



Cultural normative beliefs in the U.S. as a determinant of negative dental experiences and dental anxiety: a preliminary investigation

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Accepted: 21 October 2024 / Published online: 4 November 2024
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Abstract

Dental anxiety, a predictor of both dental treatment avoidance and health outcomes, has been linked with early negative dental experiences. The causes of this relationship remain largely unexplored. This study provides a preliminary exploration of within-cultural variations of dental normative beliefs on the perception of negative dental experiences and the subsequent experience of dental anxiety in the U.S. A sample of 190 U.S. adults recruited from Amazon's MTurk completed measures of cultural normative beliefs about oral health care, age and fear at first dental visit, history of negative dental experiences, and dental anxiety. Factor analysis yielded support for a three-factor model (daily maintenance, regular check-up, and dental treatment) of the dental cultural normative beliefs scale. Correlations and structural equation modeling found support for a previously posited theoretical model in which negative dental experiences and fear at first dental visit mediate associations between the cultural normative beliefs and dental anxiety. Most notably, cultural normative beliefs favoring a prevention orientation to dental treatment and daily maintenance of oral health predicted less fear at the first dentist visit, which in turn, related to fewer negative dental experiences and less dental anxiety. This preliminary survey suggests that dental cultural normative beliefs within the U.S. shape fear during initial dental visits. Future research should build on this initial work and explore between-cultural norm variations as well as strategies for changing cultural normative beliefs to improve perceptions of dental experiences and lessen dental anxiety.

Keywords Anxiety · Dental · Culture · Beliefs · Norms · Oral health

Introduction

Dental anxiety refers to excessive fear of dental stimuli and procedures; this fear often results in avoidance or significant distress (Seligman et al., 2017). A recent meta-analysis estimated global dental anxiety prevalence rates of 36.5% for children 3 to 5 years old, 25.8% for children 6 to 12 years

old, and 13.3% in adolescents years old between the ages of 13 and 18 (Grisolia et al., 2021). Another meta-analysis estimated that 11.2% of the adult population suffers from high dental fear and anxiety (Silveira et al., 2021). It is estimated that in the United States, 1 in 5 adults experience moderate to high levels of dental anxiety (National Institutes of Health [NIH], 2021; White et al., 2017).

Dental anxiety is a predictor of both dental treatment avoidance and health outcomes (Crego et al., 2014; Jain et al., 2019; NIH, 2021; Stein Duker et al., 2022). It is associated with behavior leading to poorer dental health, such as lower frequency of dental visits (Guentsch et al., 2017; Sohn & Ismail, 2005; Singh, & Brennan, 2021), avoidance of treatment (Armfield & Ketting, 2015), and uncooperative behavior in dental visits (AlGharebi et al., 2021). It is also linked with increased likelihood of oral bleeding, and diseased, missing, and filled teeth (Bairappan et al., 2020; Dye et al., 2019; Coxon et al., 2019; Kakkar et al., 2016; NIH, 2021). Further, oral health, which is predicted by dental

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anxiety (Heaton et al., 2023), is associated with downstream adverse consequences outside the oral cavity, including diabetes (Herrera et al., 2023), heart disease, stroke, and asthma (Botelho et al., 2022; Dietrich et al., 2017).

Previous studies support the hypothesis that direct conditioning, particularly in childhood and early adolescence, is key to the development of dental anxiety (Carrillo-Díaz et al., 2021). For example, Davey (1989) and De Jongh et al. (1995) found that individuals reporting early painful and distressing dental experiences have greater dental anxiety. Similarly, Townend et al. (2000) found that youth diagnosed with dental anxiety report more visits to the dentist that are perceived as traumatic as compared to youth not diagnosed with dental anxiety. Further, the factors that appear to interfere with the development of dental anxiety are consistent with the literature on latent inhibition of conditioning. Latent inhibition arises when a history of non-fearful learning prior to a fear conditioning event interferes with fear conditioning (Lubow & Weiner, 2010). In line with the phenomenon of latent inhibition, individuals who experience non-fearful dental events prior to potentially fearful or distressing dental events are less likely to develop dental anxiety (Seligman et al., 2023).

Cultural factors also appear to be key to understanding the development of dental anxiety (Seligman et al., 2017; Wong et al., 2020). In line with Oyserman (2017), we regard culture as human-related processes that are differentially common among regions of the world and subgroups in a society, with identifiable patterns displayed within groups. Culture involves a complex array of social, economic, psychological, and environmental factors, each of which might contribute to differences in dental anxiety (Folayan et al., 2004). Indeed, studies have identified differences in dental anxiety between ethnic groups across countries (between-cultural variations; Schwarz & Birn, 1995; Stein Duker et al., 2022). Studies have also identified differences among ethnic, regional, and social groups within the same country (within-cultural variations; Folayan et al., 2004). For example, in the U.S., dental anxiety levels vary based on both ethnic group membership (e.g., Puerto Rican immigrants, Black Americans) as well as by religious denomination (e.g., Ingman et al., 1999; Weisenberg et al., 1975). Studies also find that the relationships between dental anxiety and predictors of dental anxiety, such as age and gender, vary in magnitude based on culture (Folayan et al., 2003). These latter results are consistent with research showing that between and within-cultural variations modulate the relationship between anxiety and established predictors of anxiety (Jefferies & Ungar, 2020; Ollendick et al., 1996).

Although social-cultural context appears to shape dental anxiety, the specific mechanisms linking culture to dental anxiety are not yet clarified. The present research examines

one psychological mechanism that we hypothesize links culture and dental anxiety: cultural normative beliefs. Cultural normative beliefs, or culturally-shared “common sense”, are communal ideas and evaluations regarding what is standard in a cultural group (Zuo et al., 2009). That is, cultural normative beliefs are what members of a cultural group believe the others in the group tend to think or how they tend to behave. A robust literature finds that individuals interpret their world, make decisions, and react based, in part, on the norms and values they perceive to be widespread in their cultural group (Cialdini & Trost, 1998; Cerezo et al., 2023; Chiu et al., 2010; Feng et al., 2023). For instance, research finds that Latinx Americans are more likely than White Americans to hold a fatalistic normative belief toward cancer (e.g., a belief that individuals are unable to avoid cancer) and this belief reduces compliance with cancer screening recommendations (Chen et al., 2018). Other research has found that shared cultural beliefs about sport activities being unfeminine is related to reduced physical activity in Arab Muslim women (Sofian et al., 2010). In terms of cultural beliefs for dental care, normative beliefs may include, “others from my group go to the dentist only when they have pain or discomfort in their mouth,” and “others from my group value brushing and flossing regularly.”

As noted previously, cultural normative beliefs exist at multiple levels, such as across an entire country or within a specific geographic region or sociopolitical or strata of a country. The value of these beliefs is that they inform group members what actions have been used successfully to meet members’ needs in the past (e.g., maintaining group cohesion, minimizing financial burdens). Cultural normative beliefs are not objective assessments of group consensus, but are measurable perceptions shared through communication (Chiu & Hong, 2006; Guimond et al., 2014; Lehman et al., 2004). As such, cultural normative beliefs are perceptions transmitted among group members that are used by the members as guides for their own judgement and action (Oyserman, 2017; Shteynberg, 2010). One objective of the present study is to generate an instrument to assess cultural normative beliefs regarding dental care in the U.S. A second objective is to test theoretically derived relationships between measured dental care normative beliefs and perception of negative dental experiences and the subsequent experience of dental anxiety.

In a recent review, Seligman et al. (2017) proposed a model which explains how cultural normative beliefs can shape dental anxiety. First, the model begins with variations in cultural normative beliefs about oral health care. Key to these beliefs may be that others in the cultural group engage in regular preventative dental health actions or they instead avoid dental care. Specifically, the normative view in some cultures may favor a preventative approach to

dental health, whereas other cultures may take a more passive approach. Second, the model posits that these cultural beliefs can shape a child's learning history. For example, normative beliefs that support a more passive approach to oral health may delay a parent's decision to bring their child to the dentist for early and regular preventative care, resulting in a higher likelihood of early dental experiences being associated with pain, shame, and discomfort. That is, cultural beliefs are thought to influence the likelihood one will experience early adverse dental care experiences that serve as fear conditioning events. Additionally, cultural normative beliefs (e.g., dental visits are something to avoid) could also raise a child's fear and distress during early dental visits through verbal learning. Third, when there are increased early fear conditioning events during dental care, it raises the likelihood that dental anxiety will develop (De Jongh et al., 1995). Fourth and finally, this heightened fear should result in biased attention to and processing of potential conditioning events, thereby making future direct conditioning more likely.

The model proposed by Seligman et al. (2017) holds that cultural normative beliefs influence early dental care avoidance behavior and fear during early dental visits, increasing the likelihood of early dental experiences functioning as fear conditioning events. These early experiences increase the likelihood of subsequent dental experiences becoming adverse learning experiences, which, in turn, result in dental anxiety by direct conditioning. Although these initial pathways (behavioral avoidance and fear during early visits) from cultural beliefs to dental anxiety are plausible based on previous research in this area, no study to date has measured oral health cultural normative beliefs and evaluated them in the context of dental behaviors.

The present cross-sectional research examined the links between cultural normative beliefs, dental experiences, and dental anxiety in a US community sample. This within-culture study provides a useful starting point, as it holds constant many other factors, such as variations in dental resources across nations (Oyserman, 2017). The first

objective of the study was to devise and assess a self-report scale of cultural normative beliefs regarding oral health care. As research has not previously measured dental normative culture beliefs, the scale creation was exploratory. A second objective was to test the model of Seligman et al. (2017) regarding the links between cultural normative beliefs and dental anxiety. A set of primary hypotheses were made based on this theoretical model and tested with self-reported instruments. First, it was hypothesized that cultural normative beliefs supporting a more prevention-oriented, or active, approach toward oral health care would be negatively related to the age of one's first dental visit. Second, it was hypothesized that preventative cultural normative beliefs would be inversely related to retrospectively reported fear at one's first dental visit. Third, it was hypothesized that older age at first visit and higher fear at first visit would, in turn, predict the experience of a greater number of negative dental experiences throughout one's dental history. Fourth, it was hypothesized that the number of negative dental experiences would predict greater dental anxiety. Finally, it was hypothesized that negative dental experiences would mediate the relationships between cultural normative beliefs, age of first dental visit, fear at first visit, and dental anxiety. This model after scale development (see below) is depicted in Fig. 1. Finally, additional analyses included correlations among study measures.

Methods

Participants

Community participants ($N=194$) were recruited from Amazon's MTurk. Inclusion criteria were that participants live in the United States at the time of survey completion and be fluent in the English language. Exclusion criteria were less than a 95% approval rating on MTurk and having never visited the dentist. Two participants reported never visiting the dentist and were excluded from analyses. During data

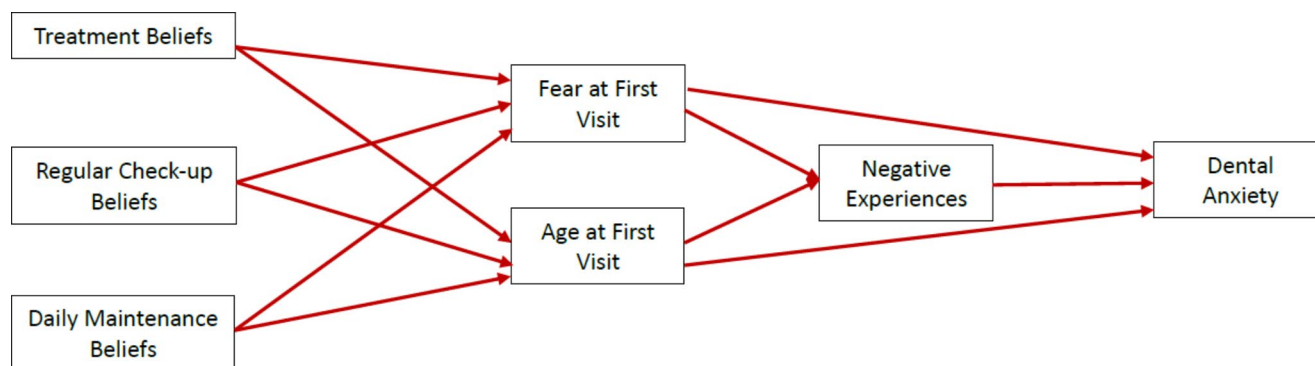


Fig. 1 Initial conceptual model

analysis, it was found that two participants reported they did not visit the dentist until they were 50 and 60 years old respectively, with corresponding z -scores of 6.4 and 7.9 for this variable. We also determined that these latter two cases were influential observations in our analyses below (each Cook's distance > 1). As such, these two cases were excluded from all analyses, resulting in a final sample of $N = 190$. Table 1 displays sample demographic information including gender, age, race/ethnicity, number of siblings, and relative age of these siblings.

Procedures

Participants were recruited through MTurk, a widely used online crowdsourcing data collection platform that provides a large and diverse base of potential participants. MTurk samples tend to approximate the general US population on

the characteristics of gender and race (Burnham & Piedmont, 2018). Survey items were completed using the Qualtrics survey software which was selected because it provides an easy to use, visually appealing, and secure online data collection interface. Measures were presented in random order using the Qualtrics survey program. Individuals were compensated \$1 USD for their participation. All methods and procedures were approved by the University Institutional Review Board (IRB) and were conducted in compliance with the guidelines of the American Psychological Associations and with the policies and principles contained in the Declaration of Helsinki.

Measures

Participants completed measures for the variables depicted in the model in Fig. 1: dental cultural normative beliefs, age of first dental visit, fear at first dental visit, history of negative dental experiences, and dental anxiety. Participants also completed demographic items. All measures were administered as part of a larger survey on anxiety and dental health.

Demographic information

Participants completed demographic items including gender, age, race/ethnicity, number of siblings, and relative age of these siblings (see Table 1).

Within-cultural normative beliefs about oral health care

Nine items were administered to assess perceptions of U.S. cultural normative beliefs regarding oral health care. The items were designed to gauge participants' perceptions of the consensual thoughts and actions of others in the cultural group. The items were based closely on items of normative beliefs in other concept domains designed by Zou et al. (2009) and Fischer et al. (2009). The process of item selection was as follows. First, we generated a pool of potential items. These items were then evaluated for consistency with the concept of perceived normative consensus, as described by Zou et al. (2009). Specifically, items were appraised in terms of whether they assessed implicit perceptions of cultural consensus beliefs and values. This removed items that assessed one's personal opinions and behaviors as well as items assessing desired opinions and behaviors for the cultural group. Next, items were evaluated in terms of wording clarity and face validity. This process resulted in the final scale items. In the survey, participants responded to these items on a 9-point Likert scale, with values ranging from 1 (*strongly disagree*) to 9 (*strongly agree*). Items were reversed scored as needed so higher scores equated to

Table 1 Sample characteristics

Participant characteristics	$N = 190$	%
Age		
20 to 26	33	17.5
27 to 33	54	28.4
34 to 40	44	23.2
41 to 47	23	12.2
48 to 54	17	9.1
≥ 55	18	9.5
Missing	0.5	0.5
Sex		
Female	72	37.9
Male	117	61.6
Other-identified	1	0.5
Race/Ethnicity		
White	146	76.8
African American/Black	20	10.5
Hispanic/Latino	11	5.8
Asian	11	5.8
American Indian/Alaskan Native	1	0.5
Bi- or Multi-racial	1	0.5
Older siblings		
0	209	58.9
1	113	31.8
2	18	5.1
3	11	3.1
4	3	0.8
7	1	0.3
Younger siblings		
0	224	63.5
1	101	28.6
2	21	5.9
3	4	1.1
4	2	0.5
6	1	0.2

Two additional participants reported they had never visited the dentist and were excluded from the sample

normative beliefs that reflect a more prevention orientation to dental care.

First dental visit measures

The following item was used to assess age of first dental visit: “How old were you the first time you visited the dentist?” Fear during first dental visit was assessed using the following item, “When I first visited the dentist, I was:”, with response options of 1 (*too afraid to go*), 2 (*very afraid*), 3 (*somewhat afraid*), 4 (*slightly afraid*), and 5 (*not afraid*). This item was reversed scored so that higher scores equated to higher dental fear.

History of negative dental experiences

The occurrence of negative dental care was assessed using the 16 traumatic dental experience items from the Level of Exposure-Dental Experiences Questionnaire (LOE-DEQ; Oosterink et al., 2008). This included 8 items on dentist behavior, 5 on patient emotional distress, and 3 on other dental distressing events. The 7-item general traumatic subscale (non-dental events) of the LOE-DEQ was not administered. The language of the LOE-DEQ was adjusted to conform to common English usage in the United States (e.g., “criticised” became “criticized”). This measure includes questions such as “You had a tooth drilled which caused extreme pain or other severe distress?”. Response options were dichotomous, coded as *No* = 0; *Yes* = 1. The 16-item LOE-DEQ has displayed acceptable test-retest reliability (intra-class correlation = 0.78) and internal consistency ($\alpha = 0.69$ to 0.85) across a variety of samples (Al-Bitar & Al-Ahmad, 2017; Oosterink et al., 2008; Scandurra et al., 2021). In the present sample, the measure displayed comparable reliability $\alpha = 0.69$. The instrument has demonstrated evidence of concurrent, discriminant, and predictive validity, in relation to trauma-related symptomatology and distress (Al-Bitar & Al-Ahmad, 2017; Humphris & King, 2011; Oosterink et al., 2008). Responses were summed to create an overall negative dental experience score, with higher values equating to more adverse dental experiences.

Dental anxiety

Dental anxiety was measured using the Modified Dental Anxiety Scale (Humphris et al., 1995). Answers to the five-items are provided on a five-point Likert scale, ranging from (1) *not anxious* to (5) *extremely anxious*. A sample question is “If you were sitting in the WAITING ROOM (waiting for treatment), how would you feel?”. The 5 items were summed to form an overall dental anxiety score ($\alpha = 0.92$), with higher scores reflecting greater levels of anxiety.

Statistical analysis

We first examined descriptive statistics, frequencies, and plots of the raw data to identify if implausible values were present, determine the extent of incomplete data, and screen for possible violations of assumptions. We then obtained bivariate correlations to assess the associations among the study variables. In addition, nearly all 190 cases reported complete data; 3 participants did not report the age at which they first visited the dentist. No excessive non-normality was indicated, as values for skewness and kurtosis were below 2.0 for each variable, which are below absolute values of 3.0 for skewness and 8.0 for kurtosis (Kline, 2016). Note that we obtained parameter estimates for the correlational and path analyses, described below, via maximum likelihood estimation and robust standard errors (i.e., MLR). This procedure is robust to violations of normality and heteroscedasticity and obtains optimal parameter estimates when response data are incomplete (Darlington & Hayes, 2016). Next, in line with our first study objective, we conducted an exploratory factor analysis (EFA) on the items regarding cultural normative beliefs related to oral health care to clarify the underlying construct(s).

In line with study objective two, path analysis via structural equation modeling was then used to assess the adequacy of the hypothesized model displayed in Fig. 1. For the specific indirect effects, percentile bootstrapped confidence intervals were obtained, with statistical significance indicated when a given interval did not include a value of zero. Bootstrapping does not rely on distributional assumptions (e.g., normality) and is recommended particularly for testing indirect effects, given that such effects are often non-normally distributed (Hayes, 2017; MacKinnon, 2012). For this procedure, we obtained 20,000 bootstrapped samples to help ensure accurate inferences. Although we used an alpha level of 0.05 for all statistical tests and 95% bootstrapped confidence intervals for the specific indirect effects, we also report *p* values for the direct and total effects and 99% bootstrapped confidence intervals for the specific indirect effects to allow readers to assess effects under more stringent alpha levels. To evaluate the overall fit of the model, we defined a well-fitting path model as one where the comparative fit index (CFI) exceeds a value of 0.90, the root mean square error of approximation (RMSEA) is less than 0.08, and the standardized root mean square residual (SRMR) is less than 0.05 (Pituch & Stevens, 2015). We also report the chi-square test of model fit, where a non-significant test result supports the fit of the model. The correlational and path analyses were conducted using Mplus software version 8.6 (Muthén & Muthén, 1998–2022).

Power analysis

With our sample size ($N=190$), the mediation analyses had adequate power to detect all but small effects, with small, moderate, and large R^2 values being 0.02, 0.13, and 0.26, respectively (Cohen, 1988). We used the Monte Carlo procedure in Mplus to identify the minimum detectable effect size, given $N=190$, for a specific three-path indirect effect and used this same effect size to assess the power available for a given two-path indirect effect, because three- and two-path indirect effects appear in the mediation model. For these analyses, we set alpha at 0.05, used 20,000 Monte Carlo replications, and determined the size of the indirect effect that would obtain power ≥ 0.80 (Muthén & Muthén, 1998–2022; Thoemmes et al., 2010). For the three-path indirect effect, power analyses indicated that a sample size of 190 achieves power = 0.85, given that each variable involved in a specific indirect effect (e.g., treatment beliefs $\rightarrow$ fear at first visit $\rightarrow$ negative experiences $\rightarrow$ dental anxiety) accounted for 9% of the variance in each respective outcome, which corresponds to a standardized indirect effect = 0.027 (i.e., $0.3 \times 0.3 \times 0.3$). For a two-path indirect effect, our power analysis indicated that a sample size of 190 achieves power = 0.99, given the same effect size for a specific indirect effect (e.g., treatment beliefs $\rightarrow$ fear at first visit $\rightarrow$ dental anxiety), which corresponds to a standardized indirect effect = 0.09 (i.e., 0.3×0.3).

Results

Participant characteristics

Participant information is presented in Table 1.

Cultural normative beliefs measure

Given that we created this measure of cultural normative beliefs related to oral health care, we conducted an EFA using SAS (n.d.) software (version 9.4) to clarify the underlying construct(s). We estimated EFA models with the number of factors varying from one to three using maximum likelihood

estimation with the (oblique) promax rotation method. A three-factor solution was supported by the EFA, and the interpretation of each factor was intuitive (see supplemental materials for further description of the EFA). Although parallel analysis supported a two-factor model, examination of the scree plot (Fig. 1 in the supplementary materials) and, particularly, values of the RMSEA, which were 0.241, 0.180, and 0.076 for the one-, two-, and three-factor models, respectively, supported the three-factor model. A four-factor model was not tenable, as none of the items loaded on the fourth factor when tested. Thus, the three-factor model received the strongest support. We labeled the resultant factors “Dental treatment cultural beliefs” (4 items; $\alpha=0.84$; example item: In general, I believe others from my cultural group go to the dentist only when they have pain or discomfort in their mouth), “Daily maintenance cultural beliefs” (3 items; $\alpha=0.73$; example item: Others from my cultural group highly value brushing and flossing regularly to prevent dental health problems), and “Regular check-up cultural beliefs” (2 items; $\alpha=0.81$; example item: In general, I believe that others from my cultural group visit the dentist regularly to prevent cavities). We formed subscale scores by computing the mean across items of the respective subscales. Correlations among the subscales are displayed in Table 2. See Table 1 in the supplemental material for the scale items and factor loadings.

Correlational analyses

Table 2 shows the correlations among study variables. All of the cultural belief variables were positively intercorrelated and each was negatively correlated with age at first visit. Dental treatment cultural beliefs and daily maintenance cultural beliefs scores were both negatively associated with fear at first visit. Having more preventative dental treatment cultural beliefs was also negatively associated with dental anxiety. Finally, dental anxiety was positively correlated with age at first visit, fear at first dental visit, and the number of negative dental experiences.

Table 2 Descriptive statistics and correlations for study variables ($N=190$)

Variable	M	SD	1	2	3	4	5	6	7
1. Dental anxiety	13.4	5.9	—	0.35**	0.42**	0.17*	−0.23**	0.03	−0.08
2. Negative dental experiences	2.3	2.3		—	0.23**	0.16*	−0.08	−0.01	0.04
3. Fear at first visit	2.6	1.2			—	0.18*	−0.23**	0.02	−0.22**
4. Age at first visit	7.5	4.4				—	−0.31**	−0.27**	−0.20**
5. Dental treatment beliefs	5.7	1.9					—	0.42**	0.53**
6. Check-up beliefs	6.4	1.8						—	0.46**
7. Daily maintenance beliefs	6.7	1.6							—

Values above were obtained via maximum likelihood estimation, which used data from all 190 participants

* $p < .05$, ** $p < .01$

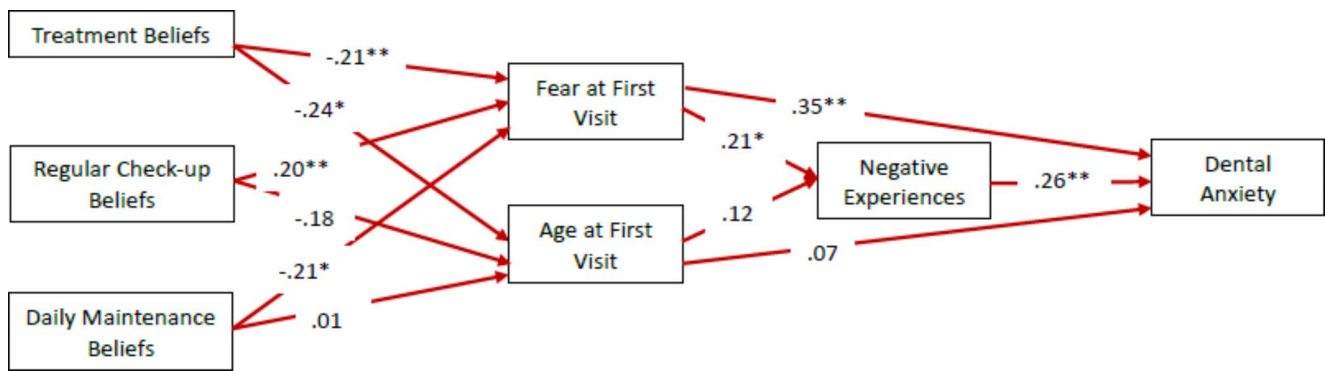


Fig. 2 Final model with standardized path estimates

Table 3 Standardized direct, total indirect, and total effects for the model

Hypothesized determinant	Direct effect		Total indirect effect		Total effect	
	β (SE)	p-value	β (SE)	p-value	β (SE)	p-value
Fear at first visit ($R^2 = 0.10$)						
Regular check-up beliefs	0.20 (0.08)	0.007	--	--	0.20 (0.08)	0.007
Dental treatment beliefs	− 0.21 (0.07)	0.005	--	--	− 0.21 (0.07)	0.005
Daily maintenance beliefs	− 0.21 (0.09)	0.022	--	--	− 0.21 (0.09)	0.022
Age at first visit ($R^2 = 0.12$)						
Regular check-up beliefs	−0.18 (0.10)	0.080	--	--	−0.18 (0.10)	0.080
Dental treatment beliefs	− 0.24 (0.09)	0.009	--	--	− 0.24 (0.09)	0.009
Daily maintenance beliefs	0.01 (0.09)	0.931	--	--	0.01 (0.09)	0.931
Negative dental experiences ($R^2 = .06$)						
Regular check-up beliefs	--	--	0.02 (0.03)	0.525	0.02 (0.03)	0.525
Dental treatment beliefs	--	--	− 0.07 (0.03)	0.008	− 0.07 (0.03)	0.008
Daily maintenance beliefs	--	--	−0.04 (0.03)	0.139	−0.04 (0.03)	0.139
Fear at first visit	0.21 (0.07)	0.003	--	--	0.21 (0.07)	0.003
Age at first visit	0.12 (0.08)	0.135	--	--	0.12 (0.08)	0.135
Dental Anxiety ($R^2 = .24$)						
Regular check-up beliefs	--	--	0.06 (0.04)	0.129	0.06 (0.04)	0.129
Dental treatment beliefs	--	--	− 0.11 (0.04)	0.004	− 0.11 (0.04)	0.004
Daily maintenance beliefs	--	--	− 0.08 (0.04)	0.045	− 0.08 (0.04)	0.045
Fear at first visit	0.35 (0.07)	<0.001	0.06 (0.02)	0.013	0.40 (0.07)	<0.001
Age at first visit	0.07 (0.07)	0.306	0.03 (0.02)	0.147	0.10 (0.07)	0.128
Negative dental experiences	0.26 (0.07)	<0.001	--	--	0.26 (0.07)	<0.001

β is a standardized estimate, where all variables in the model are standardized. Bolded values indicate statistical significance

Path analysis results

The hypothesized path model exhibited good fit to the data, CFI=0.93, RMSEA=0.07, SRMR=0.04, $\chi^2(7)=13.3$, $p=.06$. Figure 2 shows the standardized path estimates, Table 3 displays the standardized direct, (total) indirect, and total effects, and Table 4 shows results associated with the specific indirect effects. In the hypothesized model, it was expected that prevention-oriented cultural normative beliefs would be negatively related to fear at first dental visit and age of first dental visit. For the direct effects in the model, preventative cultural normative beliefs toward dental treatment and daily maintenance beliefs were negatively associated with fear at first dental visit, with preventative regular

check-up cultural beliefs being positively associated. Dental treatment cultural beliefs were the only cultural belief variable associated with age at first dental visit. Although several hypothesized paths were not significant, the model further revealed fear at first visit to be positively associated with negative dental experiences and dental anxiety, and negative dental experiences to be positively associated with dental anxiety.

The results provided evidence for mediation. First, as Table 4 indicates, there were mediated effects for the cultural normative belief scales. Specifically, all three cultural belief variables were indirectly related to negative dental experiences, and more distally to dental anxiety, via fear at first dental visit. These pathways were negative for preventative

Table 4 Standardized specific indirect effects for negative dental experiences and dental anxiety

Specific indirect path	Effect	95% CI ^a
Negative dental experiences		
Check-up beliefs → Fear at first visit → Negative dental experiences	0.04*	[0.007, 0.093]
Check-up beliefs → Age at first visit → Negative dental experiences	− 0.02	[− 0.079, 0.007]
Dental treatment beliefs → Fear at first visit → Negative dental experiences	− 0.04*	[− 0.097, − 0.007]
Dental treatment beliefs → Age at first visit → Negative dental experiences	− 0.03	[− 0.086, 0.008]
Daily beliefs → Fear at first visit → Negative dental experiences	− 0.04*	[− 0.098, − 0.003]
Daily beliefs → Age at first visit → Negative dental experiences	0.01	[− 0.023, 0.036]
Dental Anxiety		
Check-up beliefs → Fear at first visit → Dental Anxiety	0.07**	[0.014, 0.139]
Check-up beliefs → Fear at first visit → Negative dental experiences → Dental Anxiety	.01**	[0.002, 0.025]
Check-up beliefs → Age at first visit → Dental Anxiety	− 0.01	[− 0.042, 0.015]
Check-up beliefs → Age at first visit → Negative experiences → Dental Anxiety	− 0.01	[− 0.021, 0.002]
Dental treatment beliefs → Fear at first visit → Dental Anxiety	− 0.07**	[− 0.141, − 0.017]
Dental treatment beliefs → Fear at first visit → Negative experiences → Dental Anxiety	− 0.01*	[− 0.026, − 0.002]
Dental treatment beliefs → Age at first visit → Dental Anxiety	− 0.02	[− 0.065, 0.012]
Dental treatment beliefs → Age at first visit → Negative dental experiences → Dental Anxiety	− 0.01	[− 0.023, 0.002]
Daily beliefs → Fear at first visit → Dental Anxiety	− 0.07**	[− 0.141, − 0.008]
Daily beliefs → Fear at first visit → Negative dental experiences → Dental Anxiety	− 0.01*	[− 0.028, − 0.001]
Daily beliefs → Age at first visit → Dental Anxiety	0.01	[− 0.018, 0.022]
Daily beliefs → Age at first visit → Negative dental experiences → Dental Anxiety	0.01	[− 0.006, 0.009]
Fear at first visit → Negative dental experiences → Dental Anxiety	0.06**	[0.016, 0.104]
Age at first visit → Negative dental experiences → Dental Anxiety	0.03	[− 0.010, 0.079]

Bolded values indicate statistical significance

^a 95% CI displays the lower and upper limits of a 95% percentile bootstrapped confidence interval for a standardized effect

* 95% percentile bootstrapped confidence interval does not include a value of 0

** 99% percentile bootstrapped confidence interval does not include a value of 0

dental treatment-and daily maintenance cultural beliefs, but positive for regular check-up cultural beliefs. In addition, cultural beliefs favoring a preventative approach to dental treatment and daily maintenance were also negatively associated with distal dental anxiety through the longer pathway involving fear at first visit and negative dental experiences,

with a preventative approach to regular check-ups having a positive indirect association following this same pathway. Note though that Table 3 indicates that the total effects of regular check-up beliefs were not significant for negative dental experiences and dental anxiety, whereas the total effects of dental treatment beliefs were significant for negative dental experiences and the total effects of dental treatment-and daily maintenance beliefs were significant for dental anxiety. Fear at first visit was also indirectly and positively associated with distal dental anxiety via negative dental experiences. No indirect association occurred through age at first visit and this variable was not directly or indirectly related to negative dental experiences or distal dental anxiety.

Discussion

This study was a preliminary investigation into the possibility that within-cultural normative variations play a role in the development of dental anxiety in the U.S. In doing so, we tested the model proposed by Seligman et al. (2017) to ascertain whether cultural normative beliefs, via their influence on fear and age at the first dentist visit, contribute to the occurrence of negative dental experiences and hence dental anxiety. The results provided support for the position that within-cultural normative beliefs contribute to the development of dental anxiety, with these beliefs relating directly to age and fear at first dental visit and indirectly to current dental anxiety. In addition to these primary findings, the results provide support for and insight into the pathways hypothesized in the model proposed by Seligman et al. (2017). Most notably, cultural normative beliefs favoring a prevention orientation to dental treatment and daily maintenance of oral health were linked to less fear at the first dentist visit, which in turn, related to fewer negative dental experiences and less dental anxiety.

To assess the role of normative cultural beliefs in the cultural context, we began by creating an instrument to assess cultural beliefs. At the outset, we examined the factor structure of our dental cultural normative beliefs measure. Results indicated that the dental normative cultural beliefs scores were not unidimensional. Rather, there was support for the multi-dimensional nature of this instrument, which was observed to include factors pertaining to dental *treatment, daily maintenance, and regular check-up cultural beliefs*. The potential usefulness of distinguishing between these beliefs was seen in the associations observed among measures. For example, cultural normative beliefs regarding dental treatment were the only subscale to predict age of first dental visit in the mediational analysis. From these data, it may be surmised that dental treatment cultural

beliefs are particularly useful in understanding the role of culture in a parent's decision to bring their child to their first dentist appointment. That said, daily maintenance and regular check-up cultural beliefs were also related to fear at one's first dental visit and indirectly related to negative dental experiences, and dental anxiety. As such, it seems likely that all three dimensions of dental cultural beliefs have a role to play in dental health. It is important to note that this measure is new and awaits rigorous validation efforts. Future research should verify the replicability of these subscale differences and assess the generalizability of the factors among other cultural groups.

Our resulting path model (Fig. 2) displays pathways by which cultural normative beliefs are related to dental anxiety. The model shows that negative dental experiences and fear at first dental visit mediated, or partially explained, associations between dental cultural normative beliefs and dental anxiety. Specifically, more prevention-oriented cultural beliefs about dental treatment were negatively related to negative dental experiences and negatively related to dental anxiety. Daily maintenance (e.g., beliefs about daily behaviors such as brushing and flossing) cultural beliefs were also negatively related to distal dental anxiety. Thus, cultural normative beliefs appear to play a distal role in the development of dental anxiety by shaping early dental experiences which are directly and indirectly (through subsequent negative experiences) associated with dental anxiety.

Extrapolating from these findings suggests that prevention efforts targeting normative beliefs within a culture—particularly treatment and daily maintenance beliefs—could decrease fear at first visit, thereby increasing the likelihood of early positive learning events associated with dental care and providing an opportunity for the latent inhibition of dental fears (Seligman et al., 2023). Previous research has suggested that fear and trauma at early dentist visits can contribute to not only a higher rate of adverse oral (Ardenghi et al., 2012; Sanguida et al., 2019) and overall health outcomes (Halvari et al., 2019), but also to increased anxiety around dental health care (Armfield et al., 2007; Carrillo-Díaz et al., 2021). The associations between cultural beliefs and fear at first dentist visit thus suggest potentially modifiable variables (e.g., cultural normative beliefs) that might be employed to encourage engagement in formal dental health care practices early in the child's development. Our findings also underscore the potential positive impacts of providing youth and parents with positive dental health care messages early in the child's development to promote positive feelings associated with dental health care (Merdad & El-Housseiny, 2017). Dental health messages could be tailored by presenting members of the cultural reference group advocating preventative dental care and engaging in preventative dental care behaviors.

An unexpected finding was that regular check-up cultural beliefs (e.g., believing that those in one's reference group consistently visit the dentist to maintain oral health) corresponded to greater fear at one's first dental visit, negative dental experiences, and dental anxiety. These results are counterintuitive, as it may be expected that the normative belief in regular dental visits would be associated with less fear, anxiety, and negative dental experiences. Notably, although the specific indirect effects of check-up beliefs that were statistically significant on negative dental experiences and dental anxiety, the total effects of regular check-up beliefs were small for negative dental experiences (0.02) and distal dental anxiety (0.06), with the total effects not statistically significant (see Table 3). These nonsignificant total effects for the regular check-up belief variable are consistent with the nonsignificant bivariate correlations shown in Table 2 (i.e., -0.01 , 0.03). In contrast, the total effects of preventative oriented dental treatment beliefs were significant on dental anxiety (-0.11) and negative dental experiences (-0.07), and the total effect of daily maintenance beliefs on dental anxiety was also significant (-0.08). Taken together, the total effect results suggest that regular check-up beliefs played a much smaller role in accounting for negative dental experiences and dental anxiety as compared to the other cultural beliefs.

Although the total effects of regular check-up beliefs on the distal outcomes were small, it is still uncertain why these beliefs were related to increased fear in the path model. One possibility is that individuals with high regular check-up beliefs infer that their group members seek regular check-ups because they are likely at risk for dental health problems. Thus, some individuals may experience fear at their first dental visit because they believe they are likely to have problems at the visit. It is also possible that when visiting the dentist for check-ups is the norm in a cultural group, it increases the likelihood of exposure to negative social communications about unpleasant dental visits. That is, due to the norm to attend regular dental visits, individuals in the cultural group are likely to attend a larger number of visits, which in turn could increase the probability that adverse dental experiences occur, and the story of such events spread through the cultural group. This possibility would be consistent with the high spread through social communication of other low occurrence negative experiences, such as drug side effects (Faasse & Petrie, 2016).

In considering the link between dental beliefs and age of first visit, one unanticipated yet intriguing finding was that, although age of first dental visit was modestly correlated with negative dental experiences and dental anxiety, it did not mediate the paths from cultural normative beliefs to negative dental experiences and dental anxiety. The path model suggests that this was due to the non-significant direct

effects of age at first dental visit on the distal outcomes of negative dental experiences and dental anxiety. That is, after controlling for fear at first visit, age at first visit was no longer related to negative dental experiences and dental anxiety. This result was unexpected, as previous research has suggested that later ages of first dentist visits can contribute to not only a higher rate of adverse oral (Ardenghi et al., 2012; Sanguida et al., 2019) and overall health outcomes (Halvari et al., 2019), but also to increased anxiety around dental health care (Armfield et al., 2007; Carrillo-Díaz et al., 2021). The current results point to fear at first visit as perhaps a stronger determinant of dental anxiety than age of first visit. That said, the limited predictive ability of age of first dental visit in the present study may be due to having few individuals in the sample with substantial delay in their first dental visit. For example, only three participants in the analyzed sample were over the age of 20 at their first visit. It may be that greater variability in ages of first visit increases the strength of this variable. Alternatively, other unique characteristics of the present sample, such as education or participating in an online study, might have influenced the relationships observed between age at first dental visit and dental anxiety. Additional research, including a sample with greater variability of age of first dental visit, would be useful to further ascertain the mediational role of age of first dental visit from cultural normative beliefs.

As noted at the outset, previous studies have revealed differences in dental anxiety within and across ethnic and social groups (e.g., Folayan et al., 2004; Schwarz & Birn, 1995; Weisenberg et al., 1975), as well as findings suggesting that oral health and oral health care practices might vary across culture (e.g., Arora et al., 2016; Kelesidis, 2014). The present findings provide evidence that within-cultural differences may be due, in part, to normative cultural beliefs. However, it must be noted that the present investigation only examined one cultural context and was not designed to assess for differences across cultural contexts or for use in making cross-cultural generalizations. A valuable direction for further research is to build from the present exploration and assess normative cultural beliefs across countries and other cultural groups.

Limitations

There are important limitations to this work. First, the cultural normative belief measures has yet to undergo rigorous validation. Studies are needed to assess and refine this instrument. Second, while this preliminary study moves forward our understanding of early dental health care experiences, our retrospective assessment of items such as age and fear at first dentist visit is potentially biased by factors such as clarity of memory, the contribution of more recent events

to those recalled, and the amount of time elapsed between one's current age and these recalled experiences (Schwarz & Sudman, 2012). Future work in this area might benefit from the inclusion of measures designed to assess the occurrence of recent negative dental events, thus allowing for the control of such experiences in the analyses. Relatedly, study measures relied on self-reports and our variables were assessed in the absence of independent verification (e.g., age at first dental visit, the occurrence of negative dental experiences). Future inquiries may expand these results, for example, examining whether there is a differential effect of perceived versus actual dental experiences (potentially combining the reports of parents and offspring) on subsequent anxiety. Finally, the cross-sectional design of the present study precludes causal inferences, suggesting that a particularly valuable area of future investigation might be longitudinal work in which these variables are assessed across development and the elapsing of time in the context of related individual difference variables (e.g., temperamental anxiety).

Implications

This work represents a preliminary exploration into cultural normative beliefs and dental anxiety. The results provide evidence for a three-factor measure of dental cultural normative beliefs that assesses cultural normative beliefs related to treatment, daily maintenance, and regular dental check-ups. Employing this measure, we provide an empirically-based understanding of the role of within-cultural normative beliefs in the experience of negative dental experiences and subsequent dental anxiety, a model previously only supported theoretically. Although the cultural normative belief measure is new and requires validation, our initial findings suggest that early education in the form of universal prevention programming for youth might specifically seek to counteract the potential influences of within-cultural normative beliefs, which might, for example, target fears that youth have about dentists and dental health care regimens, thus allowing for more positive early experiences which could serve to offset the experience of later dental visits as negative in nature. Accordingly, the model posited here is consistent with current recommendations for best practices in oral health research. Specifically, the recent Consensus Statement on Future Directions of the Behavioral and Social Sciences in Oral Health (McNeil et al., 2022) states that many extant approaches emphasize “individual, proximal explanations of behavior”, without adequately taking into consideration the more distal and diffuse factors contributing to health such as socioeconomic status and community values. The inclusion of these broader health determinants in the theories and models tested, in line with the conceptual

model presented here, has the potential to influence public policies for oral health care in terms of both prevention and treatment (McNeil et al., 2022).

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1007/s12144-024-06879-5>.

Author contributions Data acquisition, analysis, and interpretation by AG, LS, and KP. Manuscript drafted and edited by AG, LS, KP, KC, SF, LK, ES, and MV. All authors contributed to concept, design, and revisions for intellectual content.

Funding No external funding was received for this research.

Data availability The data examined in the current study are available from the corresponding author on reasonable request.

Declarations

Ethical standards All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript. No external funding was received for this research. All methods and procedures were approved by the University of Texas Rio Grande Valley Institutional Review Board (IRB) and were conducted in compliance with the guidelines of the American Psychological Associations and with the policies and principles contained in the Declaration of Helsinki.

Conflict of interest All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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