

# Dental anxiety, oral health-related quality of life, and general well-being: A self-determination theory perspective

Anne Elisabeth Münster Halvari<sup>1</sup>  | Hallgeir Halvari<sup>2</sup> | Edward L. Deci<sup>2,3,4</sup>

<sup>1</sup>Faculty of Odontology, Department of Dental Hygienist Education, University of Oslo, Oslo, Norway

<sup>2</sup>Department of Business, Marketing and Law, University of South-Eastern Norway, Hønefoss, Norway

<sup>3</sup>Department of Psychology, University of Rochester, Rochester, NY, USA

<sup>4</sup>Institute for Positive Psychology and Education, Australian Catholic University, Strathfield, NSW, Australia

## Correspondence

Anne Elisabeth Münster Halvari, Faculty of Odontology, Department of Dental Hygienist Education, University of Oslo, Geirmyrsveien 69/71, Oslo 0455, Norway.  
Email: ahalvari@odont.uio.no

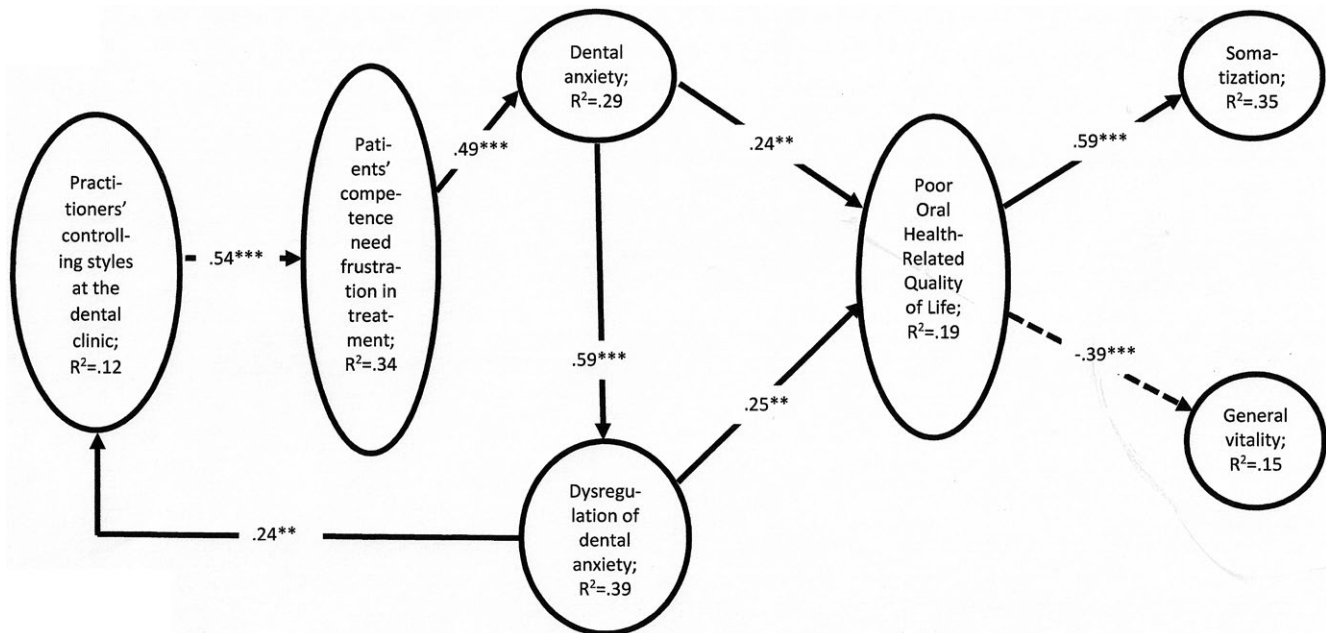
## Abstract

The aim of this study was to test a structural equation model (SEM) with the following hypotheses: (1) patients' perceptions of oral health care professionals' (i.e., dentists and dental hygienists) controlling interpersonal styles would positively predict patients' dental anxiety through their basic psychological need frustration in treatment; (2) in turn, high dental anxiety would positively predict dysregulation of dental anxiety, which through a feedback loop contributes to perception of oral health care professionals' controlling styles; and, (3) in addition, both dental anxiety and dysregulation of dental anxiety would predict poor Oral Health-Related Quality of Life (OHRQoL) and subsequently poor general well-being. A cross-sectional study was conducted among 322 students at the University of Oslo. Participants responded to a survey with validated questionnaires. All variables in the model tested were acceptably normally distributed. The SEM did fit the data well and all hypotheses were supported. A bootstrapping procedure indicated that all indirect links in the model were supported. Analysis indicated that common method variance (CMV) did not seriously distort the results in this setting. Although the majority of oral health care professionals are perceived as being noncontrolling by their patients (51%), the proportion perceived as moderately (38%) or highly (11%) controlling represent a challenge for oral health care education and practice. It would be useful for oral health care professionals to be trained in avoiding a controlling treatment style.

## 1 | INTRODUCTION

Recent research indicated that patients' perception of controlling dental treatment contexts, patients' need frustration in treatment, and their dental anxiety were strongly positively associated (Halvari, Halvari, & Deci, 2017). Dependent on population, 10–20% of adults in Western societies suffer from dental anxiety (Buunk-Werkhoven, Dijkstra, & van der Schans, 2009; Johnsen et al., 2003). Both patients' perception of controlling oral health care professionals and their fear of dental treatment or certain aspects of it (ter Horst & de Wit, 1993) are related to low dental attendance and poor oral health and functioning (Hägglin, Berggren, Hakeberg, & Ahlqwist, 1996; Halvari et al., 2017). According to the model tested in the present

study (see Figure 1), it would be important to answer questions including whether patients' perception of controlling dental treatment contexts and patients' need frustration in treatment are indirectly positively associated with poor oral health through dental anxiety; whether high dental anxiety along with the patients' high dysregulation of dental anxiety would make patients' perception of practitioners even more controlling through a feedback loop, which, in turn, would be associated with poor oral health through the patients' need frustration and dental anxiety. These research questions have not been tested in the dental field before, although the potential practical implications of reducing contextual controllingness might reduce dental anxiety and improve both oral health and general well-being.



**FIGURE 1** Standardized parameter (regression) estimates depicting the relations in the full latent SDT model of dental anxiety, poor Oral Health-Related Quality of Life, somatic symptom burden, and overall vitality [ $\chi^2$  ( $df=586$ ,  $N=322$ ) = 1073.92,  $p < 0.001$ ; RMSEA (90% CI) = 0.051 (0.046, 0.056); CFI = 0.96; IFI = 0.96; SRMR = 0.081]. \* $p < 0.05$ ; \*\*\* $p < 0.001$ . Due to presentation clarity, factor loadings are presented in the methods section. All variables are latent

### 1.1 | The controlling dental treatment social context, need frustration, and dental anxiety

The present study is grounded in self-determination theory (SDT; Deci & Ryan, 2000) which examines whether authority figures such as dentists and dental hygienists are perceived as controlling, meaning they pressure and coerce their patients to behave in certain ways, or are perceived as autonomy supportive, meaning they are supportive and allow patients a sense of volition and choice. A perceived controlling oral health care professional style is also associated with withdrawal of attention and affection when the patients do not enact the recommended behaviors. Such perceptions of professionals' behavior may frustrate patients' needs for autonomy, competence, and relatedness (Halvari, Halvari, Bjørnebekk, & Deci, 2010; Roth, Assor, Niemiec, Ryan, & Deci, 2009), resulting in a range of negative consequences, including enhanced anxiety in the clinic (Halvari et al., 2017). To illustrate, withdrawal of positive feedback may leave patients feeling ineffective in interacting with the environment and frustrate their need for competence (White, 1959). Withdrawal of attention and care may result in patients feeling alone, therefore frustrating their need for relatedness (Deci & Ryan, 1985), whereas a lack of an open discussion regarding treatment alternatives may undermine patients' feelings of choice and freedom and thus frustrate their need for autonomy (Deci & Ryan, 2000). SDT further claims that none of the three needs can be threatened, thwarted, or neglected without having significant negative consequences for people's healthy functioning (Deci & Ryan, 2000). Recent research has supported this association of a perceived controlling treatment style and need frustration in the dental field (Halvari et al., 2017), and in

the field of education (Haerens, Aelterman, Vansteenkiste, Soenens, & Petegem, 2015; Vansteenkiste & Ryan, 2013), as well as supported the relation of need frustration and dental anxiety (Halvari et al., 2017). Thus, in Hypothesis 1, we predicted that patients' perception of an oral health care professional's controlling style would be positively related to patient need frustration in treatment. Further, research indicates that the consequences of long-term need frustration are negative and include ill-being, pursuit of need substitutes, and various forms of maladaptive functioning (Vansteenkiste & Ryan, 2013), such as dental anxiety and dysregulation of the dental anxiety. In a previous dental study, low need satisfaction was found to be strongly associated with high dental anxiety (Halvari et al., 2010), and high need frustration is similarly expected to relate to dental anxiety and its maladaptive regulations (Halvari et al., 2017). Accordingly, we hypothesized that need frustration would be positively associated with dental anxiety (Hypothesis 2), and according to Campbell-Sills, Ellard, & Barlow (2003) high dental anxiety would be associated with high dysregulation of dental anxiety (Hypothesis 3). Compared to non-anxious patients, anxious patients are likely to select maladaptive strategies more often and to be less competent in applying anxiety regulation strategies (Campbell-Sills et al., 2003). In the present study, dysregulation of dental anxiety implies difficulties related to cognitive control (e.g., reduced functioning in treatment) and attention difficulties (e.g., not hearing and perceiving correctly, which makes communication with the oral health care professional difficult) (Gross & John, 2003).

In addition, patients' dysregulation of dental anxiety might increase oral health care practitioners' problems related to managing patients' behavior, their frequent complaints, time-consuming

treatments, their missed appointments, and late cancellations, (Moore & Brødsgaard, 2001; Weiner & Weinstein, 1995), which could make practitioners even more controlling. This reasoning is supported by research among authority figures other than oral health care practitioners (e.g., parents and teachers) which may indicate that “pressure from below,” such as patients’ dental anxiety, their negative attitudes toward dental hygiene and treatment, and their engagement in disruptive or noncomplying behaviors, may to some degree lead practitioners to be more controlling (Pettit, Laird, Dodge, Bates, & Criss, 2001; Pelletier, Seguin-Levesque, & Legault, 2002; Van den Berghe et al., 2013). Thus, we hypothesized that dysregulation of dental anxiety would, through a feedback loop (see Figure 1), be positively associated with patients’ perception of practitioners’ controlling styles (Hypothesis 4). In addition, patient data indicate that oral health care professionals’ treatment styles perceived as non-understanding or controlling are directly associated with dental anxiety (Halvari et al., 2010, 2017; Humphris & King, 2011; Moore, Birn, Kirkegaard, Brødsgaard, & Scheutz, 1993; Oosterink, Jongh, & Aartman, 2009), which, according to the research described above, indicates that the link between patients’ perception of a controlling treatment style and dental anxiety is expected to be indirect through need frustration. In addition, the feedback loop link between patients’ dental anxiety and their perception of a controlling treatment style would be indirect through dysregulation of dental anxiety.

## 1.2 | Dental anxiety, dysregulation of dental anxiety, and OHRQoL

Oral Health-Related Quality of Life (OHRQoL) is a multidimensional construct containing the relative absence of negative oral health impacts. These negative oral health impacts may include: (a) functional limitations such as the difficulty to chew and communicate; (b) physical pain in teeth, gums, and mouth; (c) emotional ill-being such as being depressed and unfocused due to oral functional limitations or orofacial pain; (d) psychosocial disability such as being unable to work due to oral ill-being; and (e) being uncomfortable with appearance due to negative oral health impacts (John et al., 2004).

High dental anxiety has been found to be consistently linked to poor OHRQoL for patients in Sweden (Carlsson, Hakeberg, & Boman, 2015), Canada (Locker, 2003), Germany (Mehrstedt, John, Tönnies & Micheelis, 2007), Switzerland (Gisler, Bassetti, Mericske-Stern, Bayer, & Enkling, 2012), India (Kumar et al., 2009), Hong Kong (Ng & Leung, 2008), and the Netherlands (Buunk-Werkhoven, Dijkstra, Schaub, van der Schans, & Spreen, 2010; Vermaire, de Jongh, & Aartman, 2008). High anxiety often implies maladaptive anxiety regulations such as dysregulation (Campbell-Sills et al., 2003). However, the links between dysregulation of dental anxiety and OHRQoL seem to be absent in dental research. Nonetheless, to be able to test dysregulation of dental anxiety in relation to OHRQoL, we formulated the following hypotheses: High dental anxiety and dysregulation of dental anxiety are both positively correlated with poor OHRQoL (Hypotheses 5–6).

## 1.3 | OHRQoL and general well-being

General well-being and health-related quality of life (HRQoL) have been found in research to be valid and important outcome measures. Recent research indicated that poor oral health status and poor OHRQoL were associated with poor general well-being and quality of life in some settings; however, further evidence is needed to support this interpretation (Naito et al., 2006). General well-being involves positive experiences at both the physical and psychological levels, and has been operationalized by vitality, absence of anxiety, and absence of somatic symptom burden (Baard, Deci, & Ryan, 2004) and by positive affect, vitality, absence of negative affect, and absence of somatic symptom burden (Farholm, Halvari, Niemiec, Williams, & Deci, 2017). In the dental field, poor OHRQoL has been associated with poor general health and well-being (Buunk-Werkhoven et al., 2009; Halvari, Halvari, Bjørnebekk, & Deci, 2013).

In the present study, general well-being was indicated by high vitality and low somatic symptom burden. Somatic symptom burden or the subclinical manifestation of somatization is defined as “the tendency to experience and communicate somatic distress... unaccounted for by pathological findings, to attribute them to physical illness, and to seek medical help for them ... (that) becomes manifest in response to psychosocial stress” (Lipowski, 1988, p. 1359). Somatic symptoms with no basis in physical illness account for more than 50% of all outpatient medical encounters in the USA (Kroenke, Spitzer, & Williams, 2002) and thus lead to huge costs for the society in health care utilization and lost job productivity (Barsky, Orav, & Bates, 2005). Herein we study OHRQoL as a mediator in the relations between both social contextual need frustration and dental anxiety, respectively, and somatic symptom burden. Would OHRQoL mediate this relation and explain some of the variance in the “unexplained” somatic symptom burden? A study by Hassel and colleagues (2007) indicated that poor OHRQoL was significantly associated with high somatization. Thus, based on the above theory and research, we predicted poor OHRQoL to be positively correlated with somatic symptom burden (Hypothesis 7).

General vitality was the other dependent general well-being variable in the model tested in the present study, and is defined as “one’s conscious experience of possessing energy and aliveness” (Ryan & Frederick, 1997, p. 530). Subjective vitality is an important indicator of mental and physical wellness in general as it has been strongly negatively associated with physical symptoms, fatigue, psychopathology, depression, and anxiety, as well as strongly positively linked with self-determination, well-being, health, self-actualization, global self-esteem, satisfaction with life, and vigor (Ryan & Frederick, 1997). In the dental field, OHRQoL has been significantly associated with overall well-being and vitality (Hassel et al., 2011). Thus, based on the above theory and research, we predicted poor OHRQoL to be negatively correlated with perceived vitality (Hypothesis 8).

## 1.4 | Tests of indirect associations

Unconditional indirect process model associations based on the literature reviewed and the hypothesized direct associations (see Figure 1) were tested using the analytic methods discussed in Preacher and Hayes (2008). A summary of these indirect associations is described in Table 2.

## 2 | METHOD

### 2.1 | Participants

A convenience sample of 838 students at the University of Oslo was invited to participate in the study, and 322 students (38%) gave their informed consent to participate and completed the questionnaires. No incentives were offered for participation. Participants' ages ranged from 18 to 49 years ( $M = 25.5$ ,  $SD = 2.8$ ). More females than males responded to the questionnaire (females = 73.6%). The majority of the participants had regularly attended their dental clinic the last year (71.7%), whereas 21.1% and 7.2% had visited their oral health care professional about 2 and 3–7 years ago, respectively. Regarding a question about regular visits to their oral health care professional, 43.5% responded "regularly," 32.6% responded "occasionally," whereas 23.9% said they only attended when they experienced pain or problems with their teeth.

### 2.2 | Translation of measures and their reliabilities

All questionnaire measures described below were translated into Norwegian, and translated back to English, and adapted following accepted procedures in the literature (Beaton, Bombardier, Guillemin, & Ferraz, 2000). Reliabilities of these scales are presented in the diagonal of Table 1.

### 2.3 | Design of questionnaire

Before the participants responded to the items in the questionnaire, they were introduced to their own clinic context by the following instructions and questions: "Think back to your last visit to a dental hygienist or dentist. It is important that you try to think about the treatment and your experiences with this oral health care professional." This introduction was followed by questions on who this oral health care professional was (a dental hygienist or a dentist, a female or a male), the number of visits to this oral health care professional, type of clinic (private or public), and time since last visit. "If you answered 'dental hygienist' in question 1, please have this person in mind and answer the following questions with reference to your dental hygienist. However, if you answered 'dentist' in question 1, please answer the following questions with reference to your dentist." Of the participants, 84.5% recalled their dentist.

*Patients' Perceived Controllingness of the Oral Health Care Practitioner* was measured with the 6-item Perceived Controlling Style at the Dental Clinic Questionnaire (PCSDCQ) (Halvari, Halvari, Bjørnebekk, & Deci, 2012b). Sample items were: "I find that my oral

health care professional decides too much"; "When my teeth are being examined, I feel underestimated and humiliated"; and "My oral health care professional does not see me as a person, he/she sees only the teeth." Participants responded to the items on a 1 (*strongly disagree*) to 7 (*strongly agree*) scale. For additional reliability and validity indications of the PCSDCQ, see (Halvari et al., 2010, 2012b, 2013).

*Need Frustration at the Clinic* was measured using the Psychological Needs Thwarting Scale (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011), which was adapted to the dental treatment context. The stem used was: "When I am in treatment: ...." Sample items are for autonomy frustration (".... I feel pressured to behave in certain ways"), for competence frustration (".... there are situations where I am made to feel inadequate"), and for relatedness frustration (".... I feel rejected"). Four items for each need was assessed on a scale ranging from 1 (totally disagree) to 7 (totally agree). In a study among health managers in Norway, the measures of competence, autonomy, and relatedness need frustration yielded acceptable reliabilities (ranged from .71 to .88) and indications of discriminant validity (Olafsen, 2016).

*Anxiety for Dental Treatment* was measured by the 5-item Modified Dental Anxiety Scale (Humphris, Crawford, Hill, Gilbert, & Freeman, 2013). An example item is: "If you were sitting in the waiting room (waiting for treatment), how would you feel?" Participants responded on a 5-point scale ranging from 1 (*not anxious*) to 5 (*extremely anxious*). The items were averaged to reflect anxiety for dental treatment. In a UK study, the reliability of this scale was .89; test-retest was .82 (Humphris et al., 2013).

*Dysregulation of Dental Anxiety* was measured with three items adapted from Roth and Assor (2003). A sample item is "When I am anxious in dental treatment I can't concentrate on (hear or perceive) what my oral health care professional is trying to say to me," assessed on a 7-point scale ranging from 1 (not at all true) to 7 (very true). Reliability and validity indications for these scales were acceptable in two previous studies (Roth & Assor, 2003; Roth et al., 2009).

### 2.4 | Assessment of oral health-related quality of life

Dimensions of Oral health-related quality of life (OHRQL) were assessed using the 21-item Oral Health Impact Profile (John et al., 2004), with 2 additional test items measuring bleeding gums. Participants were asked how frequently they had experienced each of the several impacts during the last year. Examples of impacts are: "less tolerant of others" and "unable to work" (psychosocial factor); "toothache" and "painful gums" (pain factor); and "problems affected my appearance" and "worried about appearance" (appearance factor). The participants responded to each impact on a 5-point scale with the following alternatives: 1 (*never*), 2 (*almost never*), 3 (*sometimes*), 4 (*quite often*), and 5 (*very often*). High scores reflect a low or poor oral health-related quality of life (i.e., high impacts). The items were averaged within subscales to reflect oral health-related quality of life and its subdimensions. In a recent Norwegian study, the internal consistency coefficient was

**TABLE 1** Means, SDs, skewness, and Pearson's correlations among variables (N = 322). Cronbach's  $\alpha$  coefficients in the diagonal

	M	SD	Skew	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Controlling style	2.3	1.2	0.9	.83														
2. Comp. need frust.	1.9	1.0	1.4	.60	.90													
3. Aut. need frust.	2.3	1.1	0.7	.61	.70	.85												
4. Rel. need frust.	1.7	1.1	2.1	.60	.70	.62	.89											
5. Total need frust.	1.9	0.9	1.4	.69	.90	.87	.88	.93										
6. Dental anxiety	2.1	0.8	1.0	.39	.47	.45	.43	.51	.85									
7. Dysreg. of DA	1.7	1.1	1.9	.34	.43	.38	.42	.46	.57	.86								
8. Poor OHRQL	1.7	0.4	1.0	.27	.29	.23	.26	.30	.27	.24	.86							
9. Irr/unable work	1.4	0.6	2.6	.24	.22	.17	.18	.21	.22	.31	.67	.79						
10. Worry; appear.	1.6	0.9	1.8	.18	.22	.21	.23	.25	.15	.19	.63	.44	.88					
11. FI&Pain: tooth	1.6	0.6	1.2	.13	.21	.14	.12	.18	.08	.09	.60	.31	.26	.72				
12. Pain: Gum	1.7	0.7	1.5	.16	.19	.14	.17	.19	.21	.14	.64	.23	.22	.36	.82			
13. Somatization	2.0	0.6	1.0	.22	.25	.20	.28	.28	.29	.31	.40	.26	.25	.31	.27	.71		
14. Vitality	4.5	1.3	-0.2	-.24	-.19	-.15	-.16	-.19	-.17	-.19	-.26	-.21	-.20	-.11	-.16	-.42	.95	
15. Age	25	5.3	2.8	.20	-.16	-.16	-.16	-.18	-.14	-.06	-.11	.03	-.02	-.11	-.11	-.12	-.04	-
16. Sex <sup>1</sup>	1.3	0.4	1.1	.05	.13	.07	-.01	.07	-.05	-.04	.00	-.01	-.02	-.02	.04	-.16	.03	-.08

Note.  $R \geq 0.11$ ,  $p < 0.05$ ;  $r \geq 0.14$ ,  $p < 0.01$ ;  $r \geq 0.18$ ,  $p < 0.001$ ; two-tailed tests. Females = 1; males = 2. <sup>1</sup>Spearman's point biserial correlations are used between sex and all other variables. DA = Dental Anxiety. OHRQL = Oral Health-Related Quality of Life; FI = Functional Impact. Irr = Irritated toward others.

**TABLE 2** Tests of indirect links emerging in Figure 1

Independent variable (IV)	Mediator (M)	Dependent variable (DV)	Point		a*b-path	Bootstrapping	
			estim.	SE	Z	BC Lower	95% CI Upper
1. Controlling style	→ Need frustration	→ Dental anxiety	0.24	0.04	6.16***	0.17	0.33
2. Need frustration	→ Dental anxiety	→ Dysregulation of dental anxiety	0.27	0.04	6.71***	0.18	0.39
3. Dental anxiety	→ Dysreg of dental anxiety	→ Controlling style	0.12	0.05	2.46*	0.02	0.26
4. Dysreg of dental anxiety	→ Controlling style	→ Need frustration	0.16	0.03	5.53***	0.09	0.24
5. Need frustration	→ Dental anxiety	→ Poor OHRQL	0.04	0.02	2.43*	0.004	0.08
6. Dental anxiety	→ Dysreg of dental anxiety	→ Poor OHRQL	0.04	0.02	1.92 <sup>†</sup>	0.003	0.09
7. Dental anxiety	→ Poor OHRQL	→ Somatization	0.08	0.02	3.99***	0.04	0.12
8. Dental anxiety	→ Poor OHRQL	→ Vitality	-0.10	0.03	-3.13**	-0.21	-0.05
9. Dysreg of dental anxiety	→ Poor OHRQL	→ Somatization	0.06	0.01	4.39***	0.03	0.09
10. Dysreg of dental anxiety	→ Poor OHRQL	→ Vitality	-0.08	0.03	-3.24***	-0.15	-0.04

Note. BC = bias corrected; 5000 bootstrap samples. a-path = IV → M; b-path = M → DV. <sup>†</sup> $p < 0.10$ ; \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

.85 for the total OHRQL score, and a factor analysis discriminated between psycho-social impacts (e.g., irritable with others and unable to work), pain impacts (e.g., tooth and gum), and appearance impacts (e.g., worried about appearance) (Halvari et al., 2013).

## 2.5 | Assessment of general well-being

*Somatic symptom burden (SSB).* The Somatic Symptom Scale (SSS-8) assessed SSB (Gierk et al., 2014). The SSS-8 assesses eight somatic symptoms that account for the majority of physical complaints in outpatient settings. Participants were asked, "Over the last four weeks, to what extent have you been bothered by one or more of the following problems?" and responded to eight items reflecting physical complaints (e.g., Headaches). Responses were made on a 3-point scale from 0 (*not bothered at all*) to 1 (*bothered a little*) to 2 (*bothered a lot*). The alpha internal consistency of this scale was .81. Validity metrics indicate that the measures discriminate between the gastrointestinal, pain, fatigue, and cardiopulmonary aspects of the general somatic symptom burden. Somatic symptom burden was significantly associated with high depression and anxiety, low general health status (moderate Effect Size; ES), and high health care use (large ES) (Gierk et al., 2014).

*Vitality* was measured with the 6-item version of "the Subjective Vitality Scale" (SVS) (Ryan & Frederick, 1997). Following the stem "How do you feel in general?" (example; "I feel alive and vital"), participants responded on a 7-point Likert scale ranging from 1 (*not at all true*) to 7 (*very true*). The scale has shown good test-retest reliability (Ryan & Frederick, 1997), and good internal consistency with alphas ranging from .91 to .92 and to .93 at three points in time in a Norwegian study among older adults (Solberg, Hopkins, Ommundsen, & Halvari, 2012).

## 2.6 | Control/marker variable

Positive affect was assessed by the 10-item subscale in PANAS (Watson, Clark, & Tellegen, 1988). The PANAS was administered with the instruction: "to what degree do you generally feel [mood adjective]?" The participants responded to positive mood adjectives such as "proud" and "interested." Each adjective was responded to by use of a scale ranging from 1 (not at all) to 7 (very much). Reliability and validity indications for this scale was acceptable in a recent study among adults in Norway (Solberg, Halvari, Ommundsen, & Hopkins, 2014).

## 2.7 | Background variables

*Gender* was indicated by 1 (*female*) and 2 (*male*), and age by years.

## 3 | RESULTS

### 3.1 | Descriptive statistics and reliability

The means, standard deviations, skewness values, and reliabilities for all variables are shown in Table 1. Reliability values are acceptable exceeding the cut-off point of .70 defined by Nunnally (1979). Skewness values are somewhat high for relatedness need frustration, irritable toward others/unable to work, and age, but below the cut-off point recommended and used by Kline (2005) in the SEM analysis. Regarding examples for the distribution of scores, the distribution for a perceived controlling treatment style was low (scores 7–12; "disagree") for 51% of the participants, moderate (scores 13–24; "somewhat agree") for 38% of the participants, and high (scores

25–36; “agree”) for 11% of the participants. A similar distribution was found for dental anxiety as participants scoring low (scores 5–10; “not anxious”) was 56%, moderate (scores 10–15; “quite anxious”) was 32%, and high (scores 16–25; “very and extremely anxious”) was 12%.

We used SEM in testing the model. However, logistic regression was also used for “low” dental anxiety (score < 19) compared to extreme dental anxiety (score  $\geq$  19) as a function of a perceived controlling treatment style and need frustration. This was done just to compare the results from logistic regression with the SEM, for this part of the model tested, because comparing extreme scores with the rest is often used in dental anxiety research.

### 3.2 | Factor analysis

Factor analyses (see Appendix A) yielded four separate and unique factors explaining 61.2% of the variance for perceived practitioners’ controlling styles, competence need frustration, dental anxiety, and dysregulation of dental anxiety. Because frustration of the needs for autonomy and relatedness cross-loaded with items measuring practitioners’ controlling styles, these two needs were omitted from the SEM. The items for the OHRQoL loaded as expected on four separate and unique factors, namely (1) worry about appearance, (2) bleeding/pain in gums, (3) psychosocial, and (4) functional difficulties/unable to work (see Appendix A).

### 3.3 | Hypotheses testing

The zero-order correlations in Table 1 are all in line with the theoretical expectations.

#### 3.3.1 | Structural equation modeling

Structural equation modeling (LISREL, version 8.80) was used to test the SDT process model (Figure 1). All variables in the model are latent. In testing the model in Figure 1, factor loadings for items were all significant, and they were (loadings in parentheses) for perceived controllingness (0.59, 0.61, 0.62, 0.64, 0.79, 0.81), for competence need frustration (0.72, 0.82, 0.89, 0.89), for dental anxiety (0.46, 0.65, 0.69, 0.89, 0.89), for dysregulation of dental anxiety (0.79, 0.82, 0.91), for OHRQoL (psychosocial: .76; appearance: .57; bleeding/pain: .45; functional difficulties/unable to work: 0.66), for somatic symptom burden (0.32, 0.36, 0.36, 0.43, 0.48, 0.57, 0.58, 0.70), and for vitality (0.69, 0.80, 0.86, 0.88, 0.89, 0.94).

To evaluate the fit of the models tested, we used the chi-square likelihood ratio ( $X^2$ ), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the incremental fit index (IFI) as recommended by Bollen, and Hu and Bentler (Bollen, 1989; Hu & Bentler, 1999). A good fit should have a value close to or lower than .06 for the RMSEA, a value close to or lower than .08 for the SRMR, and a value close to or higher than .95 for the CFI and IFI.

### 3.3.2 | Empirical models

The measurement model for Figure 1 was tested with all variables and indicators and found to fit the data well [ $X^2$  ( $df = 573, N = 322$ ) = 978.63,  $p < 0.001$ ; RMSEA (95% CI) = 0.047 (0.042, 0.052); CFI = 0.97; IFI = 0.97; SRMR = 0.055]. In this measurement model, all factor loadings were significant. The structural model was tested with this measurement model included and did also yield a good fit [ $X^2$  ( $df = 586, N = 322$ ) = 1073.92,  $p < 0.001$ ; RMSEA (90% CI) = 0.051 (0.046, 0.056); CFI = 0.96; IFI = 0.96; SRMR = 0.081]. The standardized parameter estimates shown in Figure 1 supported hypotheses 1–8.

### 3.4 | Tests of indirect links

We tested the indirect links in Figure 1 using the bootstrapping procedure described by Preacher and Hayes (2008). The analyses indicated that all of the indirect associations were significantly supported because the bias-corrected 95% confidence intervals (for the bands of products of coefficients after  $n$  re-samplings) did not include zero or oppositely valued coefficients (see Table 2).

### 3.5 | Logistic regression

Because dental anxiety’s (DA) extreme scores are often compared with lower scores in dental research, we dichotomized dental anxiety into 0 (DA < 19) and 1 (DA  $\geq$  19) (Humphries et al., 2013), and hierarchically logistic-regressed dental anxiety onto a perceived controlling treatment style in block 1. The model was significant ( $X^2 = 20.39_{1, 322}$ ,  $p < 0.001$ ) with a  $B = 0.77$ ,  $p < 0.001$ , OR (95% CI for OR) = 2.16 (1.55, 3.02). In block 2, need frustration was added and the model was significant ( $X^2 = 32.702_{322}$ ,  $p < 0.001$ ), with a nonsignificant effect for a perceived controlling treatment style [ $B = 0.20$ ,  $p > 0.10$ , OR (95% CI for OR) = 1.22 (0.75, 1.99)], and a significant effect for need frustration [ $B = 0.88$ ,  $p < 0.001$ , OR (95% CI for OR) = 2.41 (1.45, 3.99)].

Thus, adding need frustration as an independent variable reduced the impact of a perceived controlling treatment style from significant to nonsignificant, which indicates that need frustration is a full mediator in the association between a perceived controlling treatment style and dental anxiety. These results are fully in accordance with the SEM test of the model, and the indirect bootstrapping analysis (see Table 2).

### 3.6 | Common method variance (CMV) and test of an alternative marker variable model

A single-factor test was performed using confirmative factor analysis (CFA) in LISREL, specifying a hypothesized method factor represented by all 36 indicators (Malhotra, Kim, & Patil 2006). The results indicated very unacceptable fit for this model, indicating that CMV is not a major source of the variations in the items included [ $X^2$  ( $df = 594, N = 322$ ) = 6469.24,  $p < 0.001$ ; RMSEA = .18; CFI = .73; IFI = 0.73; SRMR = 0.13]. In addition, we used the marker variable technique (Lindell & Whitney, 2001) to assess CMV. Positive

affect was chosen as the marker variable because it is expected to be theoretically unrelated to dental anxiety and negatively with need frustration (Malhotra et al., 2006). Further, people who express high positive affectivity view themselves and aspects of the world in generally positive terms (Burke, Brief, & George, 1993). Hence, positive affectivity may influence participants' responses in self-report questionnaires and affect systematic variance in the relations between variables that is different from the actual or true variance that exists between the variables (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Consequently, their questionnaire responses measuring for instance vitality might be higher than they actually are, and items measuring need frustration might be lower than the true scores. Therefore, we tested an alternative model in which the marker variable positive affect was included to predict all other variables in Figure 1. The Cronbach's alpha reliability coefficient was 0.91 for positive affect, and its zero-order correlations were for perceived controllingness  $-0.08$  ( $p > 0.05$ ), for competence need frustration  $-0.11$  ( $p > 0.05$ ), for autonomy need frustration  $-0.11$  ( $p > 0.05$ ), relatedness need frustration  $-0.13$  ( $p < 0.05$ ), total need frustration  $-0.13$  ( $p < 0.05$ ), for dental anxiety  $-0.09$  ( $p > 0.05$ ), for dysregulation of dental anxiety  $-0.05$  ( $p > 0.05$ ), for poor OHRQoL  $-0.13$  ( $p < 0.05$ ), for somatization  $0.02$  ( $p > 0.05$ ), and for vitality  $0.18$  ( $p < 0.05$ ). Compared to the model tested in Figure 1 [ $X^2$  ( $df = 586, N = 322$ ) = 1073.92,  $p < 0.001$ ], the alternative model did not fit the data equally well [ $X^2$  ( $df = 687, N = 322$ ) = 1274.02,  $p < 0.001$ ] because the increase in  $X^2$  was significant ( $p < 0.05$ ). However, the fit of this alternative model was also good (RMSEA = 0.052; CFI = 0.95; IFI = 0.95). Controlling for positive affect did change the parameter estimates in Figure 1 with an average of 0.023. The difference in the correlations varied from 0.01 to 0.05 and none of these changes were significant, which suggests that in this particular setting CMV may not distort our results.

## 4 | DISCUSSION

The hypothesized model was supported and yielded a good fit to the data. The results indicated that patients' perceptions of oral health care professionals as controlling was positively related to competence need frustration in treatment, which was positively associated with dental anxiety. In turn, dental anxiety was positively linked with dysregulation of the dental anxiety, which through a feedback loop positively predicted patients' perception of practitioners' controllingness. Further, both dental anxiety constructs were positively associated with poor OHRQoL, which subsequently was linked with high overall somatic symptom burden and low perceived vitality scores.

For the first time in the dental field, patients' perceptions of controlling behaviors of oral health care professionals at the dental clinic were found to be indirectly positively associated with dental anxiety through need frustration in treatment. A new finding is also that high anxiety, through a feedback loop via dysregulation of dental anxiety, is associated with the perception of practitioners as

even more controlling, which again is further positively associated with patients' competence need frustration. In turn, a new finding is also the link between competence need frustration and OHRQoL through dental anxiety, and subsequently through dysregulation of dental anxiety.

The indirect associations in the model are interesting and important. This is so because patients' perception of dental practitioners' controllingness seem to be associated with poor oral health. Perceived controllingness seems strongly associated with patient competence need frustration, which was strongly related to dental anxiety, as well as indirectly with dysregulation of dental anxiety, all of which seem to be related to poor OHRQoL.

Sources of practitioners controlling treatment styles, as perceived by patients', are probably shaped by "pressure from above" (e.g., a controlling dental clinic management; time pressure in managing patient treatment) (Karydis, Komboli-Kodovazeniti, Hatzigeorgiou, & Panis, 2001), "pressure from within" (e.g., practitioners personality), and/or "pressure from below" (e.g., patients' dental anxiety and their dysregulation of dental anxiety) (Pelletier et al., 2002). In particular, the two first sources need to be addressed in relation to patients' oral health-related behavior and health in future research.

Of the patients, 38% responded with "somewhat agree" and 11% responded with "agree" that their oral health care professional was perceived as controlling. Even though the level of controllingness might be relatively low, we should bear in mind its larger impact on individuals than positive events (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001), and its robustness in predicting maladaptive developmental outcomes (Kins, Soenens, & Beyers, 2012; Soenens, Vansteenkiste, & Luyten, 2010). A one-time incident of bad experience may have very negative consequences. Thus, the question remains of how to create social climates in dental clinics that are less controlling. According to SDT (Deci & Ryan, 2000), this can be done by being more supportive of patients' needs for autonomy, competence, and relatedness. Supporting all three needs is supposed to be important because the correlations of perceived controllingness to each of the need frustrations were very similar, and the correlations of both somatic symptom burden and vitality with each of the need frustrations were very similar. In providing such need support, oral health care professionals can listen carefully to the patients' statements about their oral health and acknowledge hearing them, and they can provide options, choices, and meaningful rationales for why dental hygiene and dental attendance is important. They can give positive competence feedback, and support their patients' initiatives, minimize controlling language, avoid feedback that can leave the patient feeling underestimated and humiliated, and remain nonjudgmental. Such need support is expected to increase patients' need satisfaction and reduce their need frustration, resulting in persistent healthy behaviors and oral health (Halvari et al., 2017). Research indicates that health care professionals can be trained to be more autonomy supportive and less controlling (Williams & Deci, 1996). Experimental research in the dental field found that more autonomy support from oral health care professionals resulted in more autonomous motivation for treatment and more



perceived oral health competence among patients, which resulted in increases in oral health-related behavior and improvement in oral health (Halvari & Halvari, 2006; Halvari, Halvari, Bjørnebekk, & Deci, 2012). Support for autonomy is considered an important outcome within medical ethics and a critical health care outcome in its own right promoting patient welfare (i.e., appropriate oral health care behaviors and oral health), which is supported by recent research (Ng et al., 2012).

The strong correlations between perceived controllingness, competence need frustration, and dental anxiety are supported by other research (Halvari et al., 2017), and suggest that avoiding controllingness and increasing autonomy support may reduce need frustration in treatment and might be important for anxiety reduction and oral health. Research support the influence of in particular dental professionals' experimentally induced autonomy supportive behavior (i.e., minimizing controlling behaviors) on increases in patients' dental attendance and oral health-related hygiene behaviors, and improvement of their oral health (Halvari et al., 2012a; Halvari, Halvari, Williams, & Deci, 2017). Thus, training oral health care professionals to increase their use of autonomy support and decrease their use of controlling strategies may reduce patients' oral diseases and increase their psycho-social functioning, which is in line with both the SDT model (Deci & Ryan, 2000) and the FDI World Dental Federation model explaining oral health (Glick et al., 2016).

The SDT approach (Deci & Ryan, 2000) to reducing the level of dental anxiety may be used in addition to more intensive competence support by giving patients information and education about oral diseases and allowing them supervised dental hygiene practice at the dental clinic. Competence support related to teaching patients to use reappraisal and acceptance strategies in anxiety and emotion regulation, as well as cognitive-behavioral therapy/behavioural therapy, has also been shown to be effective (Gordon, Heimberg, Tellez, & Ismail, 2013; Gross & John, 2003; Hofmann, Heering, Sawyer, Asnaani, 2009; Wide Boman, Carlsson, Westin, & Hakeberg, 2013).

When differentiating the sub-components of OHRQoL, the two anxiety constructs seem to be associated with the four OHRQoL components in relatively the same way (see Table 1). In addition, the four OHRQoL factors correlated with the two overall health variables in the same way. Partly due to this, we did not include the four OHRQoL factors as separate variables in the SEM. Another reason is that the model would have become too complex and overestimated, resulting in low power for the relatively little sample.

The teeth are not a separate part of the body and its health, but are clearly important in relation to general well-being. When OHRQoL alone explains 35% of the variance in overall somatization, oral health definitely matters for general health. This result is fully in line with the FDI World Dental Federation new definition of oral health as multifaceted. That is, oral health diseases (such as periodontitis and caries and related pain and discomfort), physiological functioning (such as the ability to speak, smile, chew, and swallow), and psycho-social functioning (such as the capacity to speak, smile, and interact in social and work situations without feeling uncomfortable or embarrassed) are all core elements influencing overall health

and well-being (Glick et al., 2016). The FDI World Dental Federation definition of oral health is quite similar to the BioPsychoSocial Model (Engel, 1977) acknowledging biological, psychological, and social elements as important determinants of overall health.

Research on OHRQoL is important for both theoretical and practical reasons. Because it relates to general health, poor OHRQoL could serve as an indicator of the need for general health treatment (Sischo & Broder, 2011). Thus, poor OHRQoL may suggest to health care professionals that it is important to check for example for functional limitations, pain, worries, and psychosocial impacts of appearance. When OHRQoL is measured over time it gives important information not only regarding the oral health development of patients, but also the need for more general care. Thus, it could be a basis for communicating with policymakers about the consequences of unequal access to care in a population because poor oral health and poor OHRQoL are likely to be different in conditions where socioeconomic and racial/ethnic conditions are different (Petersen, Bourgeois, Ogawa, Estupinan-Day, & Ndiaye, 2005). The latter view is in particular relevant, considering that oral diseases are the most common of the chronic diseases, with high prevalence and impact on individuals and society, and with high treatment expenses (Petersen et al., 2005). Finally, the present study indicated that observations of poor OHRQoL are linked to patients' perceived controlling orientations of oral health care professionals at the clinic, to patients' need frustration in treatment, and their dental anxiety. Other experimental research indicate that to increase patients' dental attendance and to improve patients' ongoing oral health, it is important for oral health care professionals to reduce their controllingness and increase their autonomy-supportive behavior (Halvari et al., 2012a; Halvari, Halvari, Williams, et al., 2017).

#### 4.1 | Limitations

Some limitations apply to the present study. *First*, self-reports were appropriate for perceived controllingness, need frustration, anxiety constructs, OHRQoL, somatization, and vitality. However, despite controlling for the marker variable positive affect, we cannot be sure that problems with CMV were ruled out. Consequently, objective measures of oral health and overall health would have strengthened the study. However, if construct validity of self-report measures is demonstrated, other methods are not necessarily better (Conway & Lance, 2010). In the present study, only well-validated measures were used. *Second*, the current sample is a convenience sample of college students so it is necessary to be cautious about generalizing the results. However, the purpose of the present study was to test the links between variables derived from a universal theory, assuming that constructs such as perception of controllingness, need frustration, and dental anxiety are more or less present in all individuals (Deci & Ryan, 2000). This means we tried to maximize the internal validity of the study, assuming that the relations between variables would be the same independent of sample variations. *Third*, the model tested was not controlled for educational level and socioeconomic status, two factors that are known to influence oral health

and overall health. However, in a similar sample with students from the University of Oslo, the links between SDT motivation variables and oral health-related variables were the same even after controlling for four socioeconomic variables, including education level (Halvari et al., 2012b). Fourth, the study has the limitations associated with being cross-sectional and the absence of a design allowing randomized control and longitudinal data imply that conclusions regarding causality cannot be inferred (Bollen, 1989). The analysis of the hypothesized model was performed in SEM with mostly latent variables, which is a strength, but the arrows between variables do not necessarily indicate causality.

## 5 | CONCLUSION

This study makes a contribution because it is the first study showing that patients' perception of practitioners controlling behaviors at the dental clinic were found to be indirectly positively associated with patients' dental anxiety through their competence need frustration in treatment. A new finding is also that high anxiety, through a feedback loop via dysregulation of dental anxiety, is positively associated with patients' perception of controllability, which again further is positively associated with patients' competence need frustration. In turn, a new finding is also the link between competence need frustration and OHRQoL through dental anxiety, and subsequently on general well-being.

Because patients' perception of practitioners' controlling behavior is a key antecedent variable in the model tested, future research investigating the sources of controllability and its relation to actual practitioner behavior is called for.

## ORCID

Anne Elisabeth Münster Halvari  <https://orcid.org/0000-0001-5506-4704>

## REFERENCES

- Baard, P. P., Deci, E. L., & Ryan, R. M. (2004). Intrinsic need satisfaction: A motivational basis of performance and well-being in two work settings. *Journal of Applied Social Psychology, 34*(10), 2045–2068.
- Barsky, A. J., Orav, E. J., & Bates, D. W. (2005). Somatization increases medical utilization and costs independent of psychiatric and medical comorbidity. *Archives of General Psychiatry, 62*, 903–910.
- Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology, 5*, 323–370.
- Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., & Thøgersen-Ntoumani, C. (2011). Psychological need thwarting in the sport context: Assessing the darker side of athletic experience. *Journal of Sport and Exercise Psychology, 33*, 75–102.
- Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine (Phila. Pa, 1976), 25*, 3186–3191.
- Bollen, K. (1989). *Structural equations with latent variables*. New York: Wiley.
- Buunk-Werkhoven, Y. A. B., Dijkstra, A., & van der Schans, C. P. (2009). Oral Health-Quality of Life predictors depend on population. *Applied Research Quality Life, 4*, 283–293.
- Buunk-Werkhoven, Y. A. B., Dijkstra, A., Schaub, R. M. H., van der Schans, C. P., & Spreen, M. (2010). Oral health related quality of life among imprisoned Dutch forensic psychiatric patients. *Journal of Forensic Nursing, 6*, 137–143.
- Burke, M. J., Brief, A. P., & George, J. M. (1993). The role of negative affectivity in understanding relations between self-reports of stressors and pain: A comment of the applied psychology literature. *Journal of Applied Psychology, 78*, 402–412.
- Campbell-Sills, L., Ellard, K. K., & Barlow, D. H. (2003). Emotion regulation in anxiety disorders. In J. J. Gross (Ed.), *Handbook of emotion regulation*, 2nd ed. (pp. 393–412). New York: Guilford Press.
- Carlsson, V., Hakeberg, M., & Boman, U. W. (2015). Associations between dental anxiety, sense of coherence, oral health-related quality of life and health behavior – A national Swedish cross-sectional survey. *BMC Oral Health, 15*, 100.
- Conway, J., & Lance, C. (2010). What reviewers should expect from authors regarding common method bias in organizational research. *Journal of Business and Psychology, 25*, 325–334.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Press.
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*, 227–268.
- Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. *Science, 196*, 129–136.
- Farholm, A., Halvari, H., Niemiec, C. P., Williams, G. C., & Deci, E. L. (2017). Changes in return to work among patients in vocational rehabilitation: A self-determination theory perspective. *Disability and Rehabilitation, 39*, 2039–2016.
- Gierk, B., Kohlmann, S., Kroenke, K., Spangenberg, L., Zenger, M., Brähler, E., & Löwe, B. (2014). The Somatic Symptom Scale – 8 (SSS-8): A brief measure of somatic symptom burden. *JAMA Internal Medicine, 174*, 399–407.
- Gisler, V., Bassetti, R., Mericske-Stern, R., Bayer, S., & Enkling, N. (2012). A cross-sectional analysis of the prevalence of dental anxiety and its relation to the oral health-related quality of life in patients with dental treatment needs at a university clinic in Switzerland. *Gerodontology, 29*(2), e290–e296. <https://doi.org/10.1111/j.1741-2358.2011.00465.x>
- Glick, M., Williams, D. M., Kleinman, D. V., Vujicic, M., Watt, R. G., & Weyant, R. J. (2016). A new definition for oral health developed by the FDI World Dental Federation opens the door to a universal definition of oral health. *Journal of the American Dental Association, JADA, 147*, 915–917.
- Gordon, D., Heimberg, R. G., Tellez, M., & Ismail, A. I. (2013). A critical review of approaches to the treatment of dental anxiety in adults. *Journal of Anxiety Disorders, 27*, 365–378.
- Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85*, 348–362.
- Haerens, L., Aelterman, N., Vansteenkiste, M., Soenens, B., & Petegem, S. V. (2015). Do perceived autonomy-supportive and controlling teaching relate to physical education students' motivational experiences through unique pathways? Distinguishing between the bright and dark side of motivation. *Psychology of Sport and Exercise, 16*, 26–36.
- Halvari, A., Halvari, H., Bjørnebekk, G., & Deci, E. L. (2010). Motivation and anxiety for dental treatment: Testing a self-determination theory model of oral self-care behaviour and dental clinic attendance. *Motivation and Emotion, 34*, 15–33.
- Halvari, A. E. M., Halvari, H., Bjørnebekk, G., & Deci, E. L. (2012a). Self-determined motivational predictors of increases in dental behaviors,

- decreases in dental plaque, and improvement in oral health: a randomized clinical trial. *Health Psychology*, 31, 777–88.
- Halvari, A., Halvari, H., Bjørnebekk, G., & Deci, E. L. (2012b). Motivation for dental Home care: Testing a self-determination theory model. *Journal of Applied Social Psychology*, 42, 1–39.
- Halvari, A., Halvari, H., Bjørnebekk, G., & Deci, E. L. (2013). Oral health and dental well-being: Testing a self-determination theory model. *Journal of Applied Social Psychology*, 43, 275–292.
- Halvari, A. E. M., Halvari, H., & Deci, E. L. (2017). Attending and avoiding dental appointments: Do “bright” and “dark” motivational paths have a role? *International Journal of Dental Hygiene*, 00, 1–12. <https://doi.org/10.1111/idh.12274>
- Halvari, A. E. M., Halvari, H., Williams, G. C., & Deci, E. L. (2017). Predicting dental attendance from dental hygienists’ autonomy support and patients’ autonomous motivation: A randomised clinical trial. *Psychology & Health*, 32, 127–144. <https://doi.org/10.1080/08870446.2016.1244536>
- Halvari, A., & Halvari, H. (2006). Motivational predictors of change in oral health: An experimental test of self-determination theory. *Motivation and Emotion*, 30, 295–306.
- Hassel, A. J., Danner, D., Schmitt, M., Nitschke, I., Rammelsberg, P., & Wahl, H.-W. (2011). Oral health-related quality of life is linked with subjective well-being and depression in early old age. *Quality of Life Research*, 22, 811–825.
- Hassel, A. J., Rolkó, C., Leisen, J., Schmitter, M., Rexroth, W., & Leckel, M. (2007). Oral health-related quality of life and somatization in the elderly. *Quality of Life Research*, 16, 253–261.
- Hägglin, C., Berggren, U., Hakeberg, M., & Ahlqvist, M. (1996). Dental anxiety among middle-aged and elderly women in Sweden: A study of oral state, utilization of dental services and concomitant factors. *Gerodontology*, 13, 25–42.
- Hofmann, S. G., Heering, S., Sawyer, A. T., & Asnaani, A. (2009). How to handle anxiety: The effects of reappraisal, acceptance, and suppression strategies on anxious arousal. *Behaviour Research and Therapy*, 47, 389–394.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1–55.
- Humphris, G., Crawford, J. R., Hill, K., Gilbert, A., & Freeman, R. (2013). UK population norms for the modified dental anxiety scale with percentile calculator: Adult dental health survey 2009 results. *BMC Oral Health*, 13, 1–11.
- Humphris, G., & King, K. (2011). The prevalence of dental anxiety across previous distressing experiences. *Journal of Anxiety Disorders*, 25, 232–236.
- John, M. T., Hujoel, P., Miglioretti, D. L., LeResche, L., Koepsell, T. D., & Micheelis, W. (2004). Dimensions of oral-health-related quality of life. *Journal of Dental Research*, 83, 956–960.
- Johnsen, B. H., Thayer, J. F., Laberg, J. C., Wormnes, B., Raadal, M., Skaret, E., ... Berg, E. (2003). Attentional and physiological characteristics of patients with dental anxiety. *Anxiety Disorders*, 17, 75–87.
- Karydis, A., Komboli-Kodovazeniti, M., Hatzigeorgiou, D., & Panis, V. (2001). Expectations and perceptions of Greek patients regarding the quality of dental health care. *International Journal for Quality in Health Care*, 13, 409–416.
- Kins, E., Soenens, B., & Beyers, W. (2012). Parental psychological control and dysfunctional separation-individuation: A tale of two different dynamics. *Journal of Adolescence*, 35, 1099–1109.
- Kline, R. B. (2005). *Principles and practice of structural equation modelling*. New York: The Guilford Press.
- Kroenke, K., Spitzer, R. L., & Williams, J. B. (2002). The PHQ-15: Validity of a new measure for evaluating the severity of somatic symptoms. *Psychosomatic Medicine*, 64, 258–266.
- Kumar, S., Bhargav, P., Patel, A., Bhati, M., Balasubramanyam, G., Duraiswamy, P., & Kulkarni, S. (2009). Does dental anxiety influence oral health-related quality of life? Observations from a cross-sectional study among adults in Udaipur district, India. *Journal of Oral Science*, 51, 245–254.
- Lindell, M. K., & Whitney, D. J. (2001). Accounting for common method variance in cross-sectional designs. *Journal of Applied Psychology*, 86, 114–121.
- Lipowski, Z. J. (1988). Somatization: The concept and its clinical application. *American Journal of Psychiatry*, 145, 1358–1368.
- Locker, D. (2003). Psychosocial consequences of dental fear and anxiety. *Community Dentistry and Oral Epidemiology*, 31, 144–151.
- Malhotra, N. K., Kim, S. S., & Patil, A. (2006). Common method variance in IS research: A comparison of alternative approaches and the re-analysis of past research. *Management Science*, 52, 1865–1883.
- 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, 357–363.
- Moore, R., Birn, H., Kirkegaard, E., Brødsgaard, I., & Scheutz, F. (1993). Prevalence and characteristics of dental anxiety in Danish adults. *Community Dentistry and Oral Epidemiology*, 21, 292–296.
- Moore, R., & Brødsgaard, I. (2001). Dentists’ perceived stress and its relation to perceptions about anxious patients. *Community Dentistry and Oral Epidemiology*, 29, 73–80.
- Naito, M., Yuasa, H., Nomura, Y., Nakayama, T., Hamajima, N., & Hanada, N. (2006). Oral health status and health-related quality of life: a systematic review. *Journal of Oral Science*, 48, 1–7.
- Ng, J. Y. Y., Ntoumanis, N., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-determination theory applied to health contexts: A meta-analysis. *Perspectives on Psychological Science*, 7, 325–340.
- Ng, S. K. S., & Leung, W. K. (2008). A community study on the relationship of dental anxiety with oral health status and oral health-related quality of life. *Community Dentistry and Oral Epidemiology*, 36, 347–356.
- Nunnally, J. C. (1979). *Psychometric theory*. New York: McGraw Hill.
- Olafsen, A. H. (2016). *Work motivation through the lens of self-determination theory* (doctoral dissertation). Norwegian School of Economics, Bergen.
- Oosterink, F. M. D., de Jongh, A., & Aartman, I. H. A. (2009). Negative events and their potential risk of precipitating pathological forms of dental anxiety. *Journal of Anxiety Disorders*, 23, 451–457.
- Pelletier, L. G., Seguin-Levesque, C., & Legault, L. (2002). Pressure from above and pressure from below as determinants of teachers’ motivation and teaching behaviors. *Journal of Educational Psychology*, 94, 186–196.
- Petersen, P. E., Bourgeois, D., Ogawa, H., Estupinan-Day, S., & Ndiaye, C. (2005). The global burden of oral diseases and risks to oral health. *Bulletin of the World Health Organization*, 83, 661–669.
- Pettit, G. S., Laird, R. D., Dodge, K. A., Bates, J. E., & Criss, M. M. (2001). Antecedents and behaviour-problem outcomes of parental monitoring and psychological control in early adolescence. *Child Development*, 72, 583–598.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioural research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88, 879–903.
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40, 879–891.
- Roth, G., & Assor, A. (2003). Autonomy supporting and suppressing parental practices as predictors of flexible versus rigid emotion regulation in children. Paper presented at the biennial meeting of the Society for Research in Child Development (SRCD), Tampa, Florida.
- Roth, G., Assor, A., Niemiec, C. P., Ryan, R. M., & Deci, E. L. (2009). The emotional and academic consequences of parental conditional regard: Comparing conditional positive regard, conditional negative regard, and autonomy support as parenting practices. *Developmental Psychology*, 45, 1119–1142.

- Ryan, R. M., & Frederick, C. (1997). On energy, personality, and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality, 65*, 529–565.
- Sischo, L., & Broder, H. L. (2011). Oral health-related quality of life: What, why, how, and future implications. *Journal of Dental Research, 90*, 1264–1270.
- Soenens, B., Vansteenkiste, M., & Luyten, P. (2010). Toward a domain-specific approach to the study of parental psychological control: distinguishing between dependency-oriented and achievement-oriented psychological control. *Journal of Personality, 78*, 217–256.
- Solberg, P. A., Halvari, H., Ommundsen, Y., & Hopkins, W. G. (2014). A 1-year follow-up on effects of exercise programs on well-being in older adults. *Journal of Aging and Physical Activity, 22*, 52–64.
- Solberg, P. A., Hopkins, W. G., Ommundsen, Y., & Halvari, H. (2012). Effects of three training types on vitality among older adults: A self-determination theory perspective. *Psychology of Sport and Exercise, 13*, 407–417.
- ter Horst, G., & de Wit, C. A. (1993). Review of behavioral research in dentistry 1987–1992: Dental anxiety, dentist-patient relationship, compliance and dental attendance. *International Dental Journal, 43*, 265–278.
- Van den Berghe, L., Soenens, B., Vansteenkiste, M., Aelterman, N., Cardon, G., Tallir, I. B., & Haerens, L. (2013). Observed need-supportive and need-thwarting teaching behavior in physical education: Do teachers' motivational orientations matter? *Psychology of Sport and Exercise, 14*, 650–661.
- Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration, 23*, 263–280.
- Vermaire, J. H., de Jongh, A., & Aartman, I. H. A. (2008). Dental anxiety and quality of life: The effect of dental treatment. *Community Dentistry and Oral Epidemiology, 36*, 409–416.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS Scales. *Journal of Personality and Social Psychology, 54*, 1063–1070.
- Weiner, A. A., & Weinstein, P. (1995, April). Dentists' knowledge, attitudes, and assessment practices in relation to fearful dental patients: A pilot study. *General Dentistry, 43*, 164–168.
- White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review, 66*, 297–333.
- Wide Boman, U., Carlsson, V., Westin, M., & Hakeberg, M. (2013). Psychological treatment of dental anxiety among adults: A systematic review. *European Journal of Oral Sciences, 121*, 225–234.
- Williams, G. C., & Deci, E. L. (1996). Internalization of biopsychosocial values by medical students: A test of self-determination theory. *Journal of Personality and Social Psychology, 70*, 767–779.

## APPENDIX A: FACTOR ANALYSIS

We ran an a priori maximum likelihood factor analysis with oblique rotation of the 26 items measuring practitioners controlling styles, frustration of the needs for autonomy, competence, and relatedness, dental anxiety, and dysregulation of dental anxiety. This factor analysis yielded that the items for the autonomy and relatedness need frustration loaded on the practitioner controlling styles factor (loadings for autonomy items from 0.42 to 0.48, and for relatedness items from 0.40 to 0.50). Thus, autonomy and relatedness need frustration items were omitted from the final factor analysis, which yielded four separate and unique factors explaining 61.2% of the variance: (1) dental anxiety, five items (eigenvalue: 3.49, 20.5% of variance, factor loadings from .49 to .85 and no high cross-loadings); (2) practitioners controlling styles, six items (eigenvalue: 4.20, 24.7% of variance, factor loadings from 0.56 to 0.75 and no high cross-loadings); (3) competence need frustration, four items (eigenvalue: 1.46, 8.6% of variance, factor loadings from .58 to .86 and no high cross-loadings); and (4) dysregulation of dental anxiety, three items (eigenvalue: 1.26, 7.4% of variance, factor loadings from 0.65 to 0.96 and no high cross-loadings). Based on these results, we decided to include only the items for competence need frustration in testing the SEM model, whereas autonomy and relatedness need frustration were presented in descriptive statistics and zero-order correlations.

Some of the items in the OHRQL scale were highly positively skewed. In addition, in an a priori factor analysis, some of the items cross-loaded with other subdimensions of the OHRQL measure. Due to this we accepted a somewhat higher skew and omitted two items with a skewness value higher than 4.0, a cut-off point used in research (Kline, 2005). Further, two items were omitted due to high cross-loadings. This procedure resulted in acceptable overall skew results for the sub-constructs (see Table 1), which were used in subsequent analyses. The final factor analysis yielded four separate and unique factors explaining 50.7% of the variance: (1) worry about appearance, three items (eigenvalue: 4.10, 22.7% of variance, factor loadings from 0.67 to 0.92 and no high cross-loadings); (2) bleeding/pain in gums, four items (eigenvalue: 2.10, 11.9% of variance, factor loadings from 0.71 to 0.78 and no high cross-loadings); (3) psychosocial, seven items (eigenvalue: 1.95, 10.4% of variance, factor loadings from –0.44 to –0.84 and no high cross-loadings); and (4) functional difficulties/unable to work, five items (eigenvalue: 1.54, 5.6% of variance, factor loadings from 0.47 to 0.76 and no high cross-loadings).

**How to cite this article:** Halvari AEM, Halvari H, Deci EL. Dental anxiety, oral health-related quality of life, and general well-being: A self-determination theory perspective. *J Appl Soc Psychol.* 2019;00:1–12. <https://doi.org/10.1111/jasp.12583>