**BRIEF COMMUNICATION**

# Anxiety symptoms have a direct effect on oral health perception in young women

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**Abstract**

**Purpose** Assess the influence of anxiety symptoms on oral health related-quality of life in young women from a cohort study in Southern Brazil.

**Methods** A sample of 535 young mothers were analyzed. Interviews and psychological evaluations were carried out by trained psychologists. The Brazilian version of the Corah's dental anxiety scale and the Beck anxiety inventory were used to evaluate dental anxiety and anxiety symptoms, respectively. The oral health-related quality of life (OHRQoL) was assessed by the Oral Impacts on Daily Performance instrument. Dental examinations were performed by trained dentists to assess oral health status (DMFT). The effect of anxiety symptoms on oral health-related quality of life was estimated using the parametric g-formula.

**Results** The prevalence of negative impact on OHRQoL was of 46.3 and 28% of the women presented anxiety symptoms. Unadjusted analysis showed that women with anxiety symptoms had 2.5 higher impact on OHRQoL (OR 2.55; CI 95% 1.72–3.79). The parametric g-formula revealed that anxiety had a direct effect on oral health perception (OR 1.16; CI 95% 1.04–1.30), not mediated by dental anxiety.

**Conclusion** Oral health-related quality of life is influenced by anxiety symptoms, regardless of dental anxiety.

**Keywords** Quality of life · Women · Community dentistry · Psychology · Epidemiology

## Introduction

Anxiety is one of the most common mental disorders [1], having a prevalence of 25% in young adults [2]. It can be defined as a state of persistent tension, accompanied by a sense of impending disaster, which can lead to fear. Anxious subjects tend to report lower satisfaction with life and present higher functional inability [3]. In dental settings, anxiety can be demonstrated like agitation and unbalanced responses to fright [4, 5]. Moreover, anxiety may lead to fear

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and dental anxiety, or the opposite, when the dental treatment generates the anxiety [6]. Also, dental anxiety has been associated with worse oral health conditions and impaired perception of oral health-related quality of life (OHRQoL) [7, 8].

Women, mainly at reproductive age, have a substantially higher risk of developing anxiety disorders comparing to men, including dental anxiety [3]. Genetic factors, female's reproductive hormones and social rules may play important roles in the expression of these differences [9, 10]. Even though previous studies [11, 12] have hypothesized that anxiety could favor the development of dental anxiety and impact OHRQoL negatively, this relationship is still unclear. Thus, the purpose of the present study was to assess the influence of anxiety symptoms on the OHRQoL, in a sample of young mothers followed in a cohort study to evaluate if this relationship is mediated by dental anxiety. The hypothesis is that anxiety symptoms influence on the perception regarding the impact of the oral problems over the quality of life.

## Methods

This cross-sectional study was performed with young women, enrolled in a cohort of pregnant adolescents (aged 13 to 19 years old) attending in the public health system, in Pelotas—Southern Brazil. The present study was conducted 24–36 months after children's birth. Initially, 871 pregnant adolescents were eligible for the study, however, 43 refused to participate which resulted in 828 participants. Between 2009 and 2011, another 290 individuals were lost, the final sample was of 538 in 2012 (68.0%). However, 333 women would be sufficient to detect a 1.6 relative risk (99% power), considering a 40% prevalence of negative impact on OHRQoL among the non-exposed, and with a level of significance of 5%. The study was approved by the Ethics Committee in Research of Federal University of Pelotas. All women signed a written consent form and received information regarding their health conditions.

Young women were submitted to an interview with a trained psychologist and oral clinical examination was performed by a trained dentist. The impact on OHRQoL was assessed by the Brazilian version of the Oral Impacts on Daily Performance (OIDP) [13, 14]. The total score of OIDP was dichotomized using the median as cut-off point as without impact (OIDP 0–1) and with impact (OIDP ≥ 2). In the same way, the domains score were dichotomized using the median (OIDP ≥ 1 to physical and psychological domain and OIDP ≥ 2 to social domain).

Anxiety symptoms were evaluated using the Beck Anxiety Inventory (BAI), a short list describing 21 anxiety symptoms. The scale range from 0 (not at all) to 3 (severely, I

could barely stand it). The total score had a minimum of 0 and a maximum of 63 points [15]. The cut-off point of 11 was used: BAI ≥ 11 meant "with anxiety symptoms" and BAI ≤ 10 "without anxiety symptoms" [16]. This instrument was validated for the Brazilian population and is approved by SatePsi (Psychological Testing System) and regulated by the Federal Council of Psychology.

The Brazilian version of Corah's dental anxiety scale (DAS) [3, 17] was used to assess dental anxiety. Scores up to 11 represent low anxiety state, up to 14 refer to moderate anxiety state, whereas scores equal or higher than 15 indicate high anxiety levels [3]. Data regarding socioeconomic and demographic variables comprised the following information: family income (in tertiles); maternal schooling (dichotomized as < 8 and ≥ 8 years of education, which in Brazil corresponds to the primary level of education); maternal skin color (white, black, brown, yellow and indigenous); age in complete years (discrete variable). Dental caries was measured using WHO criteria (decayed, missing and filled teeth, dichotomized as DMFT = 0 and DMFT ≥ 1) [18]. The training and calibration processes were described elsewhere [19]. The mean kappa value was 0.83 for dental caries.

The bivariate analysis was made by $\chi^2$ and Fisher's Exact test and unadjusted analyses by Logistic Regression, estimating the odds ratio and their respective 95% confidence intervals. The parametric g-formula was used to assess the total causal effect (TCE), the natural direct effect (NDE), the natural indirect effect (NIE), as well as the controlled direct effect (CDE). Dental caries was used as post-confounder. Monte Carlo approach was used to estimate the effects. Bootstrap method was used to estimate the standard errors as well as the confidence interval of the estimated effects. For this estimation, we used 1000 resamples of size 10,000. All data were analyzed using the software Stata 12.0 for Windows (Stata Corporation, College Station, USA).

## Results

Three women, from 538 who participated in the study, were excluded from the analysis due to missing responses of the OIDP instrument. Table 1 shows the frequency distribution of the sample according to the perception of impact on OHRQoL. The prevalence of negative oral impact on daily performances was 46.3% (248). The highest impact was observed on young mothers with < 8 years of education (52.8%), black skin color (64.5%), with loss of social support (51.8%), with anxiety symptoms (60.0%), with dental caries (50.0%) and higher level of dental anxiety (64.4%). Unadjusted analysis showed that women with anxiety symptoms presented 2.5 higher impact on OHRQoL (OR 2.55; CI 95% 1.72–3.79). Figure 1 presents the course of crude estimated effect, according to severity

**Table 1** Sample distribution according to impact on oral health-related quality of life and independent variables (n=535)

| Variable | Total [n (%)] | Oral health-related quality of life | | p value* |
|---|---|---|---|---|
| | | With impact [n (%)] | Without impact [n (%)] | |
| Age | | | | 0.857 |
| ≤ 19 years | 177 (33.1) | 83 (46.9) | 94 (53.1) | |
| ≥ 20 years | 358 (66.9) | 164 (46.1) | 192 (53.9) | |
| Family income (tertiles) | | | | 0.267 |
| 1st tertile | 177 (34.4) | 87 (49.1) | 90 (50.9) | |
| 2nd tertile | 169 (32.8) | 80 (47.3) | 89 (52.7) | |
| 3rd tertile | 169 (32.8) | 69 (40.8) | 100 (59.2) | |
| Schooling | | | | 0.004 |
| <8 years of study | 248 (46.6) | 131 (52.8) | 117 (47.2) | |
| ≥8 years of study | 284 (53.4) | 115 (40.5) | 169 (59.5) | |
| Skin color | | | | <0.001 |
| White | 331(63.3) | 131 (39.6) | 200 (60.4) | |
| Black | 107 (20.5) | 69 (64.5) | 38 (35.5) | |
| Brown | 72 (13.8) | 36 (50.0) | 36 (50.0) | |
| Yellow | 5 (0.9) | 1 (20.0) | 4 (80.0) | |
| Indigenous | 8 (1.5) | 4 (50.0) | 4 (50.0) | |
| Loss of social support | | | | 0.015 |
| No | 281 (53.0) | 116 (41.3) | 165 (58.7) | |
| Yes | 249 (47.0) | 129 (51.8) | 120 (48.2) | |
| Anxiety symptoms | | | | <0.001 |
| No | 375 (72.0) | 150 (40.0) | 225 (60.0) | |
| Yes | 146 (28.0) | 92 (60.0) | 54 (40.0) | |
| Caries experience | | | | 0.003 |
| DMFT < 1 | 131 (24.6) | 46 (35.1) | 85 (64.9) | |
| DMFT ≥ 1 | 402 (75.4) | 201 (50.0) | 201 (50.0) | |
| Dental anxiety | | | | <0.001 |
| Low | 326 (62.3) | 127 (39.0) | 199 (61.0) | |
| Moderate | 110 (21.0) | 57 (51.8) | 53 (48.2) | |
| High | 87 (16.7) | 56 (64.4) | 31 (35.6) | |

*$\chi^2$ and Fisher's exact test—statistically significant with $p < 0.05$

There was loss of information to family income (n=20), schooling (n=3), skin color (n=12), anxiety symptoms (n=17), dental caries (n=2), dental anxiety and quality loss of social support (n=4)

of the anxiety symptoms. The results show that the odds ratio increases when the severity of the anxiety symptoms increase.

The parametric g-formula analysis showed that anxiety symptoms had natural and controlled direct effects on the perception of the oral health impact (Table 2). When it was assumed that all subjects had moderate and high dental anxiety, it was observed that the impact was 16% higher in subjects with anxiety symptoms (OR 1.16; CI 95% 1.04–1.30), and this effect was not mediated by dental anxiety (Table 2; Fig. 2). Table 3 shows the analysis by domains of OIDP. Higher controlled direct effect of anxiety was related to the psychological domain, with anxious women presenting 20% higher odds than women without anxiety symptoms.

# Discussion

The presence of anxiety symptoms was associated with a negative impact on OHRQoL of young women, regardless of the presence of dental anxiety. This association was observed in all domains of the instrument, confirming the hypothesis of the study. It is possible that anxious women report OHRQoL from a more negative perspective. However, the relationship between anxiety symptoms and impaired OHRQoL is most likely explained by the occurrence of mental imbalances which affect the ability of the individual to take care of themselves and to use the dental services, which may cause poor oral health conditions, and consequently, a higher perception of this negative condition on their daily life [20, 21].

Fig. 1 Impact on young woman' oral health-related quality of life according to severity of anxiety symptoms
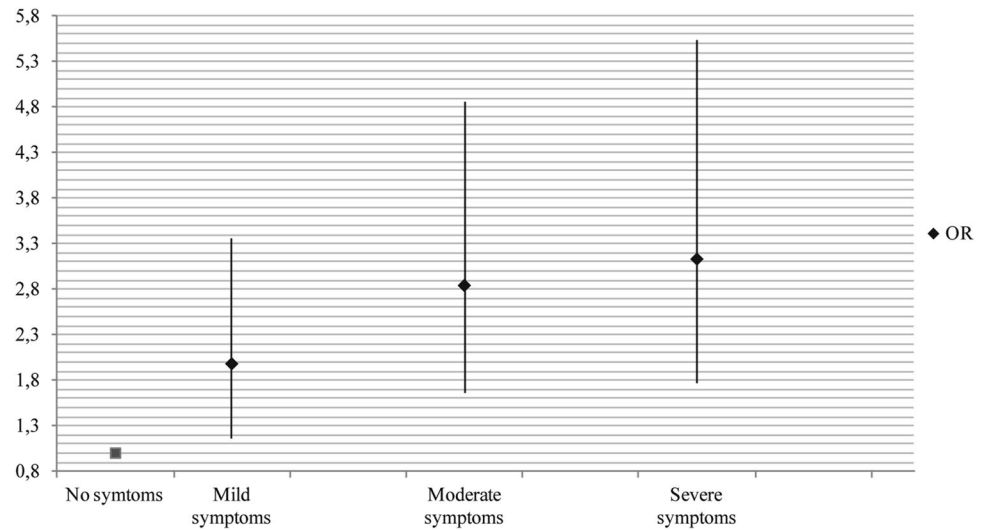


**Table 2** G-computation analysis of dental anxiety as mediator in the association between anxiety symptoms and young women' oral health-related quality of life

|  | G-computation estimate (OR) | Bootstrap std. err. | p value | 95% CI |
|---|---|---|---|---|
| TCE | 1.16 | 0.0580 | 0.009 | 1.04–1.30 |
| NDE | 1.18 | 0.0590 | 0.004 | 1.05–1.33 |
| NIE | 0.98 | 0.3230 | 0.608 | 0.92–1.05 |
| CDE | 1.16 | 0.0575 | 0.009 | 1.04–1.30 |

Control value(s): dental anxiety = moderate/high

*TCE* total causal effect, *NDE* natural direct effect, *CDE* controlled direct effect, *NIE* natural direct effect

General anxiety and dental anxiety have been reported to be strongly correlated [11, 12]. The higher vulnerability to experience negative emotional status predispose the individual to a range of psychological disorders, including dental anxiety [22, 23]. Nevertheless, the results of this study suggest that anxiety symptoms and dental anxiety may act independently. This finding could be explained by the instrument peculiarities on anxiety symptoms and dental anxiety evaluation. The BAI is able to identify many symptoms that

are not related to the environment of a dental appointment, whereas dental anxiety was described as a condition related to previous negative experiences in the dental office.

It is possible that some important confounders of the association between anxiety symptoms and OHRQoL were not evaluated in this study, as comorbidities and stressful events, and this could be considered a limitation of the study. Besides, the sample was homogeneous for socioeconomic and demographic characteristics, compromising the external validity. However, the study presents important strengths as contribute to close an existing gap in the literature and use an analytical approach with a robust method for estimating the effect of the exposure on the outcome. In addition, this analysis allows us to estimate direct and indirect effects from the exposure to the outcome, what can be useful information for clinicians and policy makers.

A worldwide increase in the prevalence of mental disorders was observed in the last years, and currently, they have been considered as a major public health problem. Taking into account that mental health is highly associated with oral health [20], it is possible that the prevalence of oral diseases is higher in anxious people, which consequently, increases the negative perception on OHRQoL.

Fig. 2 Model of mediation analysis with coefficients and respective confidence interval of total causal effect and natural indirect effect
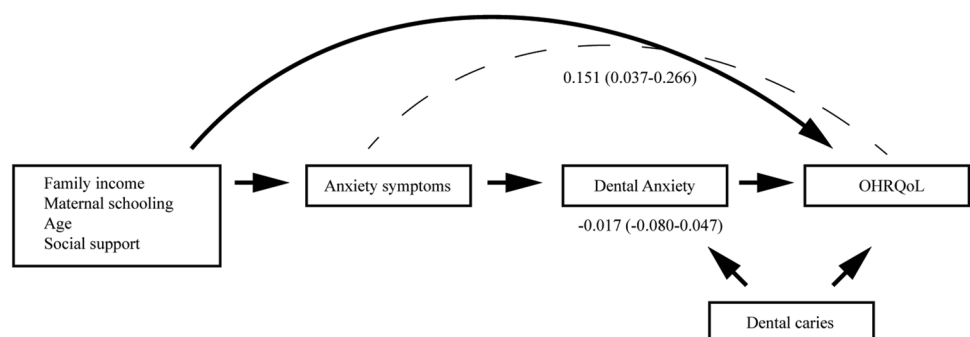
**Table 3** G-computation analysis to anxiety symptoms in young mothers and domains of oral impact on daily performance instrument

|  | G-computation estimate (OR) | Bootstrap std. err. | $p$ value | 95% CI |
|---|---|---|---|---|
| **Physical domain** | | | | |
| TCE | 1.15 | 0.0593 | 0.019 | 1.02–1.29 |
| NDE | 1.12 | 0.0602 | 0.063 | 0.99–1.26 |
| NIE | 1.03 | 0.0316 | 0.393 | 0.97–1.09 |
| CDE | 1.18 | 0.0591 | 0.004 | 1.06–1.33 |
| **Psychological domain** | | | | |
| TCE | 1.11 | 0.0514 | 0.053 | 1.00–1.22 |
| NDE | 1.07 | 0.0507 | 0.190 | 0.97–1.18 |
| NIE | 1.03 | 0.0283 | 0.241 | 0.98–1.09 |
| CDE | 1.20 | 0.0584 | 0.002 | 1.07–1.34 |
| **Social domain** | | | | |
| TCE | 1.15 | 0.0600 | 0.021 | 1.02–1.29 |
| NDE | 1.10 | 0.0608 | 0.095 | 0.98–1.25 |
| NIE | 1.04 | 0.0316 | 0.237 | 0.98–1.10 |
| CDE | 1.19 | 0.0592 | 0.004 | 1.06–1.33 |

Control value(s): dental anxiety = moderate/high

*TCE* total causal effect, *NDE* natural direct effect, *CDE* controlled direct effect, *NIE* natural direct effect

Our results disclosed that young women with anxiety symptoms presented 16% higher impact on OHRQoL compared to women without symptoms. Thus, clinicians and policy makers should be aware of the role played by anxiety on oral health perception, stimulating clinical approaches and public health policies that would consider the individual as a whole.

## Compliance with ethical standards

**Conflict of interest** All authors declare that they have no conflict of interest.

**Ethical approval** All the procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and national (Brazil) research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed consent** Informed consent was obtained from all the participants included in the study.

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