5.4% and the latter a rate of 25.6%.

As SCHUURS & HOOGSTRATEN (16) indicated in their review of dental anxiety scales, many of those used in epidemiological research are ad hoc in the sense that they are not explicitly linked to a conceptual construct or theoretical framework. Moreover, the validity of many measures has not been adequately assessed, perhaps because of the difficulty of identifying an external referent against which it may be tested. The issue of measurement in dental anxiety research may need to be revisited and consideration given to whether it is sufficient for an individual simply to report high levels of fear to be classified as dentally anxious or whether evidence in the form of behavioural, physiological or cognitive characteristics should be required as well. As LINDSAY & JACKSON (17) note, new questionnaires to measure dental anxiety and associated responses are needed which encompass new knowledge about contributing factors. Since dental anxiety is a continuum, where to place the cut-off point is a crucial issue in research which aims to compare subjects fearful of dentistry with those who are not.

We also attempted to assess if there were differences in the characteristics of the subjects identified as anxious by each of the measures. On some characteristics the groups were remarkably similar and on others, particularly behavioural and physiological responses, there were significant differences. At this point it is difficult to judge whether this is simply a reflection of differences in levels of severity of dental anxiety or whether it means that some measures identify qualitatively different subgroups of the dentally anxious population. Nevertheless, it does suggest that findings regarding dental anxiety, its etiology and its outcomes may be influenced by the measure used to identify dentally anxious subjects.

One immediate solution to the problems of measurement revealed in this paper is to use more than one measure.
of dental anxiety in each study and to look for corroborating evidence that those who say they are fearful of dental treatment indeed are. SCHUURS AND HOOGSTRATEN (16) recommend this approach because all dental anxiety measures and questionnaires have limitations and do not completely cover the concept. It would also aid in our understanding of dental anxiety if investigators were consistent in their use of measures and the cut-off points used to identify dentally anxious subjects. True variations in prevalence rates and associated characteristics across populations could then be identified which are currently masked by the use of different scales and indices.

References


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