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Oral Health-Quality of Life Predictors Depend on Population

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Abstract In the framework of the development and evaluation of oral health interventions that take into account people's oral health-related quality of life (OH-QoL), it is important to know what determinants and effects of OH-QoL are. Because the processes involved in the experience of OH-QoL may differ for different populations, this study mapped the relations of general health perception, social factors, dental anxiety and oral hygiene behavior on the one hand with OH-QoL on the other hand, in two different samples that mainly differed on the experience they had with dental care and dental pathology: In 112 patients of the Center for Dentistry and Oral Hygiene and in 339 first year psychology students. The relations of three of the four variables with OH-QoL differed in both samples. Although not all relations could be interpreted unequivocally in this cross-sectional design, the data illustrate that the main difference between both samples (i.e., patients indicated for oral treatment versus students outside treatment) influenced the psychological processes involved in OH-QoL. This implicates that oral health interventions directed at increasing OH-QoL may have to be adapted to populations.

Keywords Oral health-related quality of life · Oral hygiene behavior · General health perception · Expected social outcomes · Dental anxiety

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Introduction

The theoretical model of oral health (Locker 1988) suggests that oral disease can lead to impairments on several dimensions, such as physical, psychological and social. Impairments are described by Locker as any limitation in or lack of ability to perform activities of daily living (Slade and Spencer 1994) that can lead to a decrease in quality of life. This model is supported by results from a number of studies that show that oral disorders have a negative impact on physical, psychological and social well-being (Locker 2004, 1988; Locker and Matear 2000), and on oral health-related quality of life (OH-QoL; Locker and Allen 2007).

For modern oral health care interventions to be acceptable, they should take into account these experiential effects (Allen 2003). The awareness of quality of life as one possible outcome of medical-technical oral health interventions, assigns responsibility for this outcome to those who develop and execute the intervention. Therefore, it is of great importance to understand what the determinants are of self-perceived OH-QoL. That is, according to the state-of-the-art models of intervention development, effective interventions should aim at the determinants of the desired outcome (Bartholomew et al. 2001; Buunk and Van Vugt 2008; Green and Kreuter 1999). Thus, effective interventions aimed at increasing OH-QoL should target the causes of OH-QoL. In addition, these models also stress the possibility of side-effects of trying to reach the desired outcome. That is, as a psychological state, OH-QoL may have subsequent desired but also undesired effects. For example, a good OH-QoL may lower one's motivation to take preventive actions, for example, to regularly visit a dental hygienst or a dentist. Thus, to understand the process involved in shaping individual's OH-QoL and to be able to carefully design interventions to influence OH-QoL for the good, insight into the causes and effects of OH-QoL is essential. The present study aims to increase our knowledge of whether and how a set of potential causes and effects of OH-QoL are related to OH-QoL.

In addition, dental care interventions targeting different groups may need to be adapted to the specific causes and effects of OH-QoL in different groups. Therefore, on the basis of the principle of target group segmentation (Ahmad 2003) the causes and effects of OH-QoL must be studied in each segment that will be targeted (Baker 2007). In the present study, we present analyses within two samples of participants that differ in one essential aspect related to dental care: The experience with dental pathology and dental care. Experiences shape perceptions of reality and subsequent experiences through a process of enactive learning. Enactive learning is the most powerful source of interpretations of events and accomplishments (Bandura 1986). People with substantial experience with dental care may have developed specific perceptions of dental care and dental health on the basis of their experience. Therefore, in the present study we compare the causes and effects of OH-QoL in two samples: A sample with substantial experience with dental care and dental pathology and a sample with less experience with dental care and dental pathology.

Besides the above referred to oral disorders or pathology, socio-psychological factors may be related to OH-QoL as causes or effects. In the present research, four such factors were assessed: dental anxiety, oral hygiene behavior, expected social outcomes of having healthy teeth, and general health perception. The rationales for including these factors were the following.

Dental anxiety was included because it is a very common negative emotion related to oral health care. According to Woodmansey (2005), the average patient has low to mild anxiety but up to 15% of people report to avoid dental because of anxiety (see De Jongh et al. 1995). It is thought to be an important negative determinant of OH-QoL (Mehrstedt et al. 2007; Vermaire et al. 2008). Dental anxiety not only manifests as anticipatory worry about dental treatment and fear during treatment, but also in avoidance behaviors (e.g., not adhering to treatments or cancelling appointments), that may increase dental pathology. Therefore, especially in people with substantial experience with dental care and pathology (i.e., a history of dental treatment) we expect that the more dental anxiety they report, the lower their OH-QoL will be. However, in people with little experience with dental care and pathology, dental anxiety may not have developed and, therefore, not be related to OH-QoL.

Oral hygiene behavior refers to the preventive actions people engage in to take care of their teeth and oral health, such as brushing and flossing teeth (Buunk-Werkhoven et al. in press). These behaviors can have different relations with OH-QoL. People with substantial experience with dental care and pathology—which may manifest in a lowered OH-QoL—may be more motivated to engage in actions to cope with or to avoid reoccurring dental pathology. Thus, the lower their OH-QoL, the better they are expected to practice oral hygiene behaviors. In contrast, when people have little experience with dental care and pathology, their dental health state and related OH-QoL have no motivational property: They do not motivate people to improve something. However, their oral hygiene behavior might determine OH-QoL, through objective oral health. Thus, the worst they take care of their oral hygiene, the lower their OH-QoL may be.

Social factors may also be related to OH-QoL. That is, unhealthy teeth may affect a person's social interactions negatively, as facial attractiveness has been found to affect social attitudes and actions (Oosterhaven et al. 1989). When people recognize and value these social effects, they become integrated in the psychological domain of oral health as perceived social outcomes of their oral health. When people have substantial experience with dental care and pathology, they may more often have encountered painful negative social outcomes. From the perspective of Regulatory Focus Theory (Higgins 1997), this may have instated a prevention focus: The motivation to specifically avoid negative outcomes. Thus, the worse their OH-QoL is, the more they are anxiously focused on the importance of social outcomes. In contrast, people with little experience with dental care and pathology have not (yet) experienced negative social outcomes. This means that they are not confronted with the strong importance of social outcomes. Therefore, those with little experience may still perceive social outcomes from a promotion focus (Higgins 1997): The motivation to approach positive outcomes. As a result, when their oral health status is better, as indicated by a higher OH-QoL, they may anticipate and experience more positive social outcomes.

General health perception refers to the evaluation of one's health in general, taking into account all relevant domains (Marino et al. 2008; Mason et al. 2006). General health perception is thought to be partly determined by OH-QoL. That is, when people are asked to evaluate their health in general, they can be expected to take into account optimal and non-optimal functioning in different domains,

including the oral domain (Kieffer and Hoogstraten 2008). Therefore, we expect that the higher OH-QoL is, the more positive the general health perception will be. Although the experience with dental care and pathology may influence the strength of the relation, we have no rational to expect opposite relations for people with and without substantial experience.

In sum, the relations of OH-QoL with the four above factors—dental anxiety, oral hygiene behavior, social outcomes and general health perceptions—are thought to be relevant for understanding the processes involved in shaping OH-QoL. Whether the above four factors will be related to OH-QoL and what the directions of the relations will be, depends on other psychological factors or on contextual factors. In the present study, we assume that experience with dental care and dental pathology is a relevant contextual factor.

Overview Present Research

The aim of this research was to assess a number of factors associated with the OH-QoL (assessed with OHIP-14-NL) that may have direct of indirect implications for the effectiveness of public health interventions in the contexts of promoting OH-QoL. It was expected that the associations would depend on the experience with dental care and dental pathology. Therefore, the associations were tested in two sample that clearly differed in this experience: clinical *patients* and *students*. Whereas students mostly have few dental problems and a short dental history, patients visiting a center for dentistry and oral hygiene have substantial experience with dental care and dental pathology.

Methods

Participants and Procedure

The participants were patients who visit the Center for Dentistry and Oral Hygiene, University Medical Center of Groningen (*patients* sample), and first year students of the faculty of Psychology, University of Groningen (*students* sample). Ethical approval for this study was obtained from the ethics committee of both departments. The patients answered a paper-and-pencil-questionnaire in the waiting room before the screening/dental examination in the clinic. This screening was conducted by a dental professional and involved an evaluation of the patient's oral health care, gauging their motivation to engage in oral health care, the oral status and the need for dental treatment. In the clinical sample also the impact of patient's clinical oral health status was examined. For the *students*, the administration of a computerized version of questionnaire was completed.

Measurements

The questionnaire included 45 items divided into several parts, including a few demographic questions on matters such as age, nationality, marital status, and education. Level of education was categorised as low, medium or high. In the

Netherlands, low educational level refers to vocational training, medium level to advanced vocational training, and high level to college/university training.

OHIP-14-NL is a measure of OH-QoL which is linguistically validated in Dutch (Buunk-Werkhoven et al. in press; Werkhoven et al. 2004). This scale, a short form version of the OHIP-NL (Van der Meulen et al. 2008), includes 14 items organized in seven dimensions: function limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap (Cronbach's α=.94 in the *patients* sample, and α=.92 in the *students* sample). Responses were scored on a 5-point Likert scale ranging from "never" to "very often". Sum scores ranged from 0 to 56, and a higher score represents a lower OH-QoL.

The *Dental Anxiety Scale* is a four-item self-report scale measuring fear for dental treatment at the day before, in the waiting room, waiting to be drilled and waiting to be cleaned (DAS; Corah et al. 1978). Items can be scored on a scale from 1 to 5, and summed to provide an overall dental anxiety score ranging from 4 ("not anxious at all") to 20 ("extremely anxious"). In the *patients* sample, Cronbach's α=.94. In the *student* sample α=.84. The higher the score, the stronger the dental anxiety.

Oral hygiene behavior (OHB) is a measure of the extent to which people engage in optimal oral care, as defined by professional standards (Buunk-Werkhoven et al. 2009a, b). The index includes eight items with respect to tooth brushing, interdental cleaning and tongue cleaning. For example, the item "I brush my teeth as follows" was supported by pictures showing different brushing methods. The OHB sum score on this index could range from 0 to 16. A higher sum score indicates a higher level of oral self-care.

Expected Social Outcomes (ESO; Buunk-Werkhoven et al. 2009a, b) of having healthy teeth is a measure of the importance and salience of good oral health for social functioning and social acceptance. The scale included six items (α=.76 in both samples). An example of this five-point scale is: "In social contacts fresh breath is important." Responses varied from 1 = *disagree* to 5 = *agree*, and a sum score was computed by summing up scores on all items (ranging from 6 to 30). The higher the score, the more important and salient people find the social outcomes of good oral health.

General Health Perception (GHP) is a measure of perceived general physical health. It was measured by using a sub-scale of the RAND 36-Item Health Survey (Aaronson et al. 1998). The sum score of these items, ranges from 5 to 25 (α=.68 in the *patients* sample and α=.77 in the *students* sample), e.g., "In general, would you say your health is…?," which was answered with on a five-point ordinal scale ranging from "excellent" to "poor", or "I expect my health to get worse," with the endpoints 1 = *absolutely wrong* to 5 = *absolutely right*. Higher scores indicate a better perceived general health.

Clinical Oral Health Status in Patients Sample

Only in the patients sample a record of dentition characteristics was registered (Category I = healthy dentition, Category II = slightly unhealthy dentition, Category III = mutilated dentition, Category IV = pre-edentulous, and Category V = edentulous).

Statistical Analyses

A one-way analysis of variance was performed to determine whether any significant differences in mean scores of the variables existed between the patients and students. Linear regression analyses were performed to identify the multivariate relations of dental anxiety, social outcomes, oral hygiene behavior and general health perception with OH-QoL.

Results

Characteristics of Participants

Patients and Dentition Characteristics

The patients sample included 112 patients (52% male), and their mean (SD) age was 49 (17) years. Almost all patients were of Dutch nationality (94%) and 58% was married. Nineteen percent of the patients had a low level of education; 49% had a medium level, and 28% had a high level. Table 1 shows that just 20% of the patients had healthy teeth and almost one quarter had slightly unhealthy dentition (24%). One-third of the patients had mutilated dentition (including five patients who were pre-edentulous), and 23% in this patients sample were edentulous.

Moreover, it can be seen that the patients evaluated their OH-QoL positively, and patients' mean sum score on the DAS suggests little dental anxiety. However, frequency scores of the DAS showed that 9% of the patients reported to have anxiety and 13% extremely dental anxiety (Corah et al. 1978). Furthermore, patients felt that they had considerable control over carrying out the oral self-care practices, and they attached a high value to the positive social outcomes of having healthy teeth. Indeed, patients' general health perception was moderately good.

Patients with healthy dentition (Category I) reported less limitations because of problems with their teeth, mouth or dentures. The patients who had mutilated dentition and those who were edentulous evaluated their perceived

Table 1 Frequencies of the clinical oral health status of the *patients*, means and standard deviation (SD) for the main variables for the *patients* and the *students*

Measures	*Patients*					*Students*
Dentition	Cat. I	Cat. II	Cat. III-IV	Cat. V	Total sample	Total sample
Characteristics	*N*=22 (20%)	*N*=27 (24%)	*N*=37 (33%)	*N*=26 (23%)	all	none
OHIP-14-NL (a, b)	4.20 (5.11)	8.92 (9.11)	15.85 (13.56)	12.14 (10.29)	10.93 (11.20)	4.30 (5.88)
DAS (a, c)					8.92 (4.23)	8.23 (2.67)
OHB (d, e)					9.32 (2.22)	10.95 (1.69)
ESO (a, f)	21.74 (3.03)	24.19 (4.51)	25.74 (3.73)	24.44 (4.73)	24.32 (4.16)	23.58 (3.94)
GHP (a, g)					19.0 (3.65)	18.56 (3.30)

In total sample: (a) *n*=339. (b) *n*=103. (c) *n*=98. (d) *n*=278. (e) *n*=105. (f) *n*=79. (g) *n*=102

OH-QoL worse in comparison with the patients who had slightly unhealthy dentition. All differences in OHIP-14 sum scores between the categories of dentition characteristics were significant, $F(1,93)=5.80$, $p<.001$. Patients who had unhealthy teeth (Category II, III-IV, and V, respectively), attached a higher value to the positive social outcomes of having healthy teeth compared to patients with healthy teeth (Category I). Differences between patients with unhealthy teeth versus patients with healthy teeth and the experienced differences in perceived social consequences related to their oral health status were significant, $F(1,101)=4.18$, $p<.001$.

Psychology Students

339 Students (25% male); their mean (SD) age was 21 (6) years completed the online questionnaire. Table 1 shows that the students evaluated their OH-QoL positive. The students' mean score on the DAS suggests no dental anxiety, but the frequency scores of the DAS scale showed that 7% and 3% of the students reported to have moderate and extreme dental anxiety, respectively (Corah et al. 1978). Furthermore, they felt that they had considerable control over carrying out the oral self-care practices, and they attached a high value to the positive social outcomes of having healthy teeth. The students' general health perception was good.

Comparing Patients and Students

Patients indicated that they experienced a more negative impact of their OH-QoL than the students, $F(1,438)=61.77$, $p<.001$, and more dental anxiety, $F(1,434)=3.77$, $p=.05$. Descriptive item scores of the OHB index showed that students felt more control over carrying out their oral self-care practices in comparison with the patients, but this difference was not significant.

Differential Prediction of OH-QoL in Patients and Students

To examine whether the various predictors played a different role of in the two samples, a regression analysis was performed in the combined sample with sample as the moderator. The interactions between each of the four predictors on the one hand and sample on the other hand were entered in a linear regression analysis. The interaction terms added significant amount of variance (7.6%), $F(9,333)=10.97$, $p<.001$ to variance explained by the main effects. Three of the four variables had significant interaction effects with sample: for GHP ($\beta=.51$, $p<.05$), ESO ($\beta=-1.70$, $p<.001$), and DAS ($\beta=-.41$, $p<.05$). Thus, the findings underline that these three determinants had different relation with self-perceived OH-QoL in the *patients* sample than in the *students* sample.

Predicting OH-QoL in Patients

Two linear regression analyses were performed in the patients sample (see Table 2). In the first analysis the same four predictors were included as in the total

Table 2 Linear regression of perceived oral health-related quality of life for all variables

Determinants	OH-QoL *students* β	OH-QoL *patients* β	OH-QoL *patients* β
General health perception	−.17**	−.19 *ns*	−.03 *ns*
Expected social outcomes	−.12*	.47**	.29*
Dental anxiety	.09 *ns*	.26*	.26*
Oral hygiene behavior	.02 *ns*	.00 *ns*	.08 *ns*
Dentition characteristics			.39**

Students: R^2 =5.0 $F(4,273)=4.65$, $p<.001$

Patients: R^2 =26.9 $F(4,61)=7.00$, $p<.001$

R^2 =35.9 $F(5,60)=8.27$, $p<.001$

**$p<.001$, *$p<.05$

sample. The model proved to be significant, F (4,61)=7.00, $p<.001$, and accounted for 26.9% of the variance, which is a substantial proportion for self-perceived OH-QoL. Not only expected social outcomes (β=.47, $p<.001$), but also dental anxiety (β=.26, $p<.05$) emerged as significant predictors of OH-QoL. In the second regression analysis, in which dentition characteristics was entered with the other variables, this model proved to be significant too, F (5,60)=8.27, $p<.001$, and accounted for 35.9% of the variance, which is more than in the first model. Now, dentition characteristics (β=.39, $p<.001$), expected social outcomes (β=.29, $p<.05$), and dental anxiety (β=.26, $p<.05$) emerged as significant predictors of OH-QoL.

Predicting OH-QoL in Students

The linear regression model with four predictors was significant, F (4,273)=4.65, $p<.001$, and accounted for only 5% of the variance, which is much lower than in the patients sample. Only general health perception (β=−.17, $p<.001$) and expected social outcomes (β=−.12, $p<.05$) emerged as significant predictors of OH-QoL (see Table 2).

Discussion

The results show that the relations of general health perception, expected social outcomes, and dental anxiety with OH-QoL differed in the two samples. This suggests that the relations are moderated by psychological or contextual characteristics of the samples. We assumed that the main difference between the samples was their experience with dental care and dental pathology. Although the samples were only rough proxies of the extent of their experience, participants in the sample of patients reported a lower OH-QoL and higher dental anxiety compared to participants in the sample of students. This is what

might be expected in people who have repeatedly been exposed to dental treatment because of dental pathology. Although future research is needed to further test experience as a relevant moderator, the message of the present results is clear: The psychology of oral health-related quality of life differed for the two samples and may differ for other samples as well. This means that in the development of oral health interventions that attempt to influence OH-QoL, these differences must be taken into account: We can no longer guarantee that different populations are adequately served with the same intervention.

The differential interpretation of the relations in both samples may shed some light on the moderating characteristics of the samples. First of all, in the patient sample general health perception was not associated with OH-QoL, while in the student sample it was. The latter relation confirmed our expectation that when people estimate their general health, they take into account their oral health and the outcomes of their oral health (as assessed with the OHIP-14-NL). However, in patients this was not the case. One way or another, their OH-QoL was not relevant for their perceived general health. On the other hand, in both samples the beta was only small and the statistical power in the smaller patient sample may not have been sufficient to reveal such a small effect.

The second difference between the samples was that in the patient sample social outcomes were associated with a lower OH-QoL, whereas in the student sample they were associated with a higher OH-QoL. These results are in line with the notion that more experience with dental care and pathology changed the perception of social outcomes from a promotion perspective into a prevention perspective. In the promotion perspective, social outcomes are something positive people can strive for. In the prevention perspective, negative social outcomes become salient because they are feared and must be avoided. The experience with dental care and dental may have "traumatized" or "sensitized" these people for social outcomes.

The third difference between the samples was that only in patients dental anxiety was related to OH-QoL. Our interpretation is that the experience patients have with dental care and pathology indicates experience with aversive dental treatments because of oral health problems. This experience may have lead to levels of dental anxiety that are so inconvenient that they are taken into account in estimating their OH-QoL. In line with this interpretation is that the patients scored higher on dental anxiety than the students.

Besides the differences between the samples, two other observations are relevant. Firstly, oral hygiene behavior was not related to OH-QoL in both samples. This suggests that both possible explanations—inadequate oral hygiene behavior indirectly lowers OH-QoL and a low OH-QoL is a motivator of oral hygiene behavior—were not supported. Secondly, the relation in the patient sample, between dentition characteristics and OH-QoL is in line with OH-QoL being only partly determined by the objective dental health status and underscores the psychological and experiential nature of quality of life.

In conclusion, although not all relations can be interpreted unequivocally in this cross-sectional design, the data illustrate that the main difference between both samples (i.e., patients with substantial dental history and students with less history) influence the psychological processes involved in OH-QoL. This means

that in the development of oral health interventions that attempt to influence OH-QoL, these differences must be taken into account. For example, when in a population the perceived social outcomes are not a determinant of OH-QoL, they do not have to be specifically targeted by an intervention and resources can be used to influence other determinants. This principle is in line with the notion that interventions need to be directed at segments of a population to be effective (Ahmad 2003). In practice, at least the following global phases can be distinguished in designing effective interventions (Bartholomew et al. 2001; Buunk and Van Vugt 2008; Green and Kreuter 1999). Firstly, the potential target population should be defined. Secondly, a broad set of determinants of OH-QoL should be assessed and analyzed. Thirdly, the intervention aimed at increasing OH-QoL should specifically target the population-specific determinants of OH-QoL. The ultimate aim of such meaningful segmentation of large populations is to increase the effectiveness of OH-QoL interventions.

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