Factors related to dental caries in southeastern Brazil

ABSTRACT

Aim: Identify the experience of dental caries among adolescents associated to work, self-care, social life and access to healthcare services.

Materials and methods: This cross-sectional study was carried out with 60 adolescents aged 15 and 16 years in a city in southeastern Brazil. The data were collected through a structured interview and clinical exam for dental caries carried out by a single, duly calibrated examiner (Kappa=0.8 to 0.9). The relationships between the dependent variable (experience of dental caries) and independent variables (work, self-care, social life and access to healthcare services) was determined using bivariate ($\chi^2$ test, $p<0.10$) and multivariate analysis ($p<0.25$).

Results: Eighty percent had two or more teeth with caries (95% CI: 70.0-90.0). Mean DMFT was 4.72 (± 3.55) and DMFS was 8.07 (± 7.46). When the experience of caries was related to the independent variables, only “access to healthcare services” achieved statistical significance. Individuals with greater access had a threefold greater chance of belonging to the group with a lesser experience with caries, PR=3.2 (90% CI 1.07-9.78).

Conclusion: All interviewees reported seeking care in the private system when requiring dental assistance. Access to healthcare (declared as essentially private) was associated to dental caries.

Keywords: Adolescents; Adolescent health services; Dental caries; Health services accessibility.

Introduction

Although the prevalence of dental caries in adolescence has undergone a decline in the last 20 years, it remains at worrisome levels. The mean percentage of adolescents affected by dental caries is between 80% and 90% [Amaral et al., 2005; Gushi et al., 2005; Migale et al., 2009; Mliciuviene et al., 2009]. Exceptions are uncommon, as described in a study carried out in Valencia, Spain (56%) and another carried out in João Pessoa, Brazil (52%) [Almerich Silla and Montiel Company, 2006; Moreira et al., 2007].

Epidemiological studies conducted in Brazil have demonstrated a reduction in the prevalence and severity of dental caries. The first national epidemiological survey on oral health was carried out in Brazilian state capitals in 1986. Among other age groups, adolescents from 15 to 19 years of age were examined, revealing a mean DMFT index of 12.4 in the southeastern region of the country, which was similar to the national average of 12.7 [Brasil, 1986]. Another national survey was carried out in 2003 and revealed a decline in the mean DMFT index (6.7 ± 4.82) in this age group. Data on access to dental treatment revealed that 13.5% of Brazilian adolescents had never been to the dentist [Brasil, 2004]. This aspect merits special attention, as the factors that influence dental caries in a group or population include the difficulty in broadening access to prevention resources and ensuring treatment for affected individuals [Antunes et al., 2006; Migale et al., 2009].

Adolescence is a phase marked by intense, multidimensional changes that involve physical (biological), psychological and socio-cultural realms. The physical and biological changes have a number of implications that make adolescent healthcare a challenge. Moreover, in this age group there is considerable concern with self-image [Amaral et al., 2005; Gushi et al., 2005; Almerich Silla and Montiel Company, 2006; Migale et al., 2009]. It is a critical period in the development of social relationships, when social ties are no longer centered on the family and normally switch to peers from whom support is sought (classmates, friends, romantic partners). Adolescents develop social skills in these relationships, in which they share experiences, emotions and knowledge [Hashim et al., 2001].

Less-than-healthy habits during adolescence constitute a risk factor for a number of illnesses in adulthood, including cavities. Lifestyle changes due to a perceived need to counter ideas established as correct, which could be harmful to health [Hashim et al., 2001; Antunes et al., 2006; Migale et al., 2009; Sarmadi et al., 2009].

The aim of the present study was to identify the experience of dental caries in adolescents and associate this experience with work, self-care, social interactions and access to oral health services.

Materials and methods

A cross-sectional study was carried out involving adolescents between 15 and 16 years of age, residents of a city (10,731 inhabitants) located in southeastern Brazil (Minas Gerais, 2008). Like most small cities in Brazil, economic activity is centered on agriculture and livestock farming. The city also financially relies on craftmanship, especially weaving with manual loom, with the intense participation of the entire population. The Human Development Index is 0.73. The city has had a fluoridated public water supply since 1981. Demographic data indicate that approximately 2000
individuals are between 10 and 19 years of age, 51.7% of whom are female [Minas Gerais, 2008].

Sampling
The data were collected in March 2008 as part of a second cross-sectional study on the municipality. The first was carried out in 1999, involving individuals of 7, 12 and 15 years of age [Ferreira, 2000]. All 90 children in the municipality who were seven years of age in 1999 participated in the study of Ferreira [2000]. Seventy of these children, who are currently 15 and 16 years of age, were located and agreed to participate in the present epidemiological study (carried out in 2008). The sample size is explained by the prevalence of dental caries identified in 15-year-old adolescents in 1999 (85%), with a 90% confidence interval and 8% error.

The study was approved by the Human Research Ethics Committee of the Universidade Federal de Minas Gerais (process nº ETIC 447/07).

Materials and methods
The data were collected by means of a questionnaire administered in interview form and a clinical exam for dental caries. The questionnaire addressed aspects related to work, social interactions, self-care and access to oral health services. In order to determine the internal reliability of the instrument, the test-retest method was carried out with a group of 10 adolescents and a 15-day interval between sessions.

The examiner (ETPF) underwent a calibration phase involving the 10 adolescents who participated in the test-retest of the questionnaire. This step included a theoretical discussion regarding the diagnosis of dental caries, training with slides and the clinical exam of the participants [WHO, 1997; Rigby, 2000]. The results of the intra-examiner agreement and test-retest achieved Kappa values ranged from 0.83 to 0.92, which are considered very good [Rigby, 2000].

The clinical exam took place under the same conditions as those during the data collection carried out in 1999 [Ferreira, 2000]. The adolescents were examined in the dental clinic of a public school in the municipality, under artificial light, with prior brushing and the use of a #5 dental mirror (PRISMA®, Sao Paulo, SP, BR). The diagnosis of dental caries was performed based on the criteria used in the previous study [Ferreira, 2000].

For the data analysis, the dependent variable was dichotomized (0=DMFT $\leq$ 1 and 1=DMFT>1). The variable work was dichotomized as the presence/absence of paid activity during the data collection period. The variables self-care, social interactions and access to oral health services were assessed based on the sum of the values on the questions related to each topic. For these three variables, each question was scored one point for each affirmative response and zero for each negative response (Table 1).

Table 2 discriminates the categories established from the median values obtained for the variables social interactions, self-care and access to oral health services.

Data analysis
The data were analyzed using the Statistical Package for Social Sciences (SPSS for Windows, version 16.0, SPSS Inc, Chicago, IL, USA). Univariate analysis was first carried out. The chi-square test (p<0.10) was used to determine the relationships between the dependent variable (experience of caries) and the independent variables (work, self-care, social interactions and access to oral health services). Multiple logistic regression analysis was carried out to identify the independent impact of each variable. The independent variables were included into the logistic model in decreasing order based on their statistical significance (p<0.25; backward stepwise procedure) or clinical-epidemiological importance [Austin and Tu, 2004].

<table>
<thead>
<tr>
<th>Social interactions</th>
<th>Self-care</th>
<th>Access to oral health services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you have friends?</td>
<td>Do you like to wear perfume or cologne?</td>
<td>When you need to go to the dentist, where do you go?</td>
</tr>
<tr>
<td>Do you participate in any youth groups?</td>
<td>Do you like to take care of your hair?</td>
<td>Is the healthcare service near or far from your home?</td>
</tr>
<tr>
<td>Do you like your school?</td>
<td>Do you like to brush your teeth?</td>
<td>Have you been to the dentist since you began school?</td>
</tr>
<tr>
<td>Do you like your city?</td>
<td>Do you have the habit of using toothpaste?</td>
<td>How long has it been since your last visit to the dentist?</td>
</tr>
<tr>
<td>Would you like to move away from your city?</td>
<td>Do you have the habit of using dental floss?</td>
<td>What was the reason for your last visit to the dentist?</td>
</tr>
<tr>
<td>Do you think there is no type of prejudice in your city?</td>
<td>When you are outside your home, do you have the habit of brushing your teeth?</td>
<td></td>
</tr>
<tr>
<td>Do you have a good living experience with your family?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you think you have a good future in your city?</td>
<td>Total = 0 to 8 points</td>
<td>Total = 0 to 6 points</td>
</tr>
<tr>
<td>Total = 0 to 8 points</td>
<td>Total = 0 to 6 points</td>
<td>Total = 0 to 5 points</td>
</tr>
</tbody>
</table>

**TABLE 1** - Questions used to assess the variables social interactions, self-care and access to oral health services.
DENTAL CARIES IN ADOLESCENTS

Sixty adolescents participated in the study; the average age was 15.4 years (± 0.49) and 62.0% of them were female (n=37). The vast majority of participants reported attending school (97.0%) and 55.0% of these adolescents were in high school. Approximately 72.0% reported having jobs and being satisfied with the work; craftwork was the main activity exercised, with a monthly income of R$50.00 to R$60.00.

Regarding the number of teeth with caries, 48 adolescents (80.0%) were diagnosed with two or more carious teeth (90% CI: 70.0-90.0). Only 15% were free of caries and 5% had one carious lesion. Table 3 displays the DMFT and DMFS indexes and respective components, including the results of the 1999 study for comparison purposes. There was an increase in the experience of caries considering the two groups of adolescents. This increase was mainly related to the decayed component of the DMFT index, which rose from 1.19 in 1999 to 1.55 in 2008. The same was true for the DMFS index (Table 3).

When the results of the experience of caries were related to the independent variables, only the variable access to oral health services achieved statistical significance (p<0.10) (Table 4).

Table 5 displays the results of the multiple logistic regression. After the independent adjustments of the other variables analyzed in the model, access to oral health services remained statistically associated to the experience of caries. Individuals with greater access to dental care were threefold more likely to pertain to the group with DMFT ≤1.

The distribution of the adolescents regarding access to healthcare services revealed differences between seeking public and private services. Public services were more sought for medical problems (75.0%). With regard to dental services, all the adolescents declared seeking a dentist a private practice (100.0%) when needing dental care.

Discussion

The results of the clinical exam revealed that most of the adolescents had two or more teeth with caries (80.0%). In the epidemiological survey carried out in 1999, a similar percentage was found among 15-year-olds in the city investigated (84.6%) [Ferreira, 2000]. Previous studies carried out in Brazil have reported a prevalence of dental caries ranging from 80.0 to 90.0% in adolescents [Gushi et al., 2002; Amaral et al., 2005; Moreira et al., 2005; Migale et al., 2009]. A number of studies report a reduction in the prevalence of caries among Brazilian adolescents as well as those in the majority of developed countries [Brasil, 1986; 1996; 2004; Bonecker and Cleaton-Jones, 2003; Milciuviene et al., 2009]. However,
this phenomenon was not observed in the city in question in the years analysed (1999 and 2008).

The mean DMFT index was 4.72 (± 3.55), with a result between the decayed (1.55±2.05) and filled (2.77±3.24) components. The 1999 data on this city revealed a mean DFMT index for 15-year-old adolescents of 4.34 (± 2.38) and a difference between the decayed (1.19 ± 1.55) and filled (2.77 ± 2.87) components [Ferreira, 2000]. Analyzing this data, the decayed component was the only one to exhibit a visible increase in the nine-year interval, representing both an increase in the prevalence of the disease as well as a lack of solution by oral health care. The same occurs when examining the DMFS index. Regarding the mean number of carious teeth in this group, one should consider the observation made by Frias et al. [2007], who warns of the risk of tooth extraction stemming from untreated caries and/or an insufficient use of dental services.

Table 4 - Absolute and relative frequency of independent variables according to experience of caries among adolescents (χ² test) in southeastern Brazil.

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>DMFT ≤ 1 (%)</th>
<th>DMFT &gt; 1 (%)</th>
<th>Total (100%)</th>
<th>p-value</th>
<th>Crude PR [CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>8 (21.6)</td>
<td>29 (78.4)</td>
<td>37</td>
<td>0.75**</td>
<td>1.31</td>
</tr>
<tr>
<td>Male</td>
<td>4 (17.4)</td>
<td>19 (82.6)</td>
<td>23</td>
<td></td>
<td>[0.34-4.96]</td>
</tr>
<tr>
<td>Work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>4 (23.5)</td>
<td>13 (76.5)</td>
<td>17</td>
<td>0.72**</td>
<td>1.34</td>
</tr>
<tr>
<td>Yes</td>
<td>8 (18.6)</td>
<td>35 (81.4)</td>
<td>43</td>
<td></td>
<td>[0.34-5.23]</td>
</tr>
<tr>
<td>Social interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>7 (23.3)</td>
<td>23 (76.7)</td>
<td>30</td>
<td>0.51</td>
<td>1.52</td>
</tr>
<tr>
<td>Low</td>
<td>5 (16.7)</td>
<td>25 (83.3)</td>
<td>30</td>
<td></td>
<td>[0.42-5.47]</td>
</tr>
<tr>
<td>Self-care</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater</td>
<td>7 (25.0)</td>
<td>21 (75.0)</td>
<td>28</td>
<td>0.36</td>
<td>1.80</td>
</tr>
<tr>
<td>Lesser</td>
<td>27 (84.4)</td>
<td>32</td>
<td></td>
<td></td>
<td>[0.50-6.48]</td>
</tr>
<tr>
<td>Access of oral health services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater</td>
<td>7 (31.8)</td>
<td>15 (68.2)</td>
<td>22</td>
<td>0.08</td>
<td>3.08</td>
</tr>
<tr>
<td>Lesser</td>
<td>5 (13.2)</td>
<td>33 (86.8)</td>
<td>38</td>
<td></td>
<td>(1.04-11.30)</td>
</tr>
</tbody>
</table>

PR: Prevalence ratio; CI: Confidence interval; * 90% level of significance; ** Fisher’s exact test (cell < 5)

Table 5 - Multiple logistic regression model for the explanation of the experience of caries among adolescents in southeastern Brazil.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Ratio</th>
<th>Adjusted PR [CI]</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access of oral health services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater</td>
<td>3.24</td>
<td>[1.07 - 9.78]</td>
<td>0.08</td>
</tr>
<tr>
<td>Lesser</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PR: Prevalence ratio; CI: Confidence interval * 90% level of significance

Aspects related to self-care and social interactions were not statistically associated to the experience of caries. Studies have demonstrated that dental services (measured by the dentist-population proportion) explain just 3% of the reduction in mean DMFT index among 12-year-olds, while social factors explain 65% of this reduction [Nadanovsky and Sheiham, 1995; Bonecker and Cleaton-Jones, 2003]. However, this conclusion may not be applicable to non-industrialized locations. According to the 2000 demographic census, the municipality investigated in the present study exhibited economic growth in comparison to previous data [IBGE, 2000]. However, 41.0% of the population were categorized as poor, with a per capita income of 0.65 times the minimum salary and 72.0% of the adolescents were involved in both study and work activities.

In the present study, only the variable access to oral health care was statistically associated to the experience of caries.
of caries and was maintained in the final model following the logistic analysis. The prevalence of caries among adolescents may by associated to insufficient access to preventive resources or the limited utilization of dental care services [Skaret et al., 2004].

When the first study was carried out in the city (1999), there were four dentists in the municipal public network, two of which worked exclusively with schoolchildren. In the present study (2008), there were only two dentists, with the one in charge of schoolchildren's oral healthcare residing in a different municipality at the time the data were collected. In the databank of the Brazilian public healthcare system, the total number of dental procedures carried out by the public sector in the municipality in question was 3246 in the year 2000, with a constant decline, reaching 416 procedures in 2007 [Brasil, 2007].

Another important point is that collective procedures were also carried out in 1999, which were incorporated to basic healthcare. These procedures were established by the Health Ministry in 1992 and refer to activities of low complexity that involve collective actions in health education, supervised tooth brushing with fluoridated toothpaste and topical applications of fluoride [Brasil, 2007]. The results of the present study reveal, however, that there has been no effective contribution from these collective procedures to an improvement in oral health status among adolescents, especially considering the increase in the number of carious teeth proportional to the increase in age. Data from the national public healthcare system reveal that, from 1999 to 2007, the total number of collective actions carried out in the municipality increased considerably until 2002 (16,747) [Brasil, 2007]. From this year onward, there was a progressive decline until 2005 (10,612) and such actions were no longer performed since 2006. Evaluations involving populations that experienced this modality of collective action have found that having participated or not in the activities of the collective procedures as a small child had no significant impact on oral health care in adolescence [Souza et al., 2007].

The difference between the use of medical and dental services was noteworthy. When asked where they would go when needing a physician, the majority of adolescents responded that they would seek the public sector. However, regarding dental needs, the participants declared opting for a professional in the private sector, which corroborates the findings of previous studies [Barros and Bertoldi, 2006; Manhães and Costa, 2008]. These results are believed to reflect the fact that the municipality investigated has not had a structured basic care service for some time. Moreover, dental treatment is insufficiently offered through a single public health clinic and the school dentist, resulting in difficulty or even an impossibility of access to dental care.

The fact that the majority of adolescents reported working (72.0%) is another complication to the access to dental treatment when considering the hours when such services are offered, and reinforces the essentially private nature of dental care in Brazil [Brasil, 2007]. Although there is controversy regarding the positive and negative aspects of joining the workforce at an early age, the work factor did not affect the oral health status of the adolescents surveyed. Despite the low pay received by the interviewees, they reported being satisfied with their work activities. The percentage of young Brazilians (14 to 24 years of age) that study and work is 21.4% [IBGE, 2000]. A number of authors have argued the beneficial aspects of entering the workforce at an early age and its contribution toward the growth of an individual [Brasil, 1990; Forastieri, 1997; Oliveira et al., 2001; Migale et al., 2009]. Youths tend to incorporate feelings of self-esteem and achievement to their personality, if compatible with their energy potential [Forastieri, 1997]. However, work can become an activity with negative consequences for youths when it cannot be reconciled with other activities that are important to this phase of life, such as studying, recreation and family [Oliveira et al., 2001].

National data from 2007 reveal 13,585 medical actions versus 501 dental actions in basic healthcare [Brasil, 2007]. In the majority of Brazilian cities, oral health continues to be a challenge to the principles of the public healthcare system, especially with regard to the universality and equity of care [Barros and Bertoldi, 2002; Souza et al., 2007]. Although the Brazilian public healthcare system is an entity of considerable importance, it still plays a proportionately small role and dental care is performed through the public system on a much smaller scale than medical care [Manhães and Costa, 2008]. The Organic Healthcare Law establishes free, universal access to health services and actions as one of its principles [Brasil, 1990]. However, although this universal access is ensured in the Constitution and is indispensable to ensuring equity in care, the concept is not concretized for the majority of the population [Barros and Bertoldi, 2002; Manhães and Costa, 2008]. Data from the last epidemiological survey carried out in Brazil reveal that 13.5% of adolescents had never been to the dentist [Brasil, 2004].

Knowledge regarding the distribution of dental caries and treatment needs among adolescents could assist in prioritizing the use of resources (which always fall short of needs) for the rational use of time and spending [Gushi et al., 2005]. However, analyzing the goal of a "healthy population", the availability of dental treatment cannot be considered a solution to the problem. Understanding the individual and contextual factors associated to the experience of caries facilitates the planning of more effective health interventions directed at reducing disease and its harmful consequences in this age group [Antunes et al., 2006; Frias et al., 2007].

**Conclusion**

Considering the experience of dental caries among the adolescents in the municipality studied as a clear sign of disease and prediction of dental problems in adulthood, dental caries can be considered a local public health problem. The restructuring of dentistry, especially on the primary healthcare level, could be an effective way to solve...
the problem. Thus, it is considerably important to implement measures that enable access to public dental care on the part of adolescents in small cities.

References