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Research Article

Assessment of General Anxiety and Dental Anxiety in Low-Income Adult Dental Patients

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Abstract

One hundred million people in the US neglect needed dental visits because of dental-treatment-associated anxiety (dental anxiety). Our study aimed to assess whether there is a correlation between general anxiety and dental anxiety in low-income dental patients. For general anxiety and dental anxiety assessments, we used the State-Trait Anxiety Inventory with 40 questions (STAI-40) and the Dental Anxiety Scale Revised (DASR) questionnaires respectively. We surveyed 210 low-income dental patients. We correlated the general and dental anxiety levels with demographics, missed appointments, caries risk and patient's perception of the dental treatment to evaluate the impact of general anxiety and dental anxiety on patients' oral health. Female patients are more affected by anxiety than male patients. Asian-Americans are less anxious than white patients and there was no significant difference attributed to age regarding dental anxiety, but generally anxious patients were slightly younger than dentally anxious patients. Interestingly, we did not find any correlation between dental anxiety and caries risk and only a marginal positive association between dental anxiety and missed appointments. We concluded that general and dental anxiety are correlated conditions that mostly affect female low-income patients.

Introduction

Dental anxiety affects 20% of dental patients [1,2]. Dental patients who suffer from dental anxiety either prevent or often delay dental consultation [3]. Consequently, the eventual dental treatment becomes more urgent, costly, and difficult for dentists especially because of the anxiety-related patient behavior [3]. Dental anxiety is commonly triggered by anesthetic injections and the use of the drill during tooth preparations [4]. Additionally, dental anxious patients often report more pain than non-anxious patients [4]. However, several other factors have shown to be involved in dental anxiety, such as patient's previous dental experiences, dental treatment costs and satisfaction with one's mouth appearance [5,6]. Furthermore, dental anxiety is found more often in patients with low-educational levels, low-family income, and irregular dental appointment attendance patterns [7-10]. Patients suffering from high levels of dental anxiety are also more prone to phobias, depression, and mood disorders [10]. However, it is still unknown how dental anxiety is specific to the contextual elements of dental appointments or a secondary manifestation of a general anxiety state. Meanwhile, 30% of the US adult population suffers from general anxiety [11,12]. Despite the high prevalence of general anxiety and dental anxiety, dental adult clinics health questionnaires do not routinely include items to assess either patients' general or dental anxiety [10-12]. Therefore, because dentally anxious patients are not identified, dental anxiety is rarely and poorly addressed in routine dental care. Proper management of dental anxiety could immensely benefit anxious patients and dental care providers, promoting patients' attendance and compliance [13]. Addressing dental anxiety in routine dental appointments could potentially simplify future dental treatments [13-15].

At the University of Michigan School of Dentistry (UMSOD) adult clinics, the actual prevalence of anxious patients and related anxiety effects on oral health are still unknown. Considering the association between general and dental anxiety with poor oral hygiene and oral health status, and the large population of high caries risk patients in our clinics [16], we strongly believe we have a very high percentage of anxious patients in our adult clinics. Because the cost of dental care can increase dental anxiety, it seems very likely that more anxious dental patients would be found among the low-income population [5,6]. In this study, we propose to assess whether there is a relationship between general anxiety and dental anxiety in Medicaid and Affordable Care [17] insured dental patients. In this study, we will survey low-income dental patient population with access to dental insurance to establish the actual prevalence of anxious patients and the anxiety effects on oral health. The rationale for choosing low-income insured patients is to eliminate the bias of elevated anxiety levels due to the lack of proper dental insurance [18]. We aimed to investigate dental anxiety predictors that could help dental care practitioners identify patients who could benefit from dental anxiety management approaches more promptly in routine dental visits. To accomplish our objectives, we surveyed the Medicaid and Affordable Care [17] adult patients who received dental care at the UMSOD adult clinic about their levels of general and dental anxiety. We hypothesized that there is a positive correlation between general and dental anxiety in the studied population. We also hypothesized that dental anxiety is related to missed appointments and caries risk. Finally, we cogitate that patients' knowledge of dental treatments and patients' own oral health perception are correlated with dental anxiety levels. Therefore, patients' dental treatment knowledge and patients' own oral health perception may be considered as dental anxiety predictors. To evaluate the dental anxiety implications in oral health, we retrieved the frequency of missing appointments and the caries risk from the patients' electronic health charts.

Material and Methods

Subject Recruitment

The Institutional Review Board for the Medical Sciences (IRBMED) at the University of Michigan approved this study (#HUM00141024) based on the following methods. All Participants were randomly selected from the pool of adult insured dental patients who received dental care in the UMSOD adult clinics and were insured by either Medicaid or Affordable Care. Subjects were invited to review and sign the informed consent as approved by the IRBMED, and to participate in the



survey (QualtricsSM) through an invitation email.

From 2,400 patients, we obtained a sample of 210 responses who met our inclusion and exclusion criteria (Table 1). All subjects received a US\$5 gift-card upon completion of the survey.

Table 1: Exclusion and inclusion criteria.

Exclusion Criteria	Inclusion Criteria
≥ 18 years old	< 18 years old
Medicaid or Affordable Care dental insurance	Other dental insurances
Received dental treatment at the UMSOD in the period of 2017 to 2019	No dental treatment at the UMSOD in the period of 2017 to 2019

Survey

Invitation emails containing the informed consent and a survey link (QualtricsSM) were sent to the potential subjects. The survey included the STAI-40 questionnaire [19,20] and the DAS-R questionnaire [21,22] (Table 2), and the Patient’s Knowledge questionnaire created specifically for this study (Table 5). License to reproduce the STAI-40 questionnaire was obtained from www.mindgarden.com. All three surveys were expected to be answered in less than 10 minutes.

Table 2: Dental anxiety scale revised (DASR) questionnaire.

Items	Response Choices
1. If you had to go tomorrow for a dental check-up, how would feel about it?	a. Relaxed b. A little uneasy c. Tense d. Anxious e. So anxious that I sometimes break out in a sweat or almost feel physically sick.
2. When you are waiting in the dentist’s office for your turn in the chair, how do you feel?	
3. When you are in the dentist’s chair waiting while the dentist gets the drill ready to begin working on your teeth, how do you feel?	
4. Imagine you are in the dentist’s chair to have your teeth cleaned. While you are waiting and the dentist or hygienist is getting out the instruments, which will be used to scrape your teeth around the gums, how do you feel?	

The DAS-R questionnaire measures dental anxiety and consists of four questions that offers a set of five choices, with the scores ranging from one to five [22]. The level of patients’ dental anxiety is calculated by adding the scores to all four questions. The sum of the scores on this scale ranges from four to twenty (Table 3) with corresponding ratings that indicate the severity level of anxiety.

Table 3: DASR score interpretation.

DASR Scores	Anxiety Ratings
4-8	Low Anxiety-
9-12	Moderate Anxiety
13-14	High Anxiety
15-20	Severe Anxiety

The STAI-40 questionnaire is a standardized measure of general anxiety [19,20]. It consists of forty items, with twenty items allocated for state anxiety and twenty items for trait anxiety. For all forty items, the response choices are “not at all” (score one), “somewhat” (score two), “moderately so” (score three) and “very much so” (score four). Scores are reversed for the anxiety-absent items, and then added, resulting in total scores ranging from twenty to eighty [23]. The resulting score categories are described in Table 4.

Table 4: STAI scores interpretation.

STAI-40 Summary Scores	Provisional Diagnosis
20-29	Low Anxiety
30-39	Probable Anxiety Disorder
40-59	Moderate to Severe Anxiety
60-80	Severe Anxiety

Finally, we surveyed patients’ knowledge of their oral health and dental care received by their dental care provider (Table 5) by their responses to two items. We used a Likert response scale of 1 to 5, where score 1 equals to Strongly Disagree, 2 equals to Disagree, 3 equals to Neutral, 4 equals to Agree, and 5 equals to Strongly Agree (Table 5).

Table 5: Patients’ knowledge questionnaire.

1) I understand what my dentist explains to me about how he/she treats my teeth and mouth.				
1 Strongly disagree	2 Disagree	3 Neutral	4 Agree Strongly	5 Agree
2) I would like to know more about my teeth and my mouth health.				
1 Strongly disagree	2 Disagree	3 Neutral	4 Agree Strongly	5 Agree

Other Measures

The frequency of missed dental appointments and the caries risk assessment were retrieved from the patients’ electronic health charts. The caries risk assessment measures dental patients’ risk of developing new cavities [24-26]. Considering the American Dental Association (ADA) guidelines, the caries risk was assessed by oral hygiene, diet, saliva flow and recent presence of tooth decay [27]. Based on this classification, the dental patients are classified in high, moderate, and low caries risk. Caries risk and demographic variables related to age, gender and ethnicity were also taken from the electronic health charts from the subjects enrolled in this study.

Statistical Analysis

Sample size

A preliminary statistical power analysis was performed for sample size estimation, based on statistical findings and on dental and general anxiety data from previous published study [28,29]. The effect size of 0.80 (ES) in this study with (N = 210) is large [29]. With an alpha = 0.05 and power = 0.80, the projected sample size needed with this effect size was approximately N = 200. Our sample size of 210 is adequate to draw our conclusions.

Data analysis

To determine the relationship between general anxiety and dental anxiety, we used Pearson Correlation Coefficient (r) to calculate the two raw scores on these measures as well as their dental and general anxiety categorical scores (Tables 3 and 4). Additionally, we used a regression analysis to control for the effects of demographic attributes of our sample (age, gender, and ethnicity). We proceeded with the same statistical data analyses to assess the effect of dental anxiety with missing dental appointment frequency and caries risk. We also explored the relationship of patient’s knowledge as a predictor of dental anxiety comparing the percentage of the negative responses (disagree and strongly disagree) and positive responses (strongly agree and agree) between anxious and non-anxious dental patients. We use the statistical significance between the two groups (T-test p<0.05, 95% CI).

Results

Dental and general anxiety in our study population

In relation to dental anxiety, 46% of 210 subjects scored at a very low level of dental anxiety, 22.5% at a moderate level of dental anxiety, 10.5% at a high level of dental anxiety, and 21% at a severe level of dental anxiety. Therefore, a total of 31.5% of our



subject sample suffered from either high or severe levels of dental anxiety. In regard to general anxiety, we found that 33% of the subjects presented low to normal levels of general anxiety. However, 10% scored high enough to suggest the need of further evaluation for anxiety disorder, 29% presented moderate to severe anxiety levels and 28% presented severe anxiety. Therefore, 57% of our subjects suffered from either moderate and/or severe general anxiety (Table 6).

Table 6: Dental anxiety (DAS-R) and General Anxiety (STAI-6) questionnaire results.

Table with 2 columns: DASR score range and Number (%). Rows include Low dental anxiety (4-8), Moderate dental anxiety (9-12), High dental anxiety (13-14), Severe dental anxiety (15-20), Total respondents (210), STAI-40 score range, Low general anxiety (20-29), Low to probable anxiety disorder (30-39), Moderate to severe general anxiety (40-59), Severe general anxiety (60-80), Total respondents (210).

Relationship between dental and general anxiety

We found a moderate level of correlation between the scores of general anxiety and dental anxiety measured by STAI and DAS-R, with Pearson Correlation Coefficient r = 0.44, 95% confidence interval 0.32 – 0.54, p < 0.001. In addition, there was association between general anxiety levels as measured by the STAI-40 (very low, low to probable, moderate to severe and severe) and dental anxiety levels (low, moderate, high, and severe) as measured by the DAS-R. There are more patients with very low general anxiety and low dental anxiety and patients with severe general anxiety and severe dental anxiety than would be expected by chance. Similarly, there are fewer patients with severe anxiety and low dental anxiety than would be expected by chance with Fisher's exact test p-value < 0.001 (Table 7).

Table 7: Association between general anxiety and dental anxiety.

Table with 6 columns: Low Dental Anxiety (%), Moderate Dental Anxiety (%), High Dental Anxiety (%), Severe Dental Anxiety (%), Total (%). Rows include Very low General Anxiety (STAI < 20), Low General Anxiety (20 ≤ STAI ≤ 29), Probable General Anxiety Disorder (30 ≤ STAI ≤ 39), Moderate to Severe General Anxiety (40 ≤ STAI ≤ 59), Severe General Anxiety (60 ≤ STAI ≤ 80), Total (%).

Relationship between dental and general anxiety and demographic characteristics

We further investigated whether the association between general anxiety and dental anxiety was maintained when we accounted for race, gender, and age. From a total of 210 survey responses, we could only retrieve patient's gender information from 174 responses, with 90 females and 84 males. Interestingly, there was a significant relationship between gender and dental anxiety (Fisher's exact test p-value = 0.014). Dental anxiety was present in 58% (N=70) of the female subjects and 37% (N=20) of the male subjects. The mean age of the participants was 43.4 years old ranging from 12 to 93 years old. There was no significant difference attributed to age in regard to dental anxiety, although a trend was observed for generally anxious patients to be slightly younger than dentally anxious patients: 40.8 ± 15.3, non-dentally anxious 45.1 ± 19.1, two sample T-test (p = 0.10). When we correlated dental anxiety and general anxiety accounting for race, gender, and age, we also found a significant positive association as a 10-point increase in STAI-40 would result in an estimate effect of 0.7 increase in DAS-R (p<0.001). In addition, Asian-Americans are less anxious than White patients (p=0.014) (Table 8).

Table 8: Association between general and dental anxiety and demographic characteristics.

Table with 5 columns: Estimated effect, Lower limit of 95% confidence interval, Upper limit of 95% confidence interval, P-value. Rows include 10-point increase in STAI, African American vs White, Asian/Native Hawaiian/Pacific Islander vs White, Unknown/Other vs White, Male vs Female, 10 additional years of age, Constant.

Relationship between dental anxiety and missed appointments

We further explored whether the number of missed appointments was associated with dental anxiety still accounting to the demographic characteristics. We found a marginal positive association between dental anxiety and missed appointments as every 10-point increase in DAS-R resulted in an estimated effect of 0.3 additional missed appointments (30% additional missed appointments) (p=0.054). In addition, we found a significant negative but small association between age and missed appointments as every 10 additional years of age resulted in an estimated effect of 0.1 fewer missed appointments (p=0.006) (Table 9).

Table 9: Association between age and missed appointments.

	Estimated effect	Lower limit of 95% confidence interval	Upper limit of 95% confidence interval	P-value
10-point increase in DASR	0.3 additional missed appointments	0 additional missed appointments	0.7 additional missed appointments	0.054
African American vs White	0.6 additional missed appointments	0.2 fewer missed appointments	1.5 additional missed appointments	0.15
Asian/Native Hawaiian/Pacific Islander vs White	0.1 additional missed appointments	0.9 fewer missed appointments	1 additional missed appointment	0.87
Unknown/Other vs White	0.9 additional missed appointments	0.4 fewer missed appointments	2 additional missed appointments	0.16
Male vs Female	0.3 fewer missed appointments	0.7 fewer missed appointments	0.1 additional missed appointments	0.14
10 additional years of age	0.1 fewer missed appointments	0.2 fewer missed appointments	0.03 fewer missed appointments	0.006
Constant	0.8 missed appointments	0.2 missed appointments	1.3 missed appointments	0.009

Relationship between dental anxiety and caries risk

Still considering the demographics characteristics, we assessed caries risk and its correlation to dental anxiety. Caries risk assessment was available in only 99 subjects of our sample. Our results showed that there was not a significant relationship between caries risk and dental anxiety (Table 10) (Fisher’s exact test p-value 0.23) and just a marginal positive non-significant association between race and caries risk. However, there was a significant positive but small association between age and caries risk as 10 additional years of age resulted in an estimate of 0.1-point increase in caries risk (p=0.017). Consequently, as the subjects’ age increases the risk of caries went higher (Table 11).

Table 10: Caries risk and dental anxiety.

		Caries risk			
		Low	Moderate	High	Total
Dental anxiety	Yes	11 (26%)	10 (23%)	22 (51%)	43
	No	13 (23%)	22 (39%)	21 (38%)	56
	Total	24 (24%)	32 (32%)	43 (43%)	99

Table 11: Association between age and caries risk.

	Estimated effect	Lower limit of 95% confidence interval	Upper limit of 95% confidence interval	P-value
10-point increase in DASR	0.2 additional caries risk	0.01 less caries risk	0.5 additional caries risk	0.16
African American vs White	0.3 additional caries risk	0.1 less caries risk	0.8 additional caries risk	0.15
Asian/Native Hawaiian/Pacific Islander vs White	0.4 less caries risk	1 less caries risk	0.2 additional caries risk	0.18
Unknown/Other vs White	0.4 additional caries risk	0 more caries risk	0.9 additional caries risk	0.05
Male vs Female	0.1 less caries risk	0.5 less caries risk	0.3 additional caries risk	0.65
10 additional years of age	0.1 additional caries risk	0.02 additional caries risk	0.2 additional caries risk	0.017

Relationship between Dental Anxiety and Patient’s Perception

Most individuals in our surveyed patient population reported that they do not understand what their dentists explain to them. But surprisingly, patients who answered strongly disagree or disagree to “I understand what my dentist explains to me about how he/she treats my teeth and mouth” had significantly lower DAS-R scores (mean 9.5 ± sd 4.6) than patients who did strongly agree or agree (mean 13.3 ± sd 4.6, two-sample T-test p < 0.001). Patients who answer strongly disagree or disagree to “I would like to know more about my teeth and my mouth health” did not have significantly different DAS-R scores (mean 10.1 ± sd 4.8) than patients who strongly agreed or agreed to this same question (mean 9.8 ± 4.6, two-sample T-test p = 0.66).

Discussion

We proposed to survey low-income dental patients insured by either Medicaid or Affordable Care to assess general and dental anxiety levels. This study aimed to evaluate whether dental anxiety is specific to dental appointments’ context or a secondary manifestation of general anxiety states in low-income adult dental patients. Our results showed that there was moderate correlation between general anxiety measured by the STAI-40 questionnaire and dental anxiety measured by the DAS-R. In addition, there was significant positive relationship among anxiety levels between these two measures. Individuals with low general anxiety mainly presented with low dental anxiety and individuals with high general anxiety generally presented high dental anxiety. As previously observed [30-32], our results also showed female dental patients to be more affected by dental anxiety. Further analysis of our results showed association between anxiety and some demographic characteristic. Asian-Americans demonstrated lower anxiety levels than other races while female patients scored higher for anxiety than males. Interestingly, only a marginal association with missed appointments and anxiety was found. However, we have found a significant association between age and missed appointments, in which as patient’s age increases, we found fewer missed appointments. Similar results were previously described in the literature that showed that dental anxiety is more common in women, individuals with higher anxiety receive less regular care and anxiety decreases with age [30-32].



In our study, most patients reported that they do not understand the dentist's explanations about proposed treatments and dental procedures. But when analyzing patient's answers to our questionnaires, surprisingly, we found that dental anxious patients, more commonly than non-anxious dental patients, do understand their dentists' explanations about their dental treatment. We did not find any association between dental anxiety and patients' willingness of knowing more about their oral health. However, because dental anxiety is associated with lower income and educational levels [5,7], it is possible that the lack of knowledge and willingness to know more about oral health observed in our study is a consequence of our low-income sample population. Therefore, in this study we did not find any additional predictor of dental anxiety for low-income dental populations [4-9]. Considering the association between general anxiety and dental anxiety with poor dental care [5-9], we hypothesized that there was a high number of either general anxious and/or dental anxious patients in the UMSOD adult clinics than previously reported. Our results showed that this hypothesis was true. We identified 210 patients and more than half of them presented general or dental anxiety. It is important to point out that our study have only focused on patients covered by Medicaid and Affordable Care dental patients. Consequently, if we had extended the analysis to our whole patient population, the number of anxious patients presenting either general and/or dental anxiety may have been higher than what we found.

Our previous data show that the UMSOD adult clinics attract a large population of high caries risk patients [16]. More specifically, approximately 55% of our patients are classified as high caries risk [16]. However, our results did not demonstrate an association between general or dental anxiety and caries risk. It is possible that we could not find any association because only 99 individuals from our 210-cohort had caries risk assessments available in their charts. Thus, it is possible that a larger sample would show a positive correlation between dental anxiety, general anxiety, and caries risk. In this study, we also aimed to bring the awareness of the importance of incorporating anxiety questionnaires as part of the health questionnaire used in adult dental clinics. Dental anxiety management could help dental patients cope with their general anxiety and vice-versa. Moreover, this study can initiate future studies in dental adult clinics that aim to identify anxiety vulnerable populations, and to assess low-risk anxiety management approaches to manage anxiety [32-34] and improve oral health in low-income patients.

Conclusion

In summary, our results showed that general and dental anxiety are two correlated conditions in lower income insured dental patients.

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