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RESEARCH ARTICLE

Factors Influencing Dental Anxiety Using a Modified Dental Anxiety Scale (MDAS)

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Abstract

While multiple investigations show that dental treatments are associated with patient anxiety, the most relevant contributing factors to dental anxiety are not fully understood. This study explored the prevalence and causes of dental anxiety in patients from Northern Virginia USA. Participants (n=57) were given a survey that included demographic questions, a modified dental anxiety scale (MDAS, Cronbach's alpha = 0.908), and an opportunity to self-report the causes of their dental anxiety. Survey results were analyzed via an ANOVA using JASP software to determine the most significant factors contributing to dental treatment anxiety. A majority of patients (57.9%) reported some degree of dental anxiety, with many patients reporting high-anxiety (21.2%) and dental phobia (19.2%). In contrast to other studies, females only had slightly higher levels of dental anxiety compared to their male counterparts, scoring 1.67 points higher on the MDAS. Importantly, individuals that visit the dentist on a primarily emergency basis have significantly higher levels of dental anxiety compared to their counterparts ($p<0.0001$). This study suggests that regular dental visits are associated with decreased treatment anxiety and that clinicians should promote routine dental care alongside other anxiety reducing interventions as a way to minimize dental treatment anxiety

Keywords: Dentistry, Dental Anxiety, Modified Dental Anxiety Scale (MDAS), Dental Treatment Frequency.

1. Introduction

While improvements in care and pain management in dentistry have been significantly refined over time, patients still exhibit treatment-anxiety, often citing the intrusive procedures associated with their treatments as a cause for their anxiety (Deogade et al. 2016). Dental anxiety begins as early as the anticipation of the treatment and may result in anxiety associated behaviors that can exacerbate disease (e.g. bruxism). Dental anxiety, either moderate or severe, can cause patients to avoid important dental treatments. Treatment avoidance can lead to deteriorating dental health and symptom-driven dental appointments over preventative dental care. Visits for symptom-driven treatment often lead to more intense operations, such as root canals and crowns, potentiating more extensive treatments. According to a study conducted by the Cleveland Clinic, thirty-six percent of the adult population in the US has a generalized fear of dental treatment, with 3% of adults exhibiting "Dentophobia", a term described as having a specific fear of dentists, or dental related treatments. Kassem et al. (2021) reported that around 31.5% of patients suffered from dental anxiety, and 22.4% had dental phobia. Similarly, White et al. (2017) found that out of a participant pool of 308 individuals, 19% reported levels of moderate to high dental anxiety directly due to fear of dental experience, previous negative dental experience, cost of treatment, and fear of bad news.

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The efficacy of the MDAS has been widely accepted, displaying consistency and efficacy regarding the identification of dental anxiety (Humphris et al. 2000). The survey provides a simple way for patients to communicate how they feel regarding specific scenarios presented to them and allows for a quick and easy ranking system to help researchers and dentists identify how anxious their patients are at that time.

This research hones in on the ideology that dental anxiety exists in a global context and intends to expand on the lack of literature regarding anxiety prevalence in the Northern Virginia area. Similar studies about dental anxiety that focus on demographic factors have been conducted primarily in other countries around the world, as well as a few notable studies in other cities in the US. This study mainly focuses on a highly diverse population in Northern Virginia and uncovering the true prevalence of dental anxiety in the area.

This study aims to help clinicians identify anxiety within their patient body on a broader scale, as well as educate practitioners on how dental anxiety may develop in their patients. This study aims to evaluate three main subjects: the prevalence of dental anxiety amongst the Northern Virginia population, identify the root cause of said dental anxiety, as well as assess how dental anxiety is linked to age, sex, educational status, race, and socio-economic status.

Suppose random individuals take the MDAS survey at their dental appointments in Northern Virginia. In that case, it is hypothesized that individuals from lower socioeconomic backgrounds, female, younger, and lower educated individuals, will present with higher levels of dental anxiety compared to their associated counterparts.

2. Methods

This study was conducted in Northern Virginia and designed to assess levels of dental anxiety prevalence in the local population and correlate results with demographic information. After checking into each practice, patients were given a QR code to complete the survey virtually. All participants were informed regarding the confidentiality of their answers, and anonymity was ensured. The inclusion criteria for the study ensured patients participating were over 18 and consented to release demographic information. Exclusion criteria were individuals under the age of 18 or did not consent.

The survey consisted of two sections: demographic information (age, sex, ethnicity, education level, marital status, and average household income) and data about dental visit frequency (every six months, yearly, or only on an emergency basis). The second section included the Modified Dental Anxiety Scale (MDAS), initially developed at the University of St. Andrews by Professor Gerry Humphris in 1995. It was based on Corah'sdental anxiety scale, and Dr. Humphris made some improvements and changes to the original, creating the MDAS. (Humphris et al. 2000) This scale includes five multiple-choice questions that focus on identifying the patient's level of dental anxiety regarding five scenarios.

1. How would you feel if you went to your Dentist for treatment tomorrow?

2. How would you feel if you were sitting in the waiting room (waiting for treatment)?

3.How would you feel if you were about to have a tooth drilled?

4.How would you feel if you were about to have your teeth scaled and polished?

5.If you were about to have a local anesthetic injection in your gum above your upper back tooth, how would you feel?

Possible answers for each question can range from 1, "not anxious," to 5, "extremely anxious." After completing the questionnaire, scores are summed up and may vary from 5-25. Scores of 11 or higher indicate some level of dental anxiety, scores between 11-14 indicate moderate dental anxiety, and scores 15-19 indicate high levels of dental anxiety. Scores of 19 or above are indicative of severe levels of dental anxiety and possible dentophobia. At the end of the MDAS, a check-the-box/free response style question was included, asking where the patient's dental anxiety stemmed from. Answers have traumatic previous dental experience, history of generalized anxiety, lack of empathy from practitioners, fear of pain, or "other" as a free response answer.

2.1 Validation of the Modified Dental Anxiety Scale

The validity of the modified dental anxiety scale (MDAS) was assessed in a study published by Wang et al., who determined that there was a significant correlation between the MDAS and the index of dental anxiety and fear (IDAF-4C), another method of assessing dental anxiety. Still, with more questions, the MDAS is more concise. (Chia-Shu et al. 2021) The MDAS was significantly correlated to the IDAF-4C, with a p-value less than 0.001. Each of the five

questions and their associated scores were also strongly correlated with the results from the IDAF-4C.[13] This study tested for discrimination and construct validity with the two-tailed Mann-Whitney test, which can be used instead of an unpaired T-test, assessing that two samples could have come from the same population. (Chia-Shu et al. 2021) These questions from the MDAS will include a ranking of 1: not anxious, all the way up to 5: extremely anxious. According to research and validation claims, the MDAS should be sufficient to determine the prevalence of dental anxiety. The cutoff values of the MDAS are 13, 15, and 19, indicating dental anxiety, high dental anxiety, and severe dental anxiety, respectively.

2.2 Statistical Analysis

Data was analyzed using JASP 0.17.1.0. Means and standard deviations were calculated across various demographic factors and MDAS scores. Percentiles were assigned to each age, socioeconomic status, gender, and education level. The threshold set to the MDAS indicating severe dental anxiety was 19, indicating healthcare practitioners should pursue additional/more intensive approaches to alleviating severe dental phobias, such as pharmacological intervention or relaxation. The proportion of individuals who scored 19 or above was calculated and associated with various demographic factors. ANOVAs were utilized to analyze the means of MDAS scores with various demographic factors such as age, sex, educational background, socioeconomic status, and race.

3. Results

3.1 Demographic Information

This study consisted of participants from two dental practices in the Northern Virginia Area. Each age group (18-39, 40-59, and 60-99) consisted of 57 participants with a mean age of 51.5 (SD = 11.176), ranging from 18 years of age to 68 years of age. Most participants (82.45%) were identified in the 50-59 age range. of the 57 participants, 71.93% (41) of the respondent population was female, with 28.07% (16) being male. of all participants, 57% completed their Bachelor's Degree at an accredited university. The Shapiro-Wilk value was 0.957, indicating that the data and scores for the MDAS were normally distributed.

According to the MDAS scores collected, 17.5% of individuals were dentally anxious (≥13), 21.2% of individuals were highly anxious (≥15), and 19.2% of individuals were exceptionally dentally anxious/ dental phobic (≥19). Cronbach's alpha for the MDAS was 0.908, indicating a high level of internal consistency for this specific study and set of questions. Upon analysis, we found that questions 3 and 5 – about drilling on teeth and receiving an anesthetic injection, received significantly higher score averages regarding the patient dental anxiety than questions 1, 2, and 4. According to the MDAS results, 33 out of 57 participants (57.89%) identified as at least dentally anxious.

Differences in MDAS scores between males and females were not statistically significant, although females did identify slightly higher with an average score of 13.78, indicating dentally anxious. Regarding education level, it was found that individuals who received a high school education and postgraduate education had higher MDAS scores compared to the other educational categories, with average scores of 16 and 15.5, respectively. Although there were noted differences, there was no statistically significant difference between the educational background groups and their dental anxiety ($p = 0.591$). Marital status did not seem to be a strong indicator of dental anxiety, indicating no statistically significant difference

($p = 0.915$). No statistically significant differences existed between household income brackets ($p = 0.584$). However, individuals in middle and upper socioeconomic status did have higher dental anxiety, with scores around the 13 range indicating moderate dental anxiety. After analysis of how often patients visited the dentist, it was observed that patients who only see the dentist on an emergency basis experience significantly higher levels of dental anxiety, with scores averaging around 22.8, or extremely dentallyanxious ($p = 0.001$)

Tab1e 1. *Modified Dental Anxiety Scale and Demographic ANOVA*

	N	%	Mean	SD	F	p	% ≥ 19
Total	57	100	13.52				19.29
Sex					0.346	0.559	
Female	41	71.93	13.78	5.346			17.07
Male	16	28.07	12.11	4.884			18.75

Age Bracket					6.919	0.002	
18-39	4	7.018	9.00	1.826			0
40-59	47	82.456	14.59	5.025			100
60-99	6	10.526	8.16	2.483			0
Education Level					0.707	0.591	
High School	5	8.77	16.00	5.339			20.0
Associate	7	12.28	12.143	5.429			14.28
Some College	6	10.52	14.00	5.367			33.33
Bachelor's	33	57.89	13.00	5.403			12.12
Post Grad	6	10.52	15.500	3.564			16.67
Marital Status					0.012	0.915	
Yes	36	63.16	13.583	5.173			16.67
No	21	36.84	13.429	5.353			23.81
Household Income					0.543	0.584	
<52,000	4	7	11.00	6.218			25.00
52-156,000	30	52.63	13.95	4.685			16.67
> 156,000	23	40.35	13.53	5.513			21.74
How often do you visit the dentist					7.474	0.001	
Bi-Annual	39	68.42	12.615	4.626			10.26
Yearly	13	22.80	13.308	5.407			15.38
Emergency	5	8.77	21.20	2.168			100

This chart depicts an ANOVA utilized to identify the mean difference between anxiety scores in different sex, age brackets, education levels, marital status, household income, and how often the respondent visited the dentist. There was no statistically significant difference in identifying dental anxiety differences between sex ($p = 0.559$), education level ($p = 0.591$), household income ($p = 0.584$), and marital status ($p = 0.915$). Age and how often the participant visited the dentist displayed statistically significant differences, with p-values of 0.002 and 0.001, respectively.

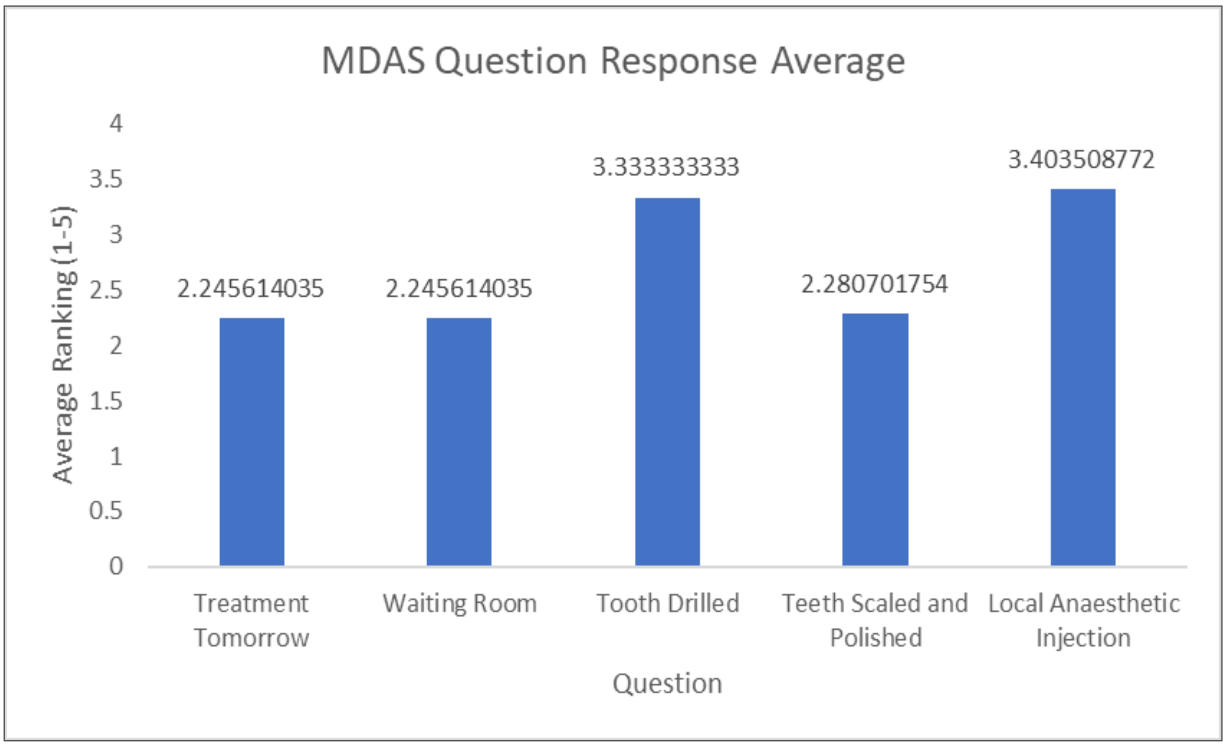

Figure 1. *Modified Dental Anxiety Scale Averages.*

This chart depicts the average response scores for each MDAS question. Question 3, regarding "getting a tooth drilled," and Question 5, regarding "receiving a local anesthetic injection," had notably higher average scores, 3.3 and 3.4, respectively.

The MDAS question response averages demonstrated that participants were significantly more anxious toward questions 3 and 5, as indicated in Figure1. Question 3 states, "If you were about to have a tooth drilled, how would you feel?". The average ranking for this question was 3.3 out of 5, indicating a moderate amount of dental anxiety. Question 5 also exhibited higher average responses, scoring 3.4 out of 5. This question states, "If you were about to have a local anesthetic injection in your gum, above your upper back tooth, how would you feel?" indicating that the participant base has an increased level of dental anxiety toward needles. Figure 2 displays the distribution of answers, with questions 1, 2, and 4 displaying significant skews to the left, indicating the participant pool trends toward being less anxious in these scenarios. The distribution of questions 3 and 5 indicates more scores ranging from 3 to 5, which shows more dental anxiety associated with these questions.

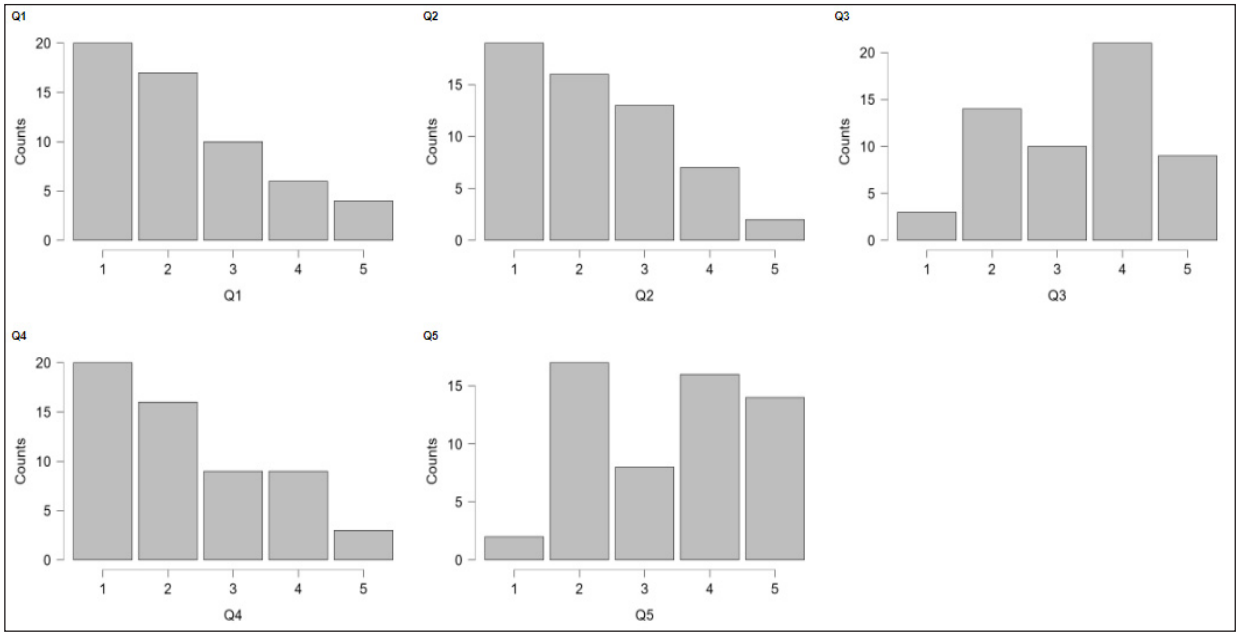

Figure 2. *Modified Dental Anxiety Scale Trends*

The distribution of each question on the Modified Dental Anxiety Scale displays the scoring values, 1-5 on the x-axis and the number of responses on the y-axis. Questions 1, 2, and 4 are skewed to the left. Question 3 is skewed to the right. Question 5 indicates a slightly divergent pattern but displays participants responding with higher anxiety scores.

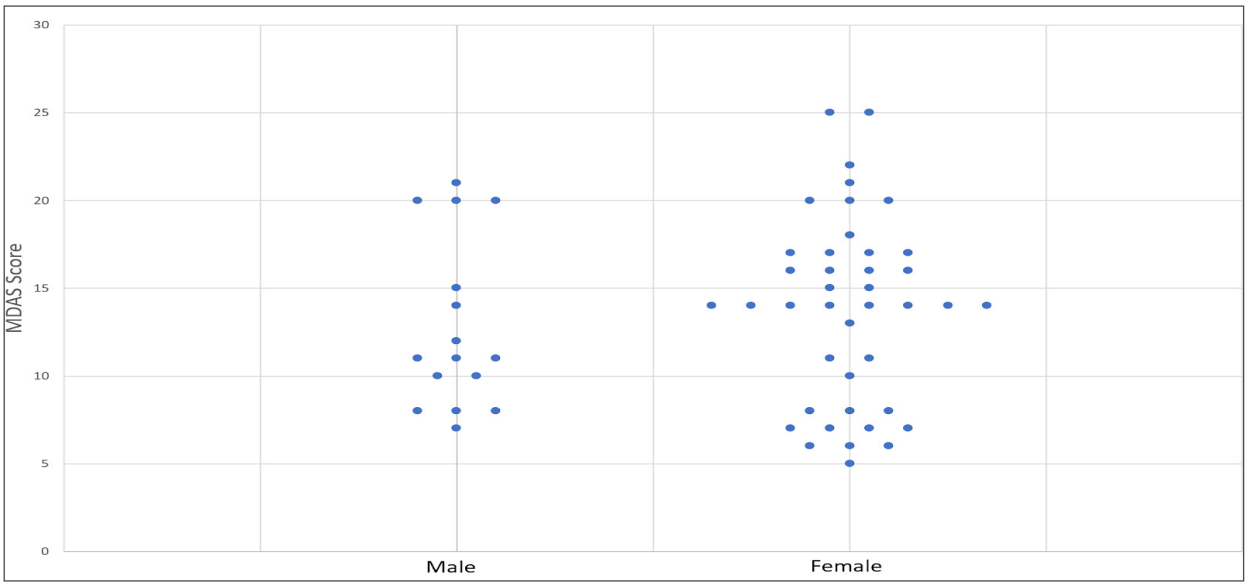

Figure 3: *Modified Dental Anxiety Scores Overall*

This graph depicts the results for each participant and their respective MDAS scores. Results are separated between males and females. The range in MDAS scores for the males was 14, whereas females displayed a range of 20, indicating a more diverse response pool on the female side. The results also suggest that roughly 57% of participants are dentally anxious according to the MDAS cutoff of 13.

The entirety of the participant pool is displayed in Figure 3, separating the participants between males and females. Out of the 56 total respondents, both the highest and lowest dental anxiety scores were associated with the Female sex, 5 (no dental anxiety) and 25 (severe dental anxiety/dental phobia). This graph also helps visualize the fact that all scores reported at 25, indicating severe dental anxiety/dental phobia, were female respondents.

The range of MDAS scores between males and females was different, with males having a range of scores between 7 and 21 and females having a range between 5 and 25.

Table 2. *Where did Participant's Dental Anxiety Stem From?*

Traumatic Previous Dental Experience	17 (29.3%)
History of Generalized Anxiety	7 (12.1%)
Lack of Empathy from Practitioner	6 (10.3%)
Fear of Pain	17 (29.3%)
N/A	12 (20.7%)

This figure depicts the percentages associated with the last question for this study, asking about where the patient's dental anxiety stemmed from. It was determined that traumatic previous dental experiences and fear of pain were the leading perceived causes of dental anxiety.

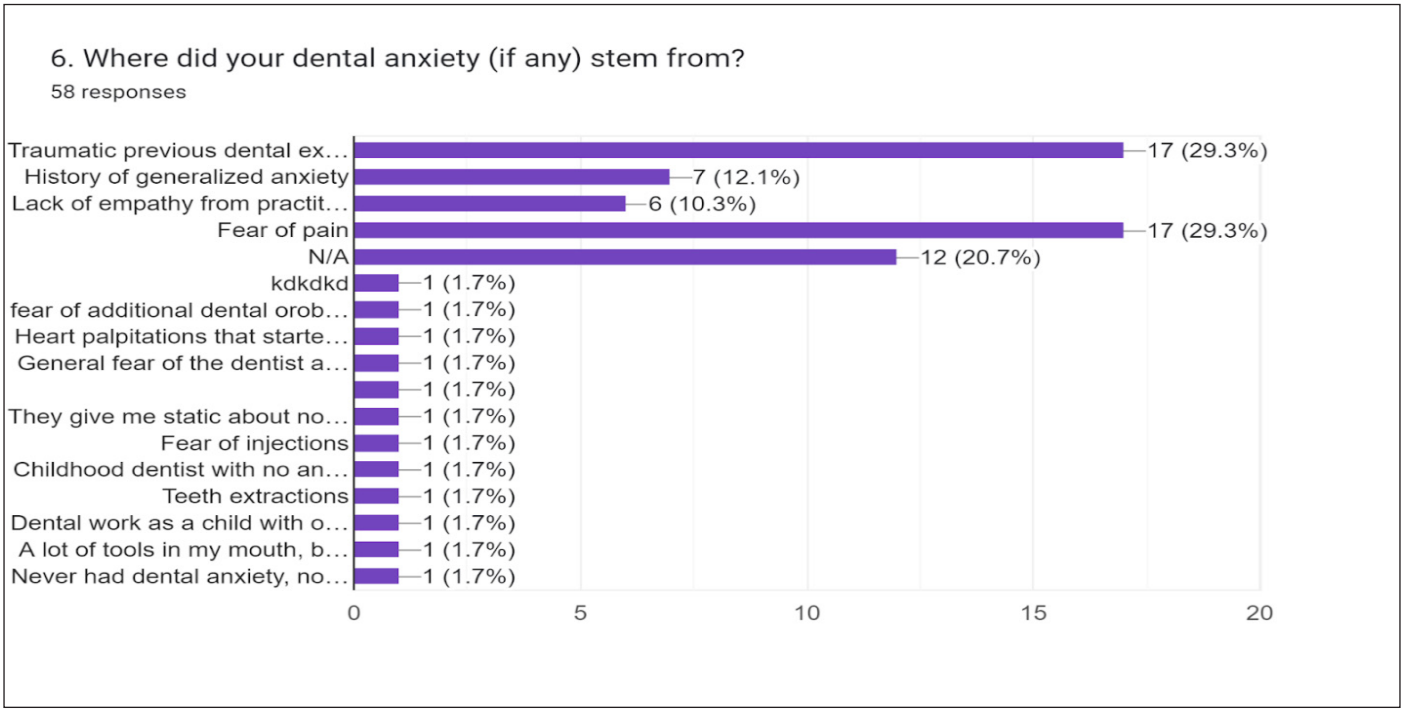

Figure 4. *Dental Anxiety Association Scores*

This figure depicts participants' responses to a prompt regarding where their dental anxiety stemmed from. The two highest recorded responses were fear of pain and traumatic previous dental experience, with 29.3% each. Responses included previous traumatic dental experience, history of generalized anxiety, lack of empathy from practitioners, fear of pain, and an optional free-response question.

In the last question, participants were asked about where their dental anxiety stemmed from. Participants were provided answer choices in a check-the-box style format, with options including Traumatic previous dental experience, history of generalized anxiety, lack of empathy from practitioners, fear of pain, N/A, or a free response question. It was determined that 29.3% of participants associated their dental anxiety with traumatic previous dental experience. Additionally, another 29.3% of participants included fear of pain as one of the root causes of their dental anxiety. The free response question yielded a wide variety of responses, including the fear of extractions, having a lot of tools in the individual's mouth, or having a childhood dentist who would never use anesthetic.

4. Discussion

4.1 Major Findings of the Study

This study was conducted on the adult population of Northern Virginia due to the lack of data and research revolving around dental anxiety in the area. The study itself displayed adequate validity compared to

other studies, and internal consistency regarding the MDAS questionnaire. This study sought to identify the prevalence of dental anxiety in the Northern Virginia population to create a practical reference for practitioners and prospective dental students to utilize when thinking about living and practicing in the area. The participant pool surveyed exhibited an average MDAS score of 13.52, with 57.89% of participants identifying as, at the very least, dentally anxious. It was additionally determined that behavioral factors associated with the frequency of going to the dentist were indicative of the level of dental anxiety the patient has, with patients who visited the dentist only on an emergency basis experiencing much higher levels of dental anxiety, averaging an MDAS score of 21.2. Additionally, it was found that traumatic previous dental experience and a fear of pain were associated with the participant's perceived presence of dental anxiety, with these two answers accounting for 58.6% of the responses to the "Where did your dental anxiety stem from" question. In addition, factors such as history of generalized anxiety and lack of empathy with practitioners were also associated with the participant's perceived presence of dental anxiety. These findings support the argument that dentists and healthcare workers need to acknowledge and develop strategies to help mitigate or treat dental anxiety.

4.2 Differences in Sex and Dental Anxiety

The study consisted of 41 female and 16 male respondents. Upon review of the literature, some studies report that females have higher rates of dental anxiety compared to their male counterparts, yet others indicate that there is no statistically significant difference between the two regarding levels of their dental anxiety. (Kassem et al. 2021) (Karibe et al. 2019) Stereotypically, women have been viewed as more emotional individuals who are more willing to voice their opinions, emotions, and beliefs more prominently than their male counterparts, who are stereotypically more reserved in their opinions and emotional displays. Heft et al. reported that women were significantly more likely to report dental fear, fear of dental pain, and specific fear of dental pain compared to their male counterparts. (Heft et al. 2019) In this study, there was no statistically significant difference found between men and women regarding their levels of dental anxiety. Males scored an average of 12.11 on the MDAS, whereas females scored 13.78. The p-value associated with this comparison was 0.559, which was not statistically significant. The highest MDAS score reported for men for this study was 21, whereas two female participants scored the maximum at 25, indicating severe dental phobia. While females scored higher on the MDAS than men, the sample size did not suggest that these results were statistically significant. A more accurate relationship would have been displayed if the sample size was significantly larger

4.3 Dental Anxiety and Appointment Attendance

The results discovered in this study are consistent with the findings that individuals with higher levels of dental fear and/or anxiety often visit the dentist less frequently, experience longer periods between visits, and have higher dental fear associated with the perception of getting extreme dental treatment. (Armfield et al. 2017) Patients who visit the dentist only on an emergency basis often experience more intense procedures due to the lack of preventative treatment in their past medical history. When they do attend visits, it's usually to relieve pain of issues that are too far gone and require invasive procedures. (White et al. 2017) (Armfield et al. 2007) (Thomson et al. 1996) Most individuals who participated in the study followed doctor's recommendations, scheduling and attending dental appointments once or twice a year. Thirty-nine participants revealed they visit the dentist on a bi-annual basis, while 13 participants revealed they visit the dentist on a yearly basis. Out of all 57 participants, five respondents indicated that they only visit the dentist on an emergency basis, but out of all 5 of those participants, 100% of them scored higher than a 19 on the MDAS. It was found that individuals with higher levels of dental anxiety demonstrated avoidance of dental care or visits on an emergency basis, leading to poorer oral health outcomes. (Nermo et al. 2021) Avoiding the dentist due to dental anxiety and fear is an issue in the United States that is not receiving enough recognition. Patients avoiding the dentist and only going in to receive emergency care can lead to more complex treatment and painful operations, nourishing the root problem cycle of dental anxiety. (betterhealth.gov) Attending the dentist on a routine basis allows for the practitioners to complete preventative care such as X-rays and cleaning, which allows for dentists to assess issues before they manifest such as periodontal disease and oral cancer. (betterhealth.gov) While the previously stated points seem like a logical reason to come to the dentist, individuals still put off treatment, for around 3% of individuals in industrialized countries avoid going to the dentist overall. (Cleveland Clinic) The question is, how do we, as dentists, dental workers,

and prospective dentists, create an effective strategy for reaching these patients if they don't show up in the first place? Strategies such as effective marketing and advertising could be a solution to help plant the seed in your prospective patient's minds that they need to come to see you. Messages that could be utilized on billboards or online ads can include statements such as "We are part of your community,"; "We can help you"; "We have new technology that enhances comfort and reduces noises"; "We offer sedation dentistry"; We can help you find an affordable payment plan". (dentaleconomics.com) While marketing strategies are often associated with selling products and seeking monetary gain, in the realm of dentistry and reaching the patients who avoid you due to fear, this strategy can provide an effective way to reach individuals who avoid you.

4.4 Age and Dental Anxiety

When it comes to age differences in dental anxiety, a study conducted by Mohammed et al. in India found that age was significantly related to the prevalence of dental anxiety. (Mohammed et al. 2014) They found that the anxiety levels of younger age groups (15 to 25 and 25 to 35) were significantly higher compared to the older age group (above 55), as well as individuals between 55 and 65 had significantly lower dental anxiety scores compared to the other age groups. The findings from Mohammed et al. do not necessarily align with the results of this study but display the disparities in dental anxiety and age worldwide. In this study, the participants between the age of 40 and 59 displayed significantly higher levels of dental anxiety compared to their older and younger counterparts (18-39 and 60-90), respectively. Individuals between the ages of 40 and 59 displayed an average MDAS score of 14.59, whereas individuals between 18 and 39 had an average MDAS score of 7.018. Additionally, individuals between the ages of 60 and 99 demonstrated an average MDAS score of 9.00. While these results were significant, the sample size for this study was predominantly individuals between the ages of 40 and 59, with 82.45% of the sample size being associated with this age bracket. While these results were determined to be statistically significant, if the study received more participants from the lower and higher age group population of the Northern Virginia area, we will achieved a better understanding of the prevalence of dental anxiety amongst older and younger populations.

4.5 Education Level and Associated Dental Anxiety

Education level plays an incredibly important role in dealing with and understanding dental anxiety. Research has shown that usually, individuals with higher levels of education experience lower levels of dental anxiety comparative to their lesser educated counterparts.[4] In other studies, it was determined that individuals with higher education levels had significantly higher dental anxiety compared to their lower education counterparts.(Stouthard et al. 1990) (Nithya et al. 2018) While this study did not show statistically significant trends regarding education level and dental anxiety, it somewhat agrees with what current studies are showing, in that different areas with different and diverse levels of education can display contrary dental anxiety prevalence. Individuals who have higher levels of dental anxiety and have higher levels of education could experience this due to an increased understanding of the procedures they are about to undergo. In contrast, on the flip side, individuals with lower levels of education could experience higher levels. In comparison, dental anxiety is due to a lack of understanding of the processes and operations they are about to undergo. Future research could focus on the significant factors related to education level and attitude towards dental anxiety, for this topic deserves more attention, for the research and data present today are muddled.

4.6 Household Income and Dental Anxiety Prevalence

Average household income or socioeconomic status has been a known influence on dental anxiety in recent years, for the amount of money an individual has usually determines whether they can afford dental treatment. Many individuals cannot afford healthcare and dental care in the United States. In 2015, it was found that 29% of the overall population and 62% of the older adult population did not have dental insurance, insinuating they do not routinely seek out dental treatment. (CDC.gov 2021) Additionally, traditional Medicare does not cover routine dental appointments. Therefore, individuals with this federal health insurance style rarely seek care. (CDC.gov 2021) The average household income in the Northern Virginia area is estimated to be around $132,128, compared to a national average of $74,580. That being said, the diversity in household income in Northern Virginia in this specific study was ample, with 52.63% of the respondents showing up in the $52-156,000 range and 40.35% indicating their average household income was above $156,000. The average MDAS scores between the groups were interestingly close, with the $52-156,000 group averaging 13.95 on their survey and respondents averaging more than $156,000 averaging 13.53 on their MDAS. Interestingly

enough, individuals making below $52,000 were seen with lower average MDAS scores, averaging at an 11, but they only accounted for 7% of the sample size. The results of this study are quite contradictory to the study conducted by Muneer et al., for they indicated that 76% of individuals of lower socioeconomic status were associated with higher levels of dental anxiety. (Muneer et al. 2022)

4.7 Dental Anxiety's Root Cause in Participants and How it Impacts Oral Health

Dental anxiety is a burden that can be cast on its victim for a variety of reasons, either stemming from the pain being brought upon them or simply bad experiences with a dental practitioner. In this study, a cluster of possible reasons for the manifestation of dental anxiety were presented to the participants. They included traumatic previous dental experience, a history of generalized anxiety, a lack of empathy from practitioners, a fear of pain, and an optional free response/fill-in-the-blank response option. (Armfield et al. 2007) (Nithya et al. 2018) (Saatchi et al. 2015) These points were pulled from many studies that sought to achieve the same goal as this study: to identify the prevalence of dental anxiety in their given region. Having a history of generalized anxiety or a history of head and neck trauma has often been associated with patients who have dental anxiety, for they associate the pain of operations and injections with previous trauma they have undergone. (betterhealth.gov) The association of traumatic past experiences or lack of empathy from practitioners can go hand in hand, for individuals who have had poor experiences with past dental procedures often lose faith in the profession, leading to mistrust and fear. A study conducted by Nermo et al. found that individuals with higher levels of dental anxiety often reported more prevalent mental health symptoms, as well as the presence of traumatic experiences being indicative of whether a patient has high or low dental anxiety scores. (Nermo et al. 2021)

4.8 Responses Indicative of Severe Dental Anxiety/ Dental Phobia

The MDAS and its associated scoring system have a cut-off score of 19. Any series of responses at or above this value displays the presence of severe dental anxiety and/or possible dental phobia of the respondent. (Humphris et al. 2000) In this population, it was discovered that 19.29% of participants scored 19 or above on the MDAS, indicating severe dental anxiety/dental phobia. Compared to a global prevalence of 2.6%, individuals who reside in Northern Virginia experience considerably higher amounts of dental anxiety. (Silveira et al. 2021) This difference could be due to a multitude of reasons. Still, due to the majority of participants being middle-aged female participants with various backgrounds with traumatic previous experiences and a fear of pain, these factors could explain the outcome of this study.

4.9 Implications and Strategies to Mitigate Dental Anxiety

Dental anxiety has a relatively high prevalence in this sample size, with around 57% of participants indicating some form of dental anxiety, compared to the results the Cleveland Clinic found, which reported a national average of approximately 38%. (Cleveland Clinic) Additionally, it was found that every patient who attended dental appointments on an emergency basis had a modified dental anxiety scale score above 19, which is the cut-off value indicating severe dental anxiety. Given that this sample size is considerably more anxious than most of the country, how do dentists and healthcare practitioners take steps toward alleviating these patients' feelings, and how can they regain the trust of their patient base? Research shows that effective marketing and outreach on social media can help develop better relationships with your patient base and the possibility of recruiting new patients to a dental practice. (Parmar et al. 2018) (Receveur 2017) Additionally, reviews on various platforms such as Google reviews that revolve around patients communicating that their treatment was pain-free and comfortable can help socially validate the work of that specific practitioner, further creating a pain-free and relaxing environment in the eyes of patients who may not necessarily believe you and are anxious about treatment. (Receveur 2017) The claims of dentists and practice employees mean little to nothing in the eyes of patients who are exceptionally dentally anxious; therefore, they process the information in a "fear-confirming" way. (Receveur 2017) There has been very little research backing how marketing and Google reviews impact the patients and their perspective of dental fear, and much is left to be discovered and expanded upon.

When it comes to creating a warm and welcoming environment in the office, research has shown that there are various methods to creating an environment in your office that helps reduce your patients' anxiety. Aromatherapy research shows that utilizing lavender and rose oil in the office can help produce a significant reduction in dental anxiety amongst patients, with

lavender being the best oil to utilize (Afaque et al. 2019) (Zabirunnjsa et al. 2014). Additionally, the color scheme of the office displays promising effects, with lower dental anxiety being associated with blue and pink schemes, compared to black and red. (Ahmadi et al. 2021)

Regarding how dentists treat their patients, empathy is a vital pillar in the arsenal of traits that should be displayed by dentists. The idea that dentists need to understand the potential fear their patients could be in is essential, for even though dentists are comfortable with the procedures they perform on a daily basis, they need to understand that their patients may not be. Putting yourself in the patient's shoes and demonstrating valid efforts of empathy can help engage your patient in their healthcare much better, which helps motivate them to take part in their treatment, rather than sit by passively and let you fix all of their oral health issues. (Uziel et al. 2019) Understanding the past trauma your patients have experienced can help you create strategies on how to treat them better in the future. In this study, it was found that 29.3% of individuals associated their dental anxiety with traumatic previous dental experiences. It is important to encourage healthcare professionals to imagine themselves in their patients' shoes, to reason and empathize with them, for it creates better patient relationships and has been shown to reduce physician burnout. (Uziel et al. 2019)

4.10 Limitations and Future Studies

The sample size of this study was 57 participants, which is relatively small compared to the population of Northern Virginia. The population of Northern Virginia today is around 3 million individuals, meaning a larger and more diverse sample size is needed to help create more significant results and a better understanding of the prevalence of dental anxiety in the area. Additionally, to ensure a proper sample size is achieved, a power analysis could be implemented to help identify how large the sample size should be to help generate both sufficient and statistically significant results. Since the method of collecting data was done via a Google survey and anonymously, certain biases towards questions could have been present, leading to dishonest responses, either diminishing or exacerbating perceived symptoms of dental anxiety.

5. Conclusion

Dental anxiety is present in the Northern Virginia area despite consistent efforts to help remediate anxiety of patients. Dental anxiety is not an issue that will ever disappear. Still, it is most definitely one that has a bright future in being remediated and diminished over time as technology, strategies, and relations between healthcare providers and patients develop in the coming years. Dentists should raise awareness and pursue methods to help alleviate the symptoms of dental anxiety in their patients.

5.1 The Following Trends Were Discovered in this Study

1. Females tend to have slightly higher average dental anxiety compared to their male counterparts, with an average MDAS score of 1.67 points higher.

2. Individuals who visit the dentist on an emergency basis experience significantly more dental anxiety compared to individuals who visit on a yearly or bi-annual basis.

3. Dental anxiety has been shown to develop in this population from traumatic experiences at the dentist and pain caused during treatment.

More widespread studies and approaches should be considered to help provide additional and more robust data regarding the significance of sample size to better represent the entire population and the population associated with Northern Virginia. There is additionally a call for more research in the area of associating the cause of dental anxiety with its prevalence and how practitioners can shape the future of dental anxiety management and prevention within their patient bases. This paper aims to improve the dental appointment experience for dentists and patients alike, making the development of healthy and happy smiles considerably more accessible than ever before.

6. References

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The purpose of this research is to identify dental anxiety and its prevalence with various demographic factors.

If you participate in this research, you will be asked to provide information about the following subjects and topics:

1. Demographic information such as age, sex, socioeconomic status and ethnic background

2. Dental anxiety levels regarding certain scenarios

3. History of patient's dental anxiety

There are no foreseeable risks or discomforts to you as the subject.

There will be no personal benefits to you from your participation in this research. However, the results of the research may contribute to Christos Dimitriou's Master's in Biomedicine Thesis.

Your participation in the survey will take approximately 5 minutes. The duration of this research project is 7/25/23-10/10/23.

Your participation in this research is strictly voluntary. You may refuse to participate at all, or choose to stop your participation at any point in the research without fear of penalty or negative consequence.

The information/data you provide for this research will be treated confidentially, and all raw data will be kept in a secured file by the researcher. Results of the research will be reported as aggregate summary data only, and no individually identifiable information will be presented unless explicit permission is given to do so.

You also have the right to review the results of the research if you wish to do so. A copy of the results may be obtained by contacting the researcher:

Christos Dimitriou

cdimitriou65@gmail.com

If further questions arise, or you feel you have been treated unfairly, please contact Dr. Kate Clark, chair of the Eastern Mennonite University Institutional Review Board, Eastern Mennonite University, 1200 Park Rd., Harrisonburg, VA, ph. (540) 432-4710, email: kate.clark@emu.edu.

You must be 18 years of age or older.

- ◯ I am age 18 or older and I agree to participate in this research.
- ◯ I do not with to participate.

Section 2 of 3

Demographic Information

Description (optional)

What is your age? *

Short answer text

What is your sex?

- ◯ Male
- ◯ Female

What is your ethnicity?

- ◯ Asian or Pacific Islander
- ◯ Black or African American
- ◯ Hispanic or Latino
- ◯ Native American or Alaskan Native
- ◯ White or Caucasian
- ◯ Multi or Biracial
- ◯ Other...

What is your education level?

- 12th grade or less
- Graduated high school or eqivalent
- Some college, no degree
- Associate degree
- Bachelor's degree
- Post-graduate degree

Are you married?

- Yes
- No

What is your average joint household income?

- I am a dependent.
- Less than $52,200
- $52,200-$156,600
- More than $156,600

How often do you visit the dentist?

- Every 6 months
- Yearly
- Only on emergency basis

Section 3 of 3

Modified Dental Anxiety Scale

Description (optional)

1. If you went to your Dentist for treatment tomorrow, how would you feel?

- Not Anxious
- Slightly Anxious
- Fairly Anxious
- Very Anxious
- Extremely Anxious

2. If you were sitting in the waiting room (waiting for treatment), how would you feel?

- Not Anxious
- Slightly Anxious
- Fairly Anxious
- Very Anxious
- Extremely Anxious

3. If you were about to have a tooth drilled, how would you feel?

- Not Anxious
- Slightly Anxious
- Fairly Anxious
- Very Anxious
- Extremely Anxious

4. If you were about to have your teeth scaled and polished, how would you feel?

- Not Anxious
- Slightly Anxious
- Fairly Anxious
- Very Anxious
- Extremely Anxious

5. If you were about to have a local anesthetic injection, in your gum, above your upper back tooth, how would you feel?

- Not Anxious
- Slightly Anxious
- Fairly Anxious
- Very Anxious
- Extremely Anxious

6. Where did your dental anxiety (if any) stem from?

- [ ] Traumatic previous dental experience
- [ ] History of generalized anxiety
- [ ] Lack of empathy from practitioners
- [ ] Fear of pain
- [ ] N/A
- [ ] Other...