Sense of Coherence and Toothache of Adolescents from Southern Brazil

Arisson Rocha da Rosa, MSc
Civil Servant
Family Health Strategy of
  Porto Alegre City
Porto Alegre, Rio Grande do Sul
Brazil

Claides Abegg, PhD
Associate Professor
School of Dentistry
Universidade Federal do Rio Grande
  do Sul
Porto Alegre, Rio Grande do Sul
Brazil

Helenita Corrêa Ely, PhD
Lecturer
School of Dentistry
Pontifícia Universidade Católica
  do Rio Grande do Sul
Porto Alegre, Rio Grande do Sul
Brazil

Correspondence to:
Arisson Rocha da Rosa
Rua Vilmar Ribeiro Wogt, 250
CEP 91260-500
Porto Alegre/RS, Brazil
Fax: (+5551)34344544
E-mail: arisson78@gmail.com

Aims: To investigate the association in adolescents between toothache and sense of coherence (SOC), a psychosocial construct defined as a global orientation to life. **Methods:** A school-based cross-sectional study was carried out in 36 municipalities comprising up to 50,000 residents in southern Brazil. The target population was adolescents from 15 to 19 years of age. The sample consisted of 1,150 adolescents chosen by systematic sampling; the final adjusted analysis by Poisson regression included 1,065 individuals. Data were collected using a questionnaire, SOC scale, and the Decayed Missing Filled Teeth (DMFT) index. **Results:** Of the adolescents in the sample, 29.8% reported experiencing toothache in the previous 6 months. The prevalence of dental caries was 31.0%, and the DMFT index was 3.22. SOC was a significant protective factor for toothache; the prevalence ratio was 0.65 (95% confidence interval [CI] = 0.55–0.75). Girls presented 39% more toothaches than boys (95% CI = 1.15–1.68). Individuals who saw the dentist for reasons other than reviews or check-ups had a toothache prevalence that was 85% higher than their counterparts (95% CI = 1.47–2.34). Adolescents with tooth decay reported up to two times more toothache than those without tooth decay. **Conclusion:** The results of this study showed that a strong SOC protected against toothache. A health-promotion approach may lead to better patterns of oral health. *J Oral Facial Pain Headache 2015;29:250–256. doi: 10.11607/ofph.1383*

Keywords: *cross-sectional study, health of the adolescent, pain, sense of coherence, toothache*

Toothache remains a public health problem and is considered a major cause of psychosocial, physical, and economic distress. Individuals who suffer from toothaches often miss time at school, work, and home tasks, resulting in many hours lost each year throughout the world.[1,2] The reported prevalence of toothache varies from 7% to 32% in people aged 16 and over.[3] Data from the Brazilian Epidemiological Survey/SB Brazil 2010 showed a toothache prevalence of 24.7% in Brazilians aged 15 to 19 years old.[4]

This problem has been studied from the perspective of illness and its associated factors. Distinct from this approach, the present study investigated toothache by using the salutogenic theory, which focuses on health, resources for maintaining health, and health promotion.[5] Beyond explaining disease, salutogenesis aims to explain factors that help individuals stay healthy. The core concept of salutogenesis is the Sense of Coherence (SOC), a psychosocial construct defined as a global orientation to life, whose strength leads to subjective perceptions that facilitate successful coping with the many life stressors.[6]

Several studies have shown a correlation between SOC and health. Longitudinal studies have found that better health outcomes in adulthood are predicted by stronger SOC.[7,8] Similarly, cross-sectional studies have shown that individuals with strong SOC present more favorable general health[9,10] and dental behaviors, as well as knowledge of oral health.[11,12]

Adolescents represent a quarter of the world population[13] and comprise 35 million individuals in Brazil.[14] In a national study of Brazilian adolescents, it was reported that their oral health had a high negative impact on their quality of life.[15] Adolescents with a higher SOC are more likely to make preventive dental visits and brush their teeth more frequently than those with a lower SOC.[11,16] In addition, adults with a strong SOC have been found to have more teeth and lower levels of dental caries and periodontal disease than those with a weaker SOC.[16–18]

According to the social determination model of toothache proposed by Bastos et al,[19] social structure and oral health are linked with material, behavioral, and psychosocial factors. This study investigated the association between SOC and toothache in adolescents, a topic that has not been previously studied. The hypothesis guiding this research was that adolescents with a strong SOC will have experienced less toothache in the previous 6 months than those with a weaker SOC.

Materials and Methods

A school-based cross-sectional study was carried out in 36 municipalities comprising up to 50,000 inhabitants in Rio Grande do Sul (RS), a state in southern Brazil, from June to December 2011. Municipalities were selected according to the criteria of a larger study to which this study is related. The target population was adolescents 15 to 19 years of age. The present study was part of a major investigation called Impacto da Estratégia de Saúde da Família no Perfil Epidemiológico de Saúde Bucal no Rio Grande do Sul State (Impact of Family Health Strategy on the Epidemiologic Profile of Oral Health in RS), which aimed primarily to assess oral health in RS State and measure differences after implementation of the Family Health Strategy. This research was approved by the Research Ethics Committee of the School of Dentistry of the Federal University of Rio Grande do Sul on June 16, 2011, under protocol #15310, according to the recommendations of Resolution #196/96 of the Brazilian National Health Council. All participants provided written informed consent prior to participation in the study.

Before the main study, a pilot study with 102 adolescents was conducted to train and calibrate examiners and assess instrument suitability. The examination team included four dentists. The reproducibility of the "decayed" component from the Decayed Missing Filled Teeth (DMFT) index was assessed by re-examining 5% of participants at the end of each clinical examination group completed by each examiner. In addition, intra- and interexaminer reliability was calculated during the calibrating process.

Sample size was calculated according to the following parameters: 26.5% toothache prevalence, 5% significance level, 95% power, and 0.49 odds ratio. A sample size of 644 participants was required, but the final sample included 1,150 adolescents because this research was part of a larger study that included more outcomes and required a larger sample. Participants were selected using systematic sampling. Data were collected from rural and urban schools in each of the 36 municipalities selected for the larger study. The number of participants in each school was proportional to the population size of the municipality and the total number of students belonging to the 15- to 19-year-old age group who were regularly enrolled in school. Data were collected in schools through *(1)* self-report measures, including a structured questionnaire that assessed sociodemographic data, the use of oral health services, and the question "Have you experienced a toothache in the previous 6 months?", as well as the Brazilian version of the SOC scale (SOC-13),[20] and *(2)* a clinical oral examination performed in a room with good daytime light; handheld lights were used at night. The clinical examination followed the World Health Organization (WHO) criteria for dental caries complemented by the Brazilian Epidemiological Survey/SB Brazil 2010.[4] Independent variables were divided into four groups: sociodemographics, use of oral health services, SOC, and clinical oral health. Sociodemographic variables assessed included sex, race/skin color (white, dark-skinned black, lighter-skinned black, Asian, and Amerindian, based on criteria adopted by the Brazilian census), maternal education, and monthly family income. Male participants were chosen as the reference category. Race was categorized by white (chosen as reference), dark-skinned black, and lighter-skinned black. The categories Asian and Amerindian were excluded from the analysis due to the small number of subjects. Maternal education was collected as a continuous variable (number of school years successfully completed) and grouped into four categories: 0 to 4 years, 5 to 8 years, 9 to 11 years, and 12+ years. The last category was considered as the reference for analysis. Monthly family income was collected in Brazilian currency and organized in a crescent categorical form, here converted to US dollars (values in US dollars according to the mean in the second semester of 2011): up to $882 (low family income), from $883 to $2,647 (medium family income), $2,648 or more (high family income), and "I don't know." High income was considered the baseline for analysis. These sociodemographic variables were selected as potential confounders. The questionnaire about the use of oral health services

Table 1 Sociodemographic Characteristics, Dental Service Use and Presence of Dental Caries in the Sample (n = 1,150)

	n (%)
Sex	
Male	492 (42.8)
Female	658 (57.2)
Race/ skin color	
White	822 (71.5)
Lighter-skinned black	255 (22.2)
Dark-skinned black	59 (5.1)
Amerindian	8 (0.7)
Asian	6 (0.5)
Monthly family income (in US$)	
Up to $882	621 (54.0)
From $883 to $2,647	451 (39.2)
From $2,648 to $5,295	78 (6.8)
Maternal years of education	
Up to 4	325 (28.3)
From 5 to 8	475 (41.3)
From 9 to 11	236 (20.5)
12 or more	114 (9.9)
Time of last dental visit	
Less than 1 year	864 (75.1)
1 year or more	225 (19.6)
I don't know	61 (5.3)
Reason for the last visit	
Routine	446 (38.8)
Orthodontic examination	251 (21.8)
Pain	134 (11.7)
Tooth extraction	83 (7.2)
Regular treatment	141 (12.2)
Other	95 (8.3)
Presence of dental caries	
Caries free	793 (69.0)
1 to 2 decayed teeth	249 (21.6)
≥ 3 decayed teeth	108 (9.4)
Did you feel toothache in the previous 6 months?	
No	787 (70.2)
Yes	334 (29.8)

consisted of the following questions and possible answers: *(a)* "When did you last visit the dentist?" (never been to the dentist, less than 1 year ago, 1 to 2 years ago, 3 years or more, I don't know) and *(b)* "What was the reason for this visit?" (routine checkup, orthodontic examination, pain, tooth extraction, regular treatment, other). For analysis, responses to *(a)* and *(b)* were dichotomized based on other studies that used the same cutoff point.[11,21] For *(a)*, the reference was the answer "less than 1 year" versus "1 year or more." This cutoff point was used because people who usually visit the dentist "less than 1 year ago" are considered regular attenders.[22] In *(b)*, the baseline was routine review versus the others (orthodontic examination, tooth extraction, regular treatment, other, and pain). The responses "never been" and "I don't know" were considered as missing.

SOC was measured using the SOC-13, the short version of the scale, which has been validated and transculturally adapted for use with a Brazilian population.[20] This instrument comprises 13 questions. Responses to each question were rated on a five-point Likert-type scale that ranged from the most positive to the most negative. The 13 items generate a total score of 13 to 65, with higher values indicating stronger SOC and an overall positive view of life.[6,20] In the present study, the SOC was used as a continuous variable. To better evaluate SOC scores after analysis, the total score was divided by 10 on the log scale so the results indicated a change in the outcome variable for every increase of 10 units in the SOC score. Internal consistency was measured by Cronbach α. Clinical oral health data were collected using the DMFT index. In this study, the "decayed" component of the DMFT was used as a possible confounder in the analysis. The presence of caries was categorized into three groups: no caries, 1 to 2 decayed teeth, and 3 or more decayed teeth. The outcome variable was the participant's response (yes/no) regarding the occurrence of toothache in the previous 6 months.

Data were entered in Epidata v.3.0 software with automatic checks for consistency and range, and imported to Statistical Package for the Social Sciences (SPSS) v.18 software for data analysis. Descriptive statistics were obtained from independent variables as well as toothache prevalence. The association between the outcome and the studied factors was examined using robust Poisson regression models due to the elevated frequency of the outcome.[23] Eight bivariate analyses were performed, one for each explanatory variable (sex, race, monthly family income, mother's years of education, time since the last dental visit, reason for the last dental visit, presence of caries, and SOC). In these models, independent variables with $P \leq .20$ were selected for inclusion in the final model. At that time, six variables (sex, race, monthly family income, reason for last dental attendance, presence of caries, and SOC) remained statistically significant ($P < .05$) in at least one category.

Multivariable regression analysis was performed to obtain the adjusted prevalence ratio (PR) and 95% confidence interval (CI) for each category of the studied variables. The final model had four significant variables and was the most powerful for explaining the outcome.

Results

The response rate in this study was 94%. As shown in Table 1, of 1,150 participants, 42.8% were male and 57.2% were female. Of those who had seen a dentist, 75.1% had seen the dentist less than 1 year ago, and 19.6% more than 1 year ago. The main reasons

Table 2 Results from Robust Poisson Regression Models of the Variables in the Study Associated with Toothache in the Previous 6 Months (n = 1,065)

	Unadjusted PR	95% CI	P*	Adjusted PR	95% CI	P*
Sex						
Male	1			1		
Female	1.386	1.14–1.68	.001	1.394	1.15–1.68	.000
Race/skin color						
White	1			1		
Dark-skinned black	1.253	0.84–1.86	.264	1.020	0.67–1.53	.926
Lighter-skinned black	1.164	0.94–1.43	.158	1.103	0.90–1.35	.341
Montly family income						
High family income	1			1		
Medium family income	1.413	0.87–2.28	.156	1.297	0.82–2.04	.265
Low family income	1.692	1.05–2.70	.028	1.352	0.86–2.11	.188
Maternal years of education						
12 years or more	1					
9 to 11 years	1.003	0.69–1.44	.989	–	–	–
5 to 8 years	1.056	0.75–1.47	.748	–	–	–
Up to 4 years	1.214	0.85–1.70	.262	–	–	–
Time of last dental visit						
Less than 1 year	1					
1 or more years	0.969	0.77–1.21	.791	–	–	–
Reason of the last visit						
Routine or check-up	1			1		
Other reason	2.098	1.66–2.63	.000	1.859	1.47–2.34	.000
Presence of dental caries						
Caries free	1			1		
1 to 2 decayed teeth	1.838	1.50–2.24	.000	1.647	1.34–2.01	.000
≥ 3 decayed teeth	2.591	2.08–3.21	.000	2.080	1.67–2.59	.000
Sense of Coherence						
SOC per 10 units	0.575	0.49-0.67	.000	0.650	0.55-0.75	.000

*Wald test.

PR = prevalence ratio; CI = confidence interval.

given for visiting the dentist were routine/review (38.8%), orthodontic examination (21.8%), regular treatment (12.2%), and pain (11.7%). In the present sample, 29.8% (95% CI = 27.1–32.6) reported having a toothache in the previous 6 months. The frequency distribution of SOC scores was compatible with a normal distribution. Adolescents' SOC scores ranged from 27 to 60; the mean and median were 45 (SD 5.0). Internal reliability as measured by Cronbach α was 0.67. The kappa values for the "decayed" component at the calibrating process were 0.76 to 0.94. The reproducibility of 5% calculated during the study was > 0.90. Regarding oral health, the prevalence of dental caries was 31.0%, and the DMFT index was 3.22 (95% CI = 3.03–3.40).

Results from the unadjusted and adjusted Poisson regressions models are presented in Table 2. Time since the last dental visit and maternal years of education were not significant in the bivariate analysis. The number of individuals in the analysis varies because a response of "I don't know" was treated as missing data, and participants who classified themselves as Asian and Amerindian with regard to race/skin color were removed from the analysis. Therefore, the final adjusted analysis was based on 1,065 individuals.

SOC remained a significant protective factor for toothache prevalence even after adjusting for confounding variables. For each 10-point rise in SOC, toothache PR decreased by 35% (95% CI = 0.55–0.75). The female participants reported 39% more toothache than the male participants (95% CI = 1.15–1.68). Individuals who saw the dentist for reasons other than reviews or check-ups reported a toothache prevalence that was 86% higher than their counterparts (95% CI = 1.47–2.34). Adolescents with one to two decayed teeth had a 65% increase in toothache prevalence (95% CI = 1.34–2.01), and those with three or more decayed teeth had a twofold increase (95% CI = 1.67–2.59) compared to caries-free individuals. Race and monthly family income were not significant in the final model (P > .05).

Discussion

The findings of the present study support the hypothesis that adolescents with a strong SOC are more likely to have lower toothache prevalence in the previous 6 months than those with a weak SOC. The SOC remained associated with the outcome even after

adjusting for well-known factors related to toothache, showing the importance of this psychosocial factor in the perception of dental pain.

In the literature, SOC is considered to be a psychosocial factor that enables individuals to maintain and enhance their potential for health and well-being.[21] The results of this study showed that a high SOC was a protective factor against toothache. For each 10-point rise in SOC, toothache prevalence decreased by 35%. Pain is often considered a subjective and complex outcome associated with emotional distress and linked to biological, cultural, and psychological factors; it also is involved with the affective domain.[25,26] On the other hand, pain may reflect the adversity of the context in which the individual lives.[27] From this perspective, Antonovsky[6] considered that SOC is not primarily a variable that buffers stress, but rather the stress-buffering effects of SOC may be a result of its influence on the choice of coping strategies. SOC provides individuals with more comprehension, manageability, and meaning in a conflicting context. Hence, individuals with a high SOC may be more likely to have a wider range of adaptive strategies and positive coping methods against stressors. A previous study of 3,998 Swedish students demonstrated that a strong SOC had beneficial effects on adolescents' psychosomatic symptoms, such as headache, stomachache, nervousness, feeling irritated, sleeping problems, and dizziness. The increased risk for severe psychosomatic symptoms for boys with a weak SOC was 15 times higher than for their counterparts with a high SOC. For girls, the increased risk was 10 times. The SOC was found to be an independent resource against stressors, contributing to the favorable development of a subjective state of health.[28] In another study, a high SOC was associated with a lower prevalence of recent self-reported symptoms and provided protection against illness for girls exposed to stress.[29] Furthermore, other studies of pain found that individuals with a strong SOC are less likely to report the presence of pain.[30,31] These findings support Antonovsky's theory that SOC may affect physiologic equilibrium.[6] Thus, physiologic processes may be affected by stressors or negative coping responses, resulting in a lower pain threshold.[32,33]

At the same time, substantial evidence exists linking a strong SOC to better oral health knowledge, attitudes, and behaviors, which may result in improved oral health. Several studies have shown that individuals with a strong SOC are less likely to have tooth loss and decayed teeth,[12,17,18] leading to a decrease in the main factors that cause toothache. These mechanisms reinforce the role of SOC relative to toothache.

Almost one-third of participants of this study experienced toothache in the previous 6 months. This prevalence is higher than that in the United States[34] but similar to that found in other Brazilian studies[35,36] and a Pakistani study of adolescents.[37] Slade's review[27] found that toothache prevalence among children and adolescents in developed countries ranges from 5% to 33%, with girls presenting toothache more often than boys. This is consistent with other international and national studies.[35,36,38] There is, however, a lack of consensus regarding the association between gender and toothache in the literature.[39] Many studies have suggested that women have a lower pain threshold and are more likely to report pain, while cultural aspects create expectations about men's social roles that cause them to suppress feelings of pain.[35,40] The effect of biological and psychosocial factors on pain remains an active field of investigation.

In the bivariable model, dental pain was more common in lighter-skinned black participants and those with low monthly family income. However, these results did not remain after adjusting for participants' sex, SOC, and clinical variables. These findings are similar to those of the study by Borges et al,[35] which found no significant differences in toothache prevalence among members of different races. However, the findings of the present study regarding family income were different from that and other prior studies.[27,35]

Despite African descendants tending to have worse living and health conditions as a consequence of social inequality in Brazil, some studies have demonstrated that the higher social development of municipalities may result in better oral health outcomes (including toothache[36]) for their population.[41,42] The municipalities approached in this study had a Human Development Index (HDI) from 0.7 to 0.83 and Gini Index from 0.3 to 0.41[14]; these are considered good indicators of social development and may suggest better delivery of and access to health services and goods for their population.

Despite the variety of etiologic factors involved in the cause of toothache, its most common agent is dental decay.[27,44] The prevalence ratio of pain increased (1.6 to 2 times) with the number of decayed teeth compared to individuals without tooth decay.

Strategies to prevent and treat dental decay are well known. Therefore, the public health system should offer affordable tooth decay prevention and treatment programs. This will reduce the need for difficult or mutilating treatments related to toothache[44] and will contribute to reaching the Global Goals for Oral Health 2020.[45] In addition, referrals to pain treatment centers may be offered to individuals who seek health care for toothache, as pain is one of the most frequent reasons adolescents report seeking

dental care[36] and the best predictor for seeking dental services.[46]

Regarding the reasons for seeking dental care, the present findings showed that routine reviews or check-ups were a protective factor for toothache. Individuals who see the dentist more frequently may avoid toothache or decrease its occurrence, thus resulting in fewer reports of pain.[47] Studies of adolescents have demonstrated that strong SOC is associated with healthier behaviors such as lighter use of alcohol, not smoking, better dental hygiene, and regular dental check-ups.[10,17]

The present study showed that adolescents from small- to medium-sized municipalities in southern Brazil presented high toothache prevalence, which is similar to other regions of the country. Toothache has an impact on everyday life, emphasizing the need for a public health care network that also provides emergency dental services. A salutogenic approach to toothache should begin with preventive and health-promotion programs. Salutogenesis may be used to strengthen adolescents' general resistance resources and identify behaviors that help them to stay healthy, similar to the empowering dialogues described by Malterud and Hollnagel[48] and the SOC-enhancing intervention described by Nammontri et al.[49]

The SOC develops mainly in the first decades of life during which people learn to deal with life situations, being stimulated by the experiences that the individual faces in the course of it.[5,6] Since SOC is still maturing during adolescence, this approach seems promising for reaching higher levels of health in adulthood. Future research to increase the understanding of the factors that positively influence the SOC is necessary.

The internal validity of the present study is supported by its considerable sample size as well as the methodology, which included a validated transcultural questionnaire, high response rate, and high level of agreement between examiners. Comparisons to other studies of toothache can be made due to the timeframe adopted to report the outcome, in spite of the differences in the age groups. Self-report questionnaires may present limits such as a tendency of respondents to systematically agree or disagree with questions. In addition, subjects may not fully understand the concepts under investigation.[50] These aspects could compromise the reliability of the findings. However, the prevalence of toothache found in this study was similar to that found in other Brazilian studies.

The SOC is a five-point scale, which increases reliability. The instrument has been validated and transculturally adapted for use in the Brazilian population,[20] and it has been used in other studies with a similar age group.[27,28] However, the present results are not representative of the entire country, mainly due to the broad cultural variety and social contrasts that exist in Brazil. Moreover, there are differences in access to and the use of oral health services across different Brazilian regions. Furthermore, this study was school-based and therefore does not account for adolescents out of school or the absenteeism caused by toothache. However, the number of young matriculated students in Brazil is high, and most of them are in school (83.7%).[51] One advantage of school-based studies is the opportunity to use the findings for health promotion and the development of preventive strategies for this specific population.[52]

Acknowledgments

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