

**Self-Efficacy as a moderator variable in the relationship between Dental Anxiety and
Dental Avoidance in University Students**

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Abstract

The fear of visiting the dentist, which is defined by the term Dental Anxiety is a common phenomenon affecting population groups worldwide. Often, Dental Anxiety results in the avoidance of dentist consultation which is known as Dental Avoidance. This is a severe consequence as it increases the likelihood of entering the vicious circle of dental fear, which can lead to serious physiological as well as psychological health conditions. Previous research found that general Self-Efficacy is associated with avoidance behaviour, anxiety management and the adherence to dental treatment. This study aims to investigate general Self-Efficacy as a moderating influence on the relationship between Dental Anxiety on Dental Avoidance to contribute to possible preventative measures and protect individuals from entering the vicious circle of dental fear. Especially young adults were found to exhibit high Dental Anxiety scores and irregular dentist consultation. Thus, for this study, university students from the Dutch University of Twente within the age of eighteen and twenty-nine ($n = 81$) were provided with an online survey in which Dental Anxiety was assessed with Corah's Dental Anxiety Scale (CDAS). Dental Avoidance was assessed with two self-constructed items and Self-Efficacy was measured using the General Self-Efficacy Scale (GSE). A correlation analysis was conducted to test the assumption that Dental Anxiety positively correlates with Dental Avoidance. As expected, Pearson's correlation coefficient indicated a moderate positive correlation, $r = .59, p < .001$. For the second hypothesis, a moderation analysis to investigate the moderation of Self-Efficacy on the relationship between Dental Anxiety and Dental Avoidance was conducted using a multiple regression model. No interaction effect was found. The results stress the importance of addressing Dental Anxiety in young adults to reduce its prevalence and prevent Dental Avoidance. For future research, the use of a situation specific Self-Efficacy scale in regard to dental visits is recommended. Moreover, further investigations about possible influences on the relationship between Dental Anxiety and Dental Avoidance are suggested. Finally, Dentists are encouraged to identify Dental Anxiety at an early stage and support patients with anxiety reducing strategies based on communication.

Key words: dental anxiety, dental avoidance, self-efficacy, moderation

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Introduction

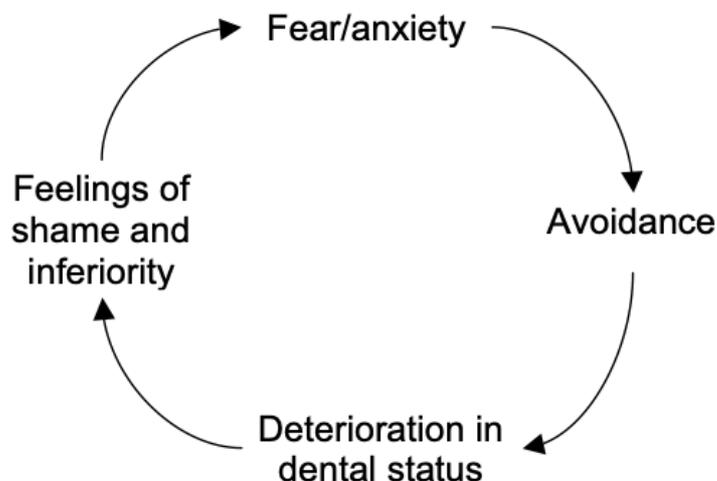
Despite the progress in anaesthetics and almost pain free dental treatments, many people experience Dental Anxiety as a barrier to regularly consult the dentist. Dental Anxiety can be defined as Anxiety associated with dental procedures and thoughts of visiting the dentist for preventive care (Appukuttan, 2016). It is estimated that about 15-20% of the worldwide population suffer from Dental Anxiety. In the adult Dutch population, Dental Anxiety was identified as the fourth most common anxiety in the Netherlands with approximately 24% inhabitants being affected (Vermaire et al., 2016). Several studies found that younger individuals generally score higher on Dental Anxiety than older ones (Mehrstedt et al., 2004). For example, in a study by Enkling et al. (2006), participants between the age of twenty and thirty showed the highest Dental Anxiety scores. Additionally, women were found to be more often affected by Dental Anxiety than men.

The development of Dental Anxiety can originate in childhood, adolescence or later in life (Silveira et al., 2021). Multiple factors were found to be involved in the development and maintenance of Dental Anxiety. For example, it was found to be associated with vicarious learning from anxious relatives, personality factors such as neuroticism and the exposure to portrayals of dentists in the media (Appukuttan, 2016). However, the most common theory to explain occurrence and maintenance of Dental Anxiety is the theory of classical conditioning by physiologist Ivan Pavlov. Conditioning happens when an individual learns through personal experiences that a stimulus causes a detrimental outcome. Pavlov found that through learning, a conditioned stimulus can be associated with a new non-conditioned stimulus so that the unconditioned stimulus finally causes a conditioned response (Carter et al., 2014). By relating the theory of classical conditioning to Dental Anxiety it was found that many individuals reported painful experiences in the past as the main reason for their Dental Anxiety. For example, if dentally anxious individuals were confronted with dental stimuli such as the doctor's office, responses such as increased heart rate and sweating were elicited (Carter et al., 2014). Therefore, the theory of classical conditioning explains that Dental Anxiety can be a reaction to past traumatic dental experiences triggered by the confrontation with dental stimuli.

Suffering from Dental Anxiety can have severe consequences. It not only leads to physiological consequences such as feelings of tension and fatigue after a dental appointment, but is also associated with psychological well-being, vitality, and social functioning

(Mehrstedt et al., 2004). For example, Carlsson et al. (2015) found a relationship between Dental Anxiety and pain, less satisfaction with dental appearance and embarrassment related to dental status, which links Dental Anxiety to a poor oral health-related quality of life. Additionally, sufferers often experience sleep disturbances such as the inability to sleep in the night before treatment or nightmares related to Dental Anxiety (Cohen et al., 2000). Moreover, individuals suffering from Dental Anxiety often only seek help in acute emergency situations (Thom et al., 2000). Due to the sophisticated damage such as missing or decayed teeth, often complicated treatment procedures need to be conducted, which can lead to traumatic experiences and the reinforcement of Dental Anxiety. In addition, treating anxious patients requires more time and resources resulting in a stressful and unpleasant experience for the dentist and patient (Appukuttan, 2016). Therefore, Dental Anxiety is not only associated with the necessity for dental care by a specialist but also predicts increased financial liability for the health care system (Boyle et al., 2009). Hence, Dental Anxiety has tremendous effects on an individual's physiological, psychological, and social functioning.

In fact, the most impactful consequence of Dental Anxiety is Dental Avoidance, which is defined by the avoidance of dental visits due to anxiety and the belief of experiencing something dreadful during treatment (Armfield, 2013). Physiological health problems such as pneumonia, septicaemia and osteomyelitis are some of the severe consequences of prolonged Dental Avoidance. Additionally, the deterioration in oral health was found to reduce self-confidence leading to an increase in social isolation, depression or other psychiatric or psychosomatic disorders (Mehrstedt et al., 2007). The development of Dental Avoidance through Dental Anxiety can be explained by the vicious circle of dental fear (see Figure 1). The feedback loop starts as soon as dental treatment is avoided due to anxiety. The avoidance leads to an instant relief, however, in the long term also to a reduced quality of oral health and feelings of shame and embarrassment in social as well as dental situations. The effects increase with time and lead to a vicious circle because increased Dental Anxiety induces increased avoidance behaviour (Bohman, 2010). Previous cross-sectional studies found a significant positive correlation between Dental Anxiety and Dental Avoidance. For example, Armfield (2013) showed that 38.5% of people with moderate to high Dental Anxiety exhibited Dental Avoidance and thus fit the hypothesized vicious circle of dental fear. Moreover, in a study by Nicolas et al. (2007) participants exhibiting higher Dental Anxiety more often avoided the dentist than participants scoring low on Dental Anxiety. Consequently, people exhibiting Dental Anxiety are at risk of entering the vicious circle of dental fear.

Figure 1*The Vicious Circle of Dental Fear*

Note. Bohman (2010)

The severe consequences of Dental Avoidance highlight the need for its prevention and further investigation of underlying factors. The Social Cognitive Theory by Albert Bandura explains that avoidance behaviour can be attributed to a perceived lack of coping skills. Bandura states that avoidance behaviour is linked to Self-Efficacy which can be defined as an individual's beliefs about the own capabilities. These beliefs are dependent on how individuals perceive their cognitive abilities, motivation, and resources to act. If an individual feels able to take action, he or she becomes more prone to actually commit to a decision (Bandura, 2002). To specify, if an individual experiences anxiety, he or she engages in the cognitive appraisal of the arousal before avoidance behaviour is activated. If Self-Efficacy increases, a subsequent reduction of arousal enables facilitation in stress and anxiety management. Therefore, Self-Efficacy provides a global insight into an individual's perception of him or herself in a variety of contexts of everyday life (Morales-Rodríguez & Pérez-Mármol, 2019). To conclude, the Social Cognitive Theory refers to Self-Efficacy as an important factor in the occurrence of avoidance behaviour.

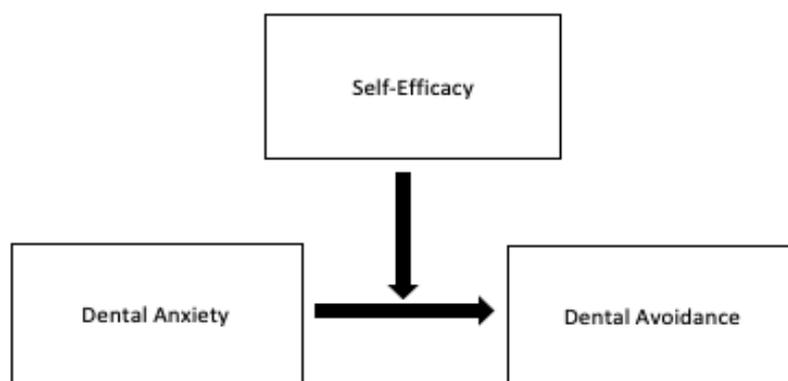
To continue, previous literature identified Self-Efficacy as a psychological construct which is consistently associated with health. It was not only found to be related to health promotion and disease prevention but also to the adherence to dental treatment (Santos-Puerta & Peñacoba-Puente, 2022). For example, Bernson et al. (2013) found that individuals who visit the dentist regularly and had higher Self-Efficacy were more likely to succeed in managing stress and anxiety. Moreover, researchers found that Self-Efficacy is positively associated the motivation to undergo dental treatment, maintain proper brushing techniques,

and use dental floss (Santos-Puerta & Peñacoba-Puente, 2022). These findings highlight the meaningful impact of Self-Efficacy on individual's lives and its specific influence on anxiety management and the willingness to attend dental appointments.

Even though previous findings suggest that Self-Efficacy plays a role in the occurrence of Dental Avoidance, information about the extent to which Self-Efficacy moderates the relationship between Dental Anxiety and Dental Avoidance is missing. On the one hand, understanding the impact of Self-Efficacy in this relationship can help to identify and create coping strategies for people dealing with Dental Anxiety which may allow to prevent or reduce the occurrence of Dental Avoidance. On the other hand, it can be interesting to find out why Self-Efficacy may not have a significant influence in this relationship and what other factors may be more relevant to investigate.

Therefore, this study aims to expand on existing research by investigating the moderating influence of Self-Efficacy on the relationship between Dental Anxiety and Dental Avoidance (see Figure 2). As mentioned above, the highest prevalence rate of Dental Anxiety was found in young adults (Enkling et al., 2006). Additionally, a survey conducted by the Dutch Centraal Bureau voor de Statistiek (CBS) showed that 20% of individuals between the age of eighteen and twenty-nine did not visit the dentist in the year 2021 (Centraal Bureau voor de Statistiek, n.d.). Thus, Dental Anxiety as well as Dental Avoidance was found to be particularly prominent within this age group. A great number of individuals within this age group are represented at universities and no studies have investigated this topic by specifically focusing on university students yet. Thus, university students within the age of eighteen and twenty-nine were chosen as the target group for this study and the following research question was formulated:

RQ: "Does Self-Efficacy moderate the relationship between Dental Anxiety and Dental Avoidance in university students within the age of twenty and twenty-nine?"

Figure 2*Scheme of Hypothesised Model*

Firstly, due to previous significant findings, it can be expected that a positive moderate correlation between Dental Anxiety and Dental Avoidance will be found in university students between the age of eighteen and twenty-nine. To gain insight into the strength of the correlation within this specific age group, the first hypothesis was formulated:

H1: There is a positive moderate correlation between Dental Anxiety and Dental Avoidance in university students within the age of eighteen and twenty-nine.

Secondly, since Self-Efficacy is known to influence the adherence of dental treatment and is linked to dental health behaviours as well as anxiety management, it can be suggested that individuals affected by Dental Anxiety are less likely to avoid visiting the dentist if their Self-Efficacy is high. In contrast, if individuals have low Self-Efficacy, it can be expected that they are more prone to engage in the maladaptive coping response of Dental Avoidance. Thus, the following hypothesis was formulated to investigate the moderating role of Self-Efficacy in the relationship between Dental Anxiety and Dental Avoidance:

H2: High Self-Efficacy moderates the relationship between Dental Anxiety and Dental Avoidance in university students within the age of eighteen and twenty-nine.

Method

Design

This is a cross-sectional study using an online survey.

Participants

Convenience sampling was used. Participants were recruited via the SONA-system of the University of Twente, which is an online environment in which students can participate in scientific research of other students. After the completion, they receive subject hour points, which are a requirement for graduation. Inclusion criteria for participation in this study were to be a student enrolled at the University of Twente between the age of 18 and 29. Moreover, the questionnaire was published in English, which required participants to be proficient in this language.

Materials

As the study was conducted online, researchers and participants needed a stable internet connection and a fully functional device. The experience management platform Qualtrics was used to create and publish the online questionnaire (see Appendix A). Moreover, the link to the online survey was presented in the online SONA-system of the University of Twente, which required access to it.

Dental Anxiety

Corah's Dental Anxiety Scale (CDAS) was chosen to assess participant's level of Dental Anxiety (see Appendix C). The English CDAS is most used internationally, providing suitable psychometric properties to measure Dental Anxiety (Enkling et al., 2006). The CDAS contains four questions dealing with reactions and expectations of going to and being treated by the dentist, which are answered on a five-point Likert scale from "not anxious at all" to "extremely anxious". Thus, the range of scores lies between four to twenty with a score below nine indicating mild anxiety, between nine and twelve indicating moderate anxiety, between thirteen and fourteen indicating high anxiety and a cutoff point of fifteen or more indicating severe levels of anxiety (Appukuttan, 2016).

Self-Efficacy

Moreover, participant's level of general Self-Efficacy was measured. For this, the General Self-Efficacy Scale (GSE) was chosen as it provides good internal reliability with Cronbach's alpha between .76 and .90 (Schwarzer & Jerusalem, 1995). The GSE consists of ten items with a four-point Likert scale ranging from "not at all true" to "exactly true". The

sum of all items indicates the total level of Self-Efficacy with forty as the highest possible score.

Dental Avoidance

To assess Dental Avoidance, two questions were formulated. The choice of questions was based on previous research, in which similar questions were used to assess Dental Avoidance. For example, in the study by Armfield (2013) all participants were asked whether they avoided visiting the dentist or visited the dentist less often than they believed they needed to. If this was the case, they were given options to indicate possible reasons such as “lack of time” or “anxiety”.

For this study, the first question about Dental Avoidance was formulated more generally: “Have you ever avoided seeking dental treatment for as long as possible?”. The second question was specifically related to Dental Anxiety as the reason for avoidance: “Have you ever avoided seeking dental treatment because you were afraid of visiting the dentist?”. If a question was responded to with “yes”, it was coded with a score of one. If a question was answered with “no”, it was coded with a score of zero. Hence, the score of Dental Avoidance ranged between zero and two with a higher score indicating higher Dental Avoidance.

Procedure

First, the online survey was created via the Qualtrics platform. Second, the study was approved by the BMS Ethics Committee/Domain Humanities and Social Sciences of the University of Twente on the 21st of October 2022. The number of the application for ethical approval was 221277. Data collection started on the 25th of October and ended on the 15th of November 2022. Participants were able to access the survey through a link provided on the SONA website of the University of Twente. Each participant received 0.25 SONA credits for conducting the survey. After following the survey link, participants were provided with an information sheet for the study and asked to give consent to participate (see Appendix B). If consent was given, participants created an individual identification code, which needed to be presented to the researcher in case of requested withdrawal from the study. Next, participants were instructed to fill out the online survey, which took them on average six minutes and seven seconds to complete.

First, demographic questions were asked. Second, two closed questions were asked to identify participant’s regularity of dental check-up visits. Third, all questions of Corah’s Dental Anxiety Scale (CDAS) were answered (see Appendix C). Next, all questions of the General Self-Efficacy scale (GSE) were answered (see Appendix D), followed by two closed questions about the avoidance of dental visits. Finally, four open questions were asked to

identify reasons for irregular dental visits and perceived resources for reducing Dental Anxiety and increase the frequency of dental visits. The open questions served as qualitative data for my colleague's thesis and are therefore not occurring in the following analysis.

Data Analysis

Data Analysis was conducted using the statistical softwares R (version 3.6.6) and R studio (version 1.2.5042) with the packages *broom* and *tidyverse*. Participants were excluded from the analysis if consent was not given, or demographic characteristics were not filled out. Additionally, only data from participants who responded to all items of the CDAS, SES and answered the Dental Avoidance questions were included in the data analysis.

A G*Power analysis was conducted, which indicated that a sample size of $N=80$ is sufficient for conducting the analyses. To compute participant's Dental Anxiety, the four items of the CDAS were scored from one to five and summed to gain the final score. For Dental Avoidance, the response "yes" was coded with a score of one and "no" with a score of zero. Responses were summated to indicate the final Dental Avoidance score. Thus, Dental Avoidance scores range from zero to two. For Self-Efficacy, the score for each of the ten items was summed to calculate the final score. A frequency table was used to inspect the demographic variable gender. Moreover, mean and standard deviations of the CDAS, Dental Avoidance and GSE were calculated.

For the first hypothesis, bivariate correlations between all constructs were calculated. Pearson's correlation coefficient was used with a correlation of $.1 < r \leq .39$ indicating a weak correlation, $.4 < r \leq .59$ indicating a moderate and $.6 < r \leq 1.0$ a strong correlation (Schober et al., 2018).

Next, for testing the second hypothesis, a moderation analysis using a multiple linear regression model was performed, in which Dental Anxiety (X) and Self-Efficacy (X) were treated as independent variables and Dental Avoidance as the dependent variable (Y). Since the moderation analysis consists of a regression, it was checked whether the data fulfilled the following four assumptions of linear regression: linearity of the data, normality of residuals, homogeneity of residual variance, and independence of residual error terms. Therefore, diagnostic plots to visualise the residuals of the data were created.

To investigate the moderation effect of Self-Efficacy, the interaction of the two predictor variables Dental Anxiety and Self-Efficacy were included in the model. Finally, the analysis provided two main effects for the independent variables and one interaction term indicating whether Self-Efficacy acts as a moderator variable (Z) within the relationship

between Dental Anxiety and Dental Avoidance. A significance level of $p < .05$ was used to determine the significance of the results.

Results

Sample Characteristics

Eighty-two participants took part in the online survey. One participant needed to be excluded from the analysis as the survey was not completed and answers for investigating the variables of interest were missing. Thus, the final sample size was $N = 81$. Table 1 shows that the majority of participants were female. The participant's age varied from 18 to 27 years ($M_{age} = 20.8$ years, $SD_{age} = 2.05$). All participants were enrolled at the University of Twente and took part in the online survey via the SONA platform.

Table 1

Gender in Total Numbers and Percentages

Characteristic	<i>n</i>	%
Gender		
Female	65	80.25
Male	15	18.52
Diverse	0	0.00
Prefer not to say	1	1.23

Note. $N = 81$.

Assumptions Testing

The data was tested for the four assumptions of linear regression. First, the normality of the variables was inspected. Therefore, the relationship between Dental Anxiety and Dental Avoidance was visualized using a scatterplot with a regression line (see Appendix E). Additionally, a residual plot of this relationship was created. The data was approximately normal. Second, to test the assumption of normality, a QQ plot of the residuals was created (see Appendix F). The assumption of normality was met. Third, the assumption of homoscedasticity was checked with help of a scale-location plot (see Appendix G). The plot showed non-consistent variances in the residual errors and therefore indicates heteroscedasticity. Finally, the assumption of independence was checked by inspecting the Residuals vs Leverage plot (see Appendix H). The assumption of independence was met.

Descriptive Statistics

The sample's mean score of the CDAS indicated moderate Dental Anxiety ($M = 9.42$, $SD = 3.24$). The mean score of Dental Avoidance showed that participants had on average

low Dental Avoidance ($M = 0.47$, $SD = 0.73$). The mean score of the GSE indicates that the overall sample exhibited moderate general Self-Efficacy ($M = 29.43$, $SD = 4.52$).

Table 2

Mean and Standard Deviation of the CDAS, Dental Avoidance and GSE

Scale	<i>M</i>	<i>SD</i>
CDAS	9.42	3.24
Dental Avoidance	0.47	0.73
GSE	29.43	4.52

Note. CDAS scores range from four to twenty, GSE scores range from ten to forty, Dental Avoidance scores range from zero to two.

Bivariate Correlations

The bivariate correlations depicted in Table 3 demonstrate that Dental Anxiety did not show a significant correlation with Self-Efficacy, $r = -.01$, $p = 0.32$. Moreover, Dental Avoidance also did not show a significant correlation with Self-Efficacy, $r = -.02$, $p = .34$. However, Pearson's Correlation coefficient for the relationship between Dental Anxiety and Dental Avoidance revealed a significant moderate positive correlation, $r = .59$, $p < .001$.

Table 3

Correlation Coefficients

	Dental Anxiety	Self-Efficacy	Dental Avoidance
Dental Anxiety	1		
Self-Efficacy	-.01	1	
Dental Avoidance	.59	-.01	1

Note. $R^2 = .35^*$ Correlation is significant at the .05 level ($p < 0.05$). CI = 95%

Moderation Analysis

To test the hypothesis that high Self-Efficacy moderates the relationship between Dental Anxiety and Dental Avoidance, a moderation analysis was conducted. The overall model was statistically significant $F(3,77) = 15.14$, $p < .001$, Adjusted $R^2 = .35$. This means 35% of the variance of Dental Avoidance can be explained by this model.

Table 3 demonstrates the statistics related to the moderation analysis. Firstly, there was a significant positive main effect of Dental Anxiety on Dental Avoidance $b = .37$, $t = 2.13$, $p = .04$. Secondly, the main effect of Self-Efficacy on Dental Avoidance was not significant $b = 0.06$, $t = 1.20$, $p = .23$. Thus, in this analysis Self-Efficacy did not have a significant influence on Dental Avoidance. Finally, the Interaction effect of Self-Efficacy on

the relationship between Dental Anxiety and Dental Avoidance was not significant $b = -.001$, $t = -1.38$, $p = .17$. This means Self-Efficacy did not significantly moderate the relationship between Dental Anxiety and Dental Avoidance.

Table 4

Moderation Analysis

	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Intercept	-2.66	1.60	-1.70	.10
Dental Anxiety	0.37	0.17	2.13	.04*
Self-Efficacy	0.06	0.05	1.20	.23
Dental Anxiety x Self-Efficacy	-0.01	0.01	-1.38	.17

Note. $R^2 = .35^*$ Correlation is significant at the .05 level ($p < 0.05$). CI = 95%

Discussion

The purpose of this study was to gain more insight into Self-Efficacy as a moderator in the relationship between Dental Anxiety and Dental Avoidance to contribute to the creation of possible preventative measures for Dental Avoidance. Therefore, quantitative research using an online study was conducted to investigate the relationship between Dental Anxiety and Dental Avoidance in university students within the age of twenty and twenty-nine and whether Self-Efficacy moderates this relationship. The first hypothesis expected a moderate positive correlation between Dental Anxiety and Dental Avoidance in university students within the age of eighteen and twenty-nine. The results were in line with the first hypothesis as a moderate positive correlation was found. Therefore, the first hypothesis was accepted. The second hypothesis assumed that Self-Efficacy moderates the relationship between Dental Anxiety and Dental Avoidance in university students within the age of eighteen and twenty-nine. Contrary to the expectation, no significant moderation was found. Thus, the second hypothesis was rejected.

Concerning the first hypothesis, this current study found a positive correlation between Dental Anxiety and Dental Avoidance in university students within the age of eighteen and twenty-nine. This means Dental Avoidance increased with higher Dental Anxiety. However, since it is a bivariate correlation, Dental Anxiety may also increase with higher Dental Avoidance. In fact, the mutual correlation of both constructs is explained by the model of the vicious circle of dental fear. This is because if an individual starts avoiding the dentist due to Dental Anxiety, it is likely that treatment will only be sought with proceeded

deterioration of oral health often leading to repeated Dental Avoidance in the future (Armfield, 2013). Similar to other industrialised European populations, this study's sample exhibited moderate mean scores of Dental Anxiety, which highlights the risk of developing Dental Avoidance (Nicolas et al., 2007). Thus, this finding emphasises the importance of identifying the underlying factors of Dental Anxiety and Dental Avoidance to prevent the occurrence of the vicious circle of dental fear and improve young people's oral health as well as psychological well-being.

Despite expectations, Self-Efficacy did not moderate the relationship between Dental Anxiety and Dental Avoidance. One possible explanation for the insignificance of Self-Efficacy in this relationship could be related to individual's response to trauma. Previous research found that one of the main reasons for Dental Anxiety are painful or traumatic experiences in the past (Carter et al., 2014). These traumatic experiences are often easily triggered through the senses. For example, in a dental environment, the doctor's office and equipment, the staff's clothes, the smell, taste or the sound of the tools can remind a patient of a past traumatic or painful experience. If a patient gets triggered, an anxiety response such as increased heart rate and sweating or even a panic attack can be elicited (Carter et al., 2014). Finally, as traumatic experiences are stored in the body as implicit memory, the process of cognitive appraisal as described in the Social Cognitive Theory, may be interrupted. Consequently, the body may automatically react to stimuli leading to the experience of a threatening lack of control for the patient. Therefore, general Self-Efficacy may not take effect if traumatic experience is involved.

However, it is also possible that the insignificance of the moderation effect in this model is related to the measurement instruments used. The GSE was chosen as a reliable measurement instrument for assessing Self-Efficacy which can be applied to a variety of areas of life (Morales-Rodríguez & Pérez-Mármol, 2019). However, it does not specifically focus on Self-Efficacy in relation to dental environments. Therefore, it can be argued that due to the lack of situation specific items, no influence of Self-Efficacy on the relationship between Dental Anxiety and Dental Avoidance was found. In a study by Bernson et al. (2013), the Dental Coping Strategy Questionnaire (DCSQ-15) was used to investigate dental coping strategies in relation to the regularity of dental treatment among people who either regularly attended the dentist or suffered from phobic avoidance. The DCSQ-15 consists of 15 statements about coping strategies during dental treatment with five separate scales. One of the scales includes five statements about Self-Efficacy. In comparison to this current study, two groups were compared. The results showed a significant association between Dental

Anxiety and coping. Regular attendees were found to use more coping strategies such as Self-Efficacy and optimism. The authors suggest that people who regularly attend the dentist experience higher levels of stress but can manage the anxiety with help of coping strategies such as Self-Efficacy (Bernson et al., 2013). Thus, general Self-Efficacy was not found to have a significant influence on Dental Anxiety and Dental Avoidance, however, other studies suggest that coping strategies in regard to Self-Efficacy in dental environments have a relevant influence on Dental Anxiety and the regularity of dental visits.

Moreover, the findings imply that other factors may have a greater influence on the relationship between Dental Anxiety and Dental Avoidance. In fact, not only experiences of past traumatic events but also different kinds of fears such as the fear of social evaluation, fear of germs or being away from a safe place can contribute to the occurrence of Dental Avoidance. Additionally, other psychological conditions such as depression were found to be related to reduced dental visiting (Armfield & Heaton, 2013). Thus, Dental Anxiety as well as Dental Avoidance are multifactorial constructs, which complicates the investigation of separate influences on their relationship.

Implications

Even though general Self-Efficacy was not found to be a moderator within the relationship between Dental Anxiety and Dental Avoidance, this study has emphasized the significant correlation between Dental Anxiety and Dental Avoidance in young adult university students. Additionally, the moderate prevalence of Dental Anxiety in the sample stresses the need to prevent young adults from entering the vicious circle of dental fear. As explained above, experiences of painful or even traumatic experiences in regard to the dentist seem to make up a great part of the occurrence of Dental Anxiety and Dental Avoidance. Therefore, providing patients with realistic information before the start of the treatment was found to be effective. Especially for anxious patients it is helpful to provide sensory information to decrease the likelihood to trigger traumatic experiences (Bernson et al., 2011). For example, sensory information can be provided to prepare patients to feel pressure or vibrations. Also, procedural information can help to inform patients about the order of the procedures taking place. This creates a sense of control for the patient and allows them to take an active role in the process of the treatment. However, since preferences differ, dentists are encouraged to ask patients prior to the start of the treatment what type of information they prefer and when they would like to receive it (Bernson et al., 2011).

Furthermore, the earlier Dental Anxiety can be determined, the greater the possibility to successfully work with the patient. It is beneficial to determine it before treatment, which can be done with help of a short Dental Anxiety scale such as the CDAS used in this study

(Bernson et al., 2011). Moreover, dentists are encouraged to ask questions about possible fears regarding the dental environment or procedures. This allows to support the patient if specific concerns are shared and find suitable ways to proceed with the treatment. These anxiety reducing strategies provide patients with a sense of control and predictability and avoid re-traumatisation. Finally, if a patient exhibits severe Dental Anxiety, a referral to a specialist is necessary (Bernson et al., 2011).

Limitations

Considering the limitations, the current study as well as studies previously conducted rely on cross-sectional and longitudinal data. This means there is a limitation in making causal attributions about the relationship between Dental Anxiety and Dental Avoidance. Furthermore, this study exhibited a violation of the assumption of homoscedasticity, which reduces the model's generalisability to the population as it makes the coefficients less accurate. Finally, only students from one specific university were included, which reduces the generalisability of the findings.

Future Research

This study emphasized the urgency to further identify underlying factors of Dental Anxiety and Dental Avoidance. Personality traits such as neuroticism, upbringing, gender roles and other variables need to be considered by taking into account the multifactorial nature of the constructs. Moreover, as other studies have found that coping strategies influenced Dental Anxiety as well as the regularity of treatment, it can be suggested to investigate coping more intensively within this field. For example, Self-Efficacy could be investigated in more detail by making use of or creating measurement instruments focusing specifically on Self-Efficacy as a coping strategy within the dental context. It would also be interesting to compare coping strategies of individuals suffering from different levels of Dental Anxiety and provide trainings to enhance certain strategies based on the results. For example, interventions or trainings for enhancing patient's coping strategies in regard to Self-Efficacy could be created to check how this may affect Dental Anxiety levels in the long term (Valdes-Stauber & Hummel, 2021). Additionally, to gain more insight into the causality of the relationship of Dental Anxiety and Dental Avoidance, longitudinal research can be conducted by for example examining people's changes in Dental Anxiety over time and check how the avoidance of treatment is influenced by that. Additionally, it can be proposed to include student samples from several universities to enhance generalizability. Generally, to gain more specific insight into the complexity of Dental Avoidance, conducting additional qualitative research within this field of study is suggested.

Conclusion

This study provided insight into the prevalence of Dental Anxiety and Dental Avoidance in university students within the age of twenty and twenty-nine. Moreover, a significant moderate positive correlation was found between the two constructs. General Self-Efficacy was not identified as a significant moderator variable within the relationship between Dental Anxiety and Dental Avoidance. General Self-Efficacy may not take effect in this relationship due to the influence of traumatic experiences, which can be triggered through sensory input and do not allow for cognitive appraisal of the situation. However, it needs to be further analysed whether there is a moderation effect of situation specific Self-Efficacy in regard to dental contexts within this relationship. For this, a more specific measurement instrument needs to be selected. This study highlights the need to further investigate underlying factors of Dental Anxiety and Dental Avoidance. Finally, general implications such as communication based on sensory input were provided which can support patients with Dental Anxiety and reduce their risk of developing Dental Avoidance.

References

- Armfield, J. M. (2013). What goes around comes around: Revisiting the hypothesized vicious cycle of dental fear and avoidance. *Community Dentistry and Oral Epidemiology*, 41(3), 279-287. <https://doi.org/10.1111/cdoe.12005>
- Armfield, J. M., & Heaton, L. J. (2013). Management of fear and anxiety in the dental clinic: a review. *Australian dental journal*, 58(4), 390-407. <https://doi.org/10.1111/adj.12118>
- Appukuttan, D. P. (2016). Strategies to manage patients with dental anxiety and dental phobia: literature review. *Clinical, Cosmetic and Investigational Dentistry*, 8, 35-50. <https://doi.org/10.2147/CCIDE.S63626>
- Bandura, A. (2002). Social foundations of thought and action. In D. F. Marks (Ed.), *The health psychology reader* (pp.94-106). SAGE Publications Ltd.
- Bernson, J. M., Elfström, M. L., & Hakeberg, M. (2013). Dental coping strategies, general anxiety, and depression among adult patients with dental anxiety but with different dental-attendance patterns. *European Journal of Oral Sciences*, 121(3pt2), 270-276. <https://doi.org/10.1111/eos.12039>
- Bernson, J. M., Hallberg, L. R. M., Elfström, M. L., & Hakeberg, M. (2011). ‘Making dental care possible—a mutual affair’. A grounded theory relating to adult patients with dental fear and regular dental treatment. *European journal of oral sciences*, 119(5), 373-380. <https://doi.org/10.1111/j.1600-0722.2011.00845.x>
- Bohman, W. (2010). Psychosocial and dental factors in the maintenance of severe dental fear. *Swedish Dental Journal*, 34(3), 121-127.
- Boyle, C. A., Newton, T., & Milgrom, P. (2009). Who is referred for sedation for dentistry and why?. *British Dental Journal*, 206(6), Article E12. <https://doi.org/10.1038/sj.bdj.2009.251>
- Carter, A. E., Carter, G., Boschen, M., AlShwaimi, E., & George, R. (2014). Pathways of fear and anxiety in dentistry: A review. *World Journal of Clinical Cases*, 2(11), 642-653. <https://doi.org/10.12998/wjcc.v2.i11.642>
- Carlsson, V., Hakeberg, M., & Wide Boman, U. (2015). Associations between dental anxiety, sense of coherence, oral health-related quality of life and health behaviour – a national Swedish cross-sectional survey. *BMC Oral Health*, 15, Article 100. <https://doi.org/10.1186/s12903-015-0088-5>
- Centraal Bureau voor de Statistiek. (n.d.). Retrieved January 10, 2023, from

- [https://www.staatvandemondzorg.nl/vraag-naar-mondzorg/tandartsbezoek/#:~:text=In%202021%20heeft%2079%25%20van,%2C9%20keer%20\(CBS\).https://www.staatvandemondzorg.nl/vraag-naar-mondzorg/tandartsbezoek/#:~:text=In%202021%20heeft%2079%25%20van,%2C9%20keer%20\(CBS\).](https://www.staatvandemondzorg.nl/vraag-naar-mondzorg/tandartsbezoek/#:~:text=In%202021%20heeft%2079%25%20van,%2C9%20keer%20(CBS).https://www.staatvandemondzorg.nl/vraag-naar-mondzorg/tandartsbezoek/#:~:text=In%202021%20heeft%2079%25%20van,%2C9%20keer%20(CBS).)
- Cohen, S. M., Fiske, J., & Newton, J. T. (2000). The impact of dental anxiety on daily living. *British Dental Journal*, *189*(7), 385-390. <https://doi.org/10.1038/sj.bdj.4800777>
- Enkling, N., Marwinski, G., & Jöhren, P. (2006). Dental anxiety in a representative sample of residents of a large German city. *Clinical Oral Investigations*, *10*, 84-91. <https://doi.org/10.1007/s00784-006-0035-6>
- Lee, J. Y., Divaris, K., Baker, A. D., Rozier, R. G., & Vann Jr, W. F. (2012). The relationship of oral health literacy and self-efficacy with oral health status and dental neglect. *American journal of public health*, *102*(5), 923-929. <https://ajph.aphapublications.org/doi/full/10.2105/AJPH.2011.300291>
- Mehrstedt, M., John, M. T., Tönnies, S., & Micheelis, W. (2007). Oral health-related quality of life in patients with dental anxiety. *Community Dentistry and Oral Epidemiology*, *35*(5), 357-363. <https://doi.org/10.1111/j.1600-0528.2007.00376.x>
- Mehrstedt, M., Tönnies, S., & Eisentraut, I. (2004). Dental fears, health status, and quality of life. *Anesthesia Progress*, *51*(3), 90-94.
- Morales-Rodríguez, F. M., & Pérez-Mármol, J. M. (2019). The role of anxiety, coping strategies, and emotional intelligence on general perceived self-efficacy in university students. *Frontiers in Psychology*, *10*, Article 1689. <https://doi.org/10.3389/fpsyg.2019.01689>
- Nicolas, E., Collado, V., Faulks, D., Bullier, B., & Hennequin, M. (2007). A national cross-sectional survey of dental anxiety in the French adult population. *BMC Oral Health*, *7*, Article 12. <https://doi.org/10.1186/1472-6831-7-12>
- Santos-Puerta, N., & Peñacoba-Puente, C. (2022). Pain and avoidance during and after endodontic therapy: The role of pain anticipation and self-efficacy. *International Journal of Environmental Research and Public Health*, *19*(3), Article 1399. <https://doi.org/10.3390/ijerph19031399>
- Schober, P., Boer, C., & Schwarte, L. A. (2018). Correlation coefficients: appropriate use and interpretation. *Anesthesia & Analgesia*, *126*(5), 1763-1768. <https://doi.org/10.1213/ANE.0000000000002864>
- Schwarzer, R., & Jerusalem, M. (1995). Generalized Self-Efficacy scale. In J. Weinman, S.

- Wright, & M. Johnston, *Measures in health psychology: A user's portfolio* (pp. 35-37). Nfer-Nelson.
- Silveira, E. R., Cademartori, M. G., Schuch, H. S., Armfield, J. A., & Demarco, F. F. (2021). Estimated prevalence of dental fear in adults: A systematic review and meta-analysis. *Journal of Dentistry*, *108*, Article 103632. <https://doi.org/10.1016/j.jdent.2021.103632>
- Thom, A., Sartory, G., & Jöhren, P. (2000). Comparison between one-session psychological treatment and benzodiazepine in dental phobia. *Journal of Consulting and Clinical Psychology*, *68*(3), 378-387. <https://doi.org/10.1037/0022-006X.68.3.378>
- Valdes-Stauber, J., & Hummel, K. (2021). The relationship between dental anxiety and other kinds of anxiety: a naturalistic, cross-sectional and comparative study. *BMC Psychology*, *9*, Article 184. <https://doi.org/10.1186/s40359-021-00684-6>
- Vermaire, J. H., van Houtem, C. M. H. H., Ross, J. N., & Schuller, A. A. (2016). The burden of disease of dental anxiety: Generic and disease-specific quality of life in patients with and without extreme levels of dental anxiety. *European Journal of Oral Sciences*, *124*(5), 454-458. <https://doi.org/10.1111/eos.12290>

Appendix A

Online Questionnaire

Welcome and thank you for your interest in our study!

In the following we would like to provide you with some information about the survey and how your data will be handled. If you agree to participate in this research, you will be asked to answer a short questionnaire which will take you approximately 15 minutes. The questions will cover the following topics: the fear of dental visits, habits of going to the dentist, dental avoidance and self-efficacy. The research is supervised by Rick Pinkster. It is designed in a way to minimize any risks for the participants. Risks include feelings of discomfort when answering the questions. If participation in this study causes you any concerns, anxiety, or distress, please do not hesitate to contact the UT student counselling (<https://www.utwente.nl/en/ces/sacc/coaching-counselling/student-counsellor/>).

Your participation in this study is completely voluntary and you may refuse to complete the study or withdraw from the study at any time. You may also skip any question that makes you feel uncomfortable without justifying your decision. If you decide to withdraw from the study after completing the survey, please send one of the researchers an email with your participation code (which you will receive at the beginning of the study) until November 20th, 2022. All data from this study will be kept from inappropriate disclosure and will be accessible only through the university of Twente and to the researchers and their supervisors until the 1st of November 2024. Your name will not be connected to your responses or results and data will be handled completely confidential. If you would like to receive information about the outcomes of this study, or have any questions or concerns please contact one of the researchers via e-mail:

Hennig, Lena (l.hennig@student.utwente.nl)

Warschat, Victoria (v.m.warschat@student.utwente.nl)

I confirm that I have read and understood the participant information

I have had the opportunity to consider the information, ask questions, and have had these answered satisfactorily.

I understand that in order to take part in this study, I need to be between 18 and 29 years old.

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.

I understand that my data is anonymous and will be stored on secure university servers and that it will only be used for research purposes.

I consent to take part in this study.

I consent

I do not consent

*General Questions**

Please enter the first two numbers of your birth date, the last two letters of your last name and the first letter of your favourite colour. Please save this code as you will need it as identification in case you want to withdraw from the study. *[Open Question*]*

Age *[Open Question*]*

Gender

Male

Female

Diverse

Prefer not to say

*Frequency**

How many months ago was the last time you went to the dentist for a preventative check-up?

[Open Question]*

How often do you visit the dentist for preventative check-ups?

Every 6 months

Every 12 months

Every 18 months

Every 24 months

Less than every 24 months

*Corah's Dental Anxiety Scale (CDAS)**

1. If you had to go to the dentist tomorrow for a checkup, how would you feel about it?
 - a. I would look forward to it as a reasonably enjoyable experience.
 - b. I wouldn't care one way or the other.
 - c. I would be a little uneasy about it.
 - d. I would be afraid that it would be unpleasant and painful.
 - e. I would be very frightened of what the dentist would do.

2. When you are waiting in the dentist's office for your turn in the chair, how do you feel?
 - a. Relaxed.
 - b. A little uneasy.
 - c. Tense.
 - d. Anxious.
 - e. So anxious that I sometimes break out in sweat or almost feel physically sick.
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?
 - a. Relaxed.
 - b. A little uneasy.
 - c. Tense.
 - d. Anxious.
 - e. So anxious that I sometimes break out in sweat or almost feel physically sick.
4. Imagine you are in the dentist's chair to have your teeth cleaned. While you are waiting the dentist or hygienist is getting out the instruments which will be used to scrape your teeth around the gums, how do you feel?
 - a. Relaxed.
 - b. A little uneasy.
 - c. Tense.
 - d. Anxious.
 - e. So anxious that I sometimes break out in sweat or almost feel physically sick.

*General Self-Efficacy Scale**

Next, you are asked to indicate to what extent you agree with the following statements:

(Options per statement were: Not at all true, Hardly true, Moderately true, Exactly true)*

- I can always manage to solve difficult problems if I try hard enough.
- If someone opposes me, I can find the means and ways to get what I want.
- It is easy for me to stick to my aims and accomplish my goals.
- I am confident that I could deal efficiently with unexpected events.
- Thanks to my resourcefulness, I know how to handle unforeseen situations.
- I can solve most problems if I invest the necessary effort.
- I can remain calm when facing difficulties because I can rely on my coping abilities.

- When I am confronted with a problem, I can usually find several solutions.
- If I am in trouble, I can usually think of a solution.
- I can usually handle whatever comes my way.

*Dental Avoidance**

Have you ever avoided seeking dental treatment for as long as possible?

yes

no

Have you ever avoided seeking dental treatment because you were afraid of visiting the dentist?

yes

no

*Barriers & Barrier reduction [Open Questions] **

If you are visiting the dentist for preventative check-ups less than once a year, what is stopping you from going there regularly?

What would help you to feel more comfortable when going to the dentist for a preventative check-up?

What would help you going to the dentist for preventative check-ups more frequently?

If you feel a little uneasy, tense or anxious when going to the dentist, what could reduce these feelings when going for preventative dental check-ups?

Note. information written in italics was not visible for the participants

Appendix B

Participant Information Sheet and Statement of consent

Participant Information Sheet

Hello, we are two psychology students from the University of Twente researching within the topic of Dental Anxiety for our bachelor's thesis. We are investigating factors influencing Dental Anxiety and Dental Avoidance and aim to gain knowledge about how methods for managing and reducing Dental Anxiety in students can be enhanced. We are looking for students between the age of 18 and 29 to participate in our study.

If you agree to participate in this research, you will be asked to answer a short questionnaire which will take you approximately 15 minutes. The questions will cover the following topics: the fear of dentists, dentist offices and dental procedure, habits of going to the dentist, dental avoidance and self-efficacy.

The research is designed in a way to minimize any risks for the participants. Risks include feelings of discomfort when answering the questions. If the participation in this study causes you any concerns, anxiety, or distress, please do not hesitate to contact the student counseling (<https://www.utwente.nl/en/ces/sacc/coaching-counselling/student-counsellor/>).

Your participation in this study is completely voluntary and you may refuse to complete the study or withdraw from the study at any time. You may also skip any question that makes you feel uncomfortable without justifying your decision. If you decide to withdraw from the study after completing the survey, please send one of the researchers an email with your participation number (which you will receive at the beginning of the study) until November 20th, 2022.

All data from this study will be kept from inappropriate disclosure and will be accessible only through the university of Twente and to the researchers and their supervisors until the 1st of November 2024. Your name will not be connected to your responses or results and data will be handled completely confidential.

If you would like to receive information about the outcomes of this study, please contact one of the researchers via email by the end of the academic semester.

In case you have any questions or concerns, please feel free to contact us via email:

h.j.j.pinkster@utwente.nl

v.m.warschat@student.utwente.nl

l.hennig@student.utwente.nl

Statement of consent

I confirm that I have read and understood the participant information in the information sheet. I have had the opportunity to consider the information, ask questions, and have had these answered satisfactorily.

I understand that in order to take part in this study, I should be between 18 and 29 years old.

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.

I understand that my data is anonymous and will be stored on secure university servers and that it will only be used for research purposes.

I consent to take part in this study.

Appendix C

Corah's Dental Anxiety Scale (CDAS)

1. If you had to go to the dentist tomorrow for a check-up, how would you feel about it?
 - a. I would look forward to it as a reasonably enjoyable experience.
 - b. I wouldn't care one way or the other.
 - c. I would be a little uneasy about it.
 - d. I would be afraid that it would be unpleasant and painful.
 - e. I would be very frightened of what the dentist would do.

2. When you are waiting in the dentist's office for your turn in the chair, how do you feel?
 - 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.

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?
 - 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.

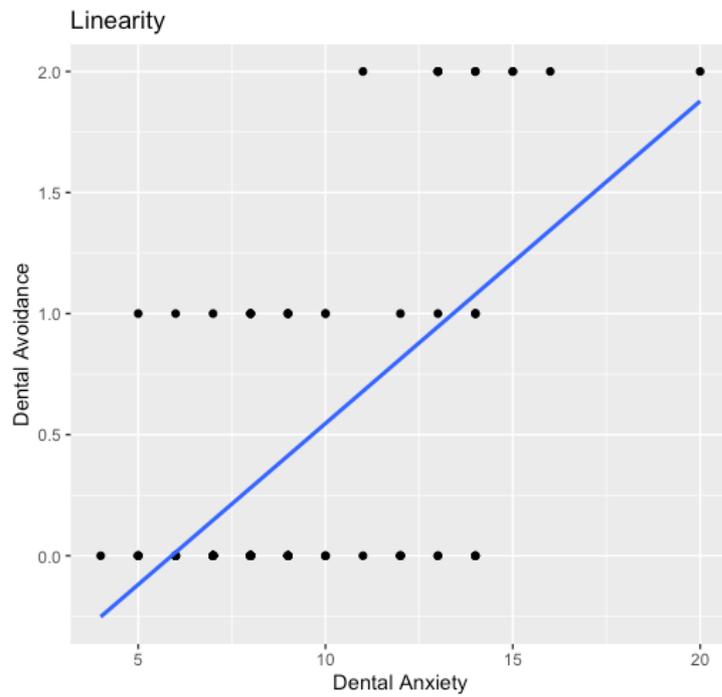
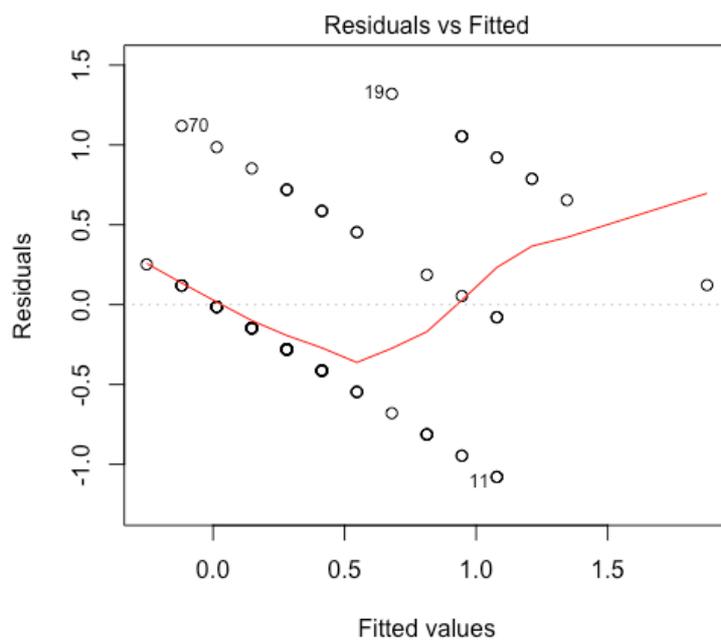
4. Imagine you are in the dentist's chair to have your teeth cleaned. While you are waiting and the dentist or hygienist is getting out the instruments which will be used to scrape your teeth around the gums, how do you feel?
 - a. Relaxed.
 - b. A little uneasy.
 - c. Tense.
 - d. Anxious.
 - e. So anxious that I sometimes break out in a sweat or almost feel physically sick.

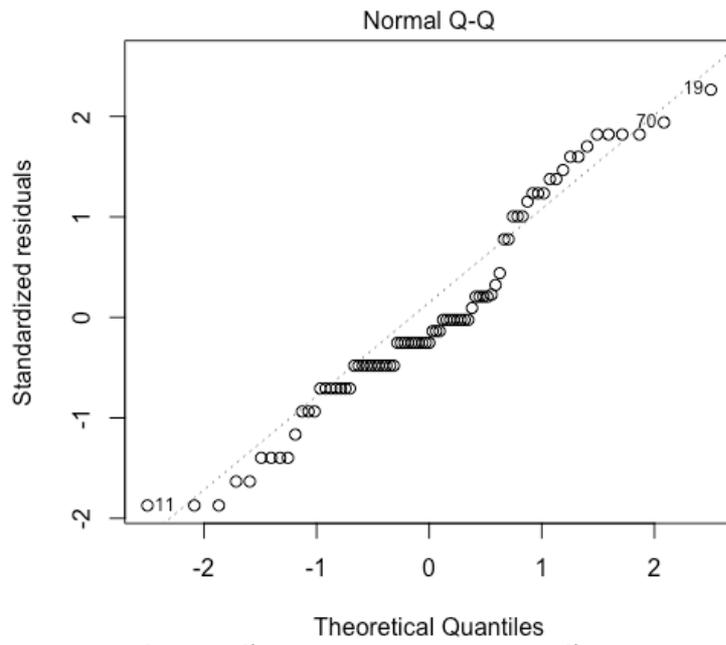
Appendix D

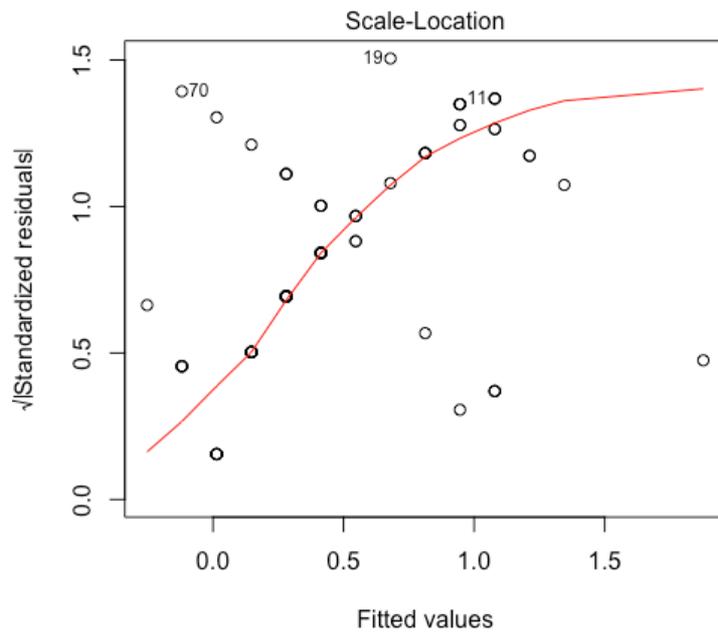
General Self-Efficacy Scale (GSE)

General Self-Efficacy Scale (GSE)

	Not at all true	Hardly true	Moderately true	Exactly true
1. I can always manage to solve difficult problems if I try hard enough	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. If someone opposes me, I can find the means and ways to get what I want.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. It is easy for me to stick to my aims and accomplish my goals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I am confident that I could deal efficiently with unexpected events.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I can solve most problems if I invest the necessary effort.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I can remain calm when facing difficulties because I can rely on my coping abilities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. When I am confronted with a problem, I can usually find several solutions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. If I am in trouble, I can usually think of a solution	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I can usually handle whatever comes my way.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*Appendix E***Figure 1***Linearity of the data***Figure 2***Linearity residual plot*

*Appendix F***Figure***Normality of residuals*

*Appendix G***Figure***Homoscedasticity*

*Appendix H***Figure***Independence of Residual Error Terms*