

EXPLORING THE ASSOCIATION OF CARIES EXPERIENCE WITH SOCIAL AND BEHAVIOURAL FACTORS AMONG SCHOOLCHILDREN FROM IASI, ROMANIA

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ABSTRACT

Aim of the study To explore the relationship between sociodemographic and oral health behavioural factors with dental caries experience in 6-8- and 11-13-year-old schoolchildren from Iasi. **Materials and Methods:** A cross-sectional study of 306 in first grade and 278 in sixth grade children was conducted in Iasi in 2012. Information on child socio-demographic characteristics and dental behaviours was collected through questionnaires. Clinical examinations were performed by one trained dentist using the ICDAS II system and caries experience was measured using dmfs/DMFS index. Oral hygiene status was assessed using the Silness and Loe plaque index. The association of sociodemographic and behavioural characteristics and oral hygiene status with caries experience (dmfs/DMFS) was assessed using negative binomial regression models. **Results:** For 6-8 years old children, socio-economical position, sugary food consumption between meals, treatment and dental pain as reason for the last dental visit and oral hygiene status were found to be significantly associated with dental caries experience in both unadjusted and adjusted models. For 11-13 years old children, oral health status and relatives supervision when child not at school were strongly associated with high levels of caries experience, while all the other factor were not significantly associate with caries experience in both unadjusted and adjusted models. **Conclusion:** Sociodemographic and behavioural variables and oral hygiene status were found to be risk factors for caries experience in 6-8-yr-old children, while the first two indicators were not significantly associated in 11-13-yr-old children. Epidemiological data can be used for improved public oral health service planning and resource allocation within the region. Future oral health promotion and education programmes should address these risk factors for dental caries experience.

Key words: dental caries, sociodemographic, oral health behaviour, children

INTRODUCTION

The majority of industrialized countries have experienced a significant reduction in the prevalence of dental caries due to the continuous improvement of living conditions, adoption of healthy lifestyles, improved self-care practices, effective use of fluorides and implementation of preventive oral care

programs [1] while in developing countries has been observed an increasing level of dental caries and treatment need [2].

Although globally the levels of dental caries have decreased over the past decades, it is still the most prevalent oral health disease affecting children and teenagers [3]. Untreated dental decay is a major cause of

pain which impacts children's quality of life and daily activities such as the ability to eat, speak, sleep, study or socialize [4,5].

Because dental caries in the primary dentition is a strong predictor for cariogenic risk of the permanent dentition [6-10], it's imperative to develop and implement oral health promotion programme after we evaluated the oral risk factors.

Petersen has observed [11] that at the population level, oral health outcomes are related to socio-environmental factors and characteristics of the oral health services available. In addition to the use of oral health services, modifiable risk behaviors such as oral hygiene practices, dietary habits, tobacco use and excessive consumption of alcohol were found. Across countries and oral health systems, the existence of a social gradient (economic characteristics and educational background) in dental caries prevalence was found.

Therefore, aim of this study was to explore the influence of socio-demographic, oral hygiene status and behavioural determinants on dental caries experience in schoolchildren from Iasi.

MATERIAL AND METHODS

A cross-sectional study of oral health status of schoolchildren was conducted in Iasi in 2012, where four public schools were selected based on having a dental chair operating within their premises, for detailed clinical oral examinations. All 588 first-grade and sixth-grade children in the selected schools were invited to participate in the survey.

Permission to conduct this study was obtained from the Research Ethics Committee of the "Gr. T. Popa" University of Medicine and Pharmacy Iasi. Parents were fully informed about the study and given the opportunity to opt out. A written consent form was obtained from parents before their

children's participation.

Data were collected through questionnaires and clinical oral examinations. Questionnaires were used to gather information on child socio-demographic characteristics and dental behaviours. Family socio-economic position (SEP) was assessed based on parents' occupation according to the Classification of occupation in Romania and education level. Child's dental behaviours included consumption of sugary food between meals, reason for the last dental visit and toothbrushing frequency.

Oral hygiene status was assessed using the plaque index of Silness and Loe which determines the quality of oral hygiene by quantifying the soft debris on tooth surfaces. The teeth surfaces examined were vestibular for 16, 21, 24, and lingual for 36, 41 and 44. When the permanent tooth had not erupted, assessments were done on the corresponding deciduous tooth. The scores were: 0=no plaque, 1=plaque detected by using the probe on the tooth surface in contact with the gingival margin, 2=moderate plaque accumulation visible to the naked eye, 3=tooth surface covered with a significant amount of plaque. The mean plaque index was calculated by the total scores divided by the number of teeth examined. Furthermore, to determine oral hygiene status the final results were grouped in four categories: 0=very good oral hygiene, $PI < 0.4$; 1=good oral hygiene, $PI = 0.4-1.0$; 2=less good oral hygiene, $PI = 1.1-2.0$; 3=poor oral hygiene, $PI > 2.0$.

Dental health status was assessed according to the ICDAS II diagnostic criteria, which uses a two-digit coding method to identify restorations/sealants (with the first digit - codes 0 to 8), the actual stage of the carious lesion (with the second digit - codes 0 to 6) and the reasons for the missing teeth (four special codes) [12].

All examinations were carried out by one

trained and calibrated dentist (DB), in the respective school's dental office, where a dental unit with functioning operation light and air syringe was available, using plane mouth mirrors and CPI probes, following the International Caries Detection and Assessment System (ICDAS) recommended protocol [13]. Before clinical examination children cleaned their teeth with a toothbrush supervised by the school dentist. No radiographs were taken. Intra-examiner reliability in caries diagnosis was determined by re-examining 58 children randomly selected from first- and sixth-grade after a week. Kappa value was 0.85 at surface level.

Data were analyzed using IBM SPSS Statistics 20.0 for Windows. Children's caries experience was measured using the dmfs for 6-8 year olds and the DMFS for 11-13 year olds. The ICDAS II caries codes were classified in two groups of severity levels: non-cavitated enamel carious lesions – at a d/D1-2 level (codes 1 and 2), and cavitated carious lesions – at a d/D3-6 level (codes 3 to 6). The f/F component included surfaces with fillings associated or not with early lesions (codes 1 and 2) on the same tooth surface. Fillings diagnosed in conjunction with cavitated carious lesions (codes 3 to 6) were added to the d/D-component for calculation of dmfs/DMFS scores. The occlusal surfaces with full or partial sealants were considered as healthy (code 0). Each age cohort (6-8 and 11-13 year olds) was analysed separately. Caries experience (dmfs/DMFS index) was the outcome measure for analysis. The association of sociodemographic and behavioural characteristics and oral hygiene

status with caries experience (dmfs/DMFS) was assessed using negative binomial regression models because dmfs/DMFS scores were count variables and over-dispersed. Rate ratios (RR) were therefore reported. In Model 1 the association was adjusted for demographic factors (SEP, child's sex and age) and in Model 2 for caregiver when child not at school, oral hygiene status and dental behaviours (sugary food between meals, toothbrushing frequency and reason for last dental visit). Significance was assumed at ≤ 0.05 .

RESULTS AND DISCUSSIONS

Socioeconomic status is the basis of many inequalities in health, including oral health. Occupational status, income and education are found in a close relationship with each other becoming measurement instruments. In general, population groups which have a poor oral status are those groups who have low incomes and a marked lack of education, while for those with high socioeconomic level access to healthcare services is directly proportional to their income and education increases the opportunity for adequate sanitary behaviour.

The original sample comprised a total of 588 children, but children who could not provide information about their parents' occupation were excluded from this study. Therefore the number of children included was 584, 306 6-8-yr-old children (mean age: 7.3, SD: 0.53) in first grade, and 278 11-13-yr-old children (mean age: 12.7 years, SD: 0.52) in sixth grade.

Table 1. Sample description of children from year 1 (n=306) and year 6 (n=278) by sex, socio-economic position, caregiver and oral health behaviors

Characteristics	6-8 yr olds		11-13 yr olds	
	n	%	n	%
<i>Sex</i>				
Boys	152	49.7%	128	46.0%
Girls	154	50.3%	150	54.0%

<i>Socio-economic position</i>				
High level	134	43.8%	70	25.2%
Medium level	78	25.5%	82	29.5%
Low level	94	30.7%	126	45.3%
<i>Caregiver when child not at school</i>				
Parents	72	23.5%	178	64.0%
Relatives	152	49.7%	58	20.9%
Other	26	8.5%	2	0.7%
No one	56	18.3%	40	14.4%
<i>Sugary food between meals</i>				
Yes	252	82.4%	226	81.3%
No	54	17.6%	52	18.7%
<i>Reason for the last dental visit</i>				
Dental check	98	32.0%	152	54.7%
Treatment	94	30.7%	58	20.9%
Dental pain	36	11.8%	44	15.8%
Never been to the dentist	78	25.5%	24	8.6%
<i>Toothbrushing frequency</i>				
Once a day or less	218	71.2%	144	51.8%
Twice a day or more	88	28.8%	134	48.2%
<i>Oral hygiene status</i>				
Very good	52	17.0%	44	15.8%
Good	160	52.3%	116	41.7%
Less good	62	20.3%	82	29.5%
Poor	32	10.5%	36	12.9%

Details about the description of the sample are presented in **Table 1**. Approximately 50% of children come from high and low SEP families in 6-8-yr-old children and in 11-13-yr-old children, respectively. Most children (over 80%) reported to eat sweet food between meals, and more than half that they brush their teeth once a day or less, and went to the dentist for a dental check.

Regarding the association between SEP and caries experience among first grade children we found that the mean values of decayed component at both levels has a significant increase as the SEP level decrease, while the values of m and f components were lower in children living in medium SEP

families. In sixth grade children, we found that the mean value of decayed component at 3-6 level has a significant increase as the SEP level decrease while all other differences are not statistical significant (**Table 2**). Same results were found in the study made in Brazil [14].

The relationship of health-related behaviors with socioeconomic position and with oral health on the other hand, implies that behaviors play an important role in the socioeconomic disparities in oral health. Particularly as some oral health enhancing behaviors, such as preventive dental visits, are restricted by costs [15].

Table 2. Mean of decayed, missing and filled surfaces (dmfs/DMFS) by parents' socio-economic position and the statistical significance of the differences between groups

Caries measure	High SEP	Medium SEP	Low SEP	p value for trend
	Mean [95% CI]	Mean [95% CI]	Mean [95% CI]	
<i>6-8 year olds</i>				
d _{1-2S}	0.24 [0.14-0.33]	0.51 [0.31-0.72]	0.60 [0.36-0.83]	<0.001
d _{3-6S}	5.78 [4.59-6.96]	12.05 [10.05-14.05]	11.00 [9.38-12.62]	<0.001
ms	1.18 [0.46-1.89]	0.23 [0.00-0.46]	2.04 [1.28-2.81]	0.002
fs	1.00 [0.71-1.29]	0.23 [0.06-0.40]	0.26 [0.11-0.40]	<0.001

d ₃₋₆ mfs	7.96 [6.54-9.37]	12.51 [10.51-14.51]	13.30 [11.47-15.13]	<0.001
<i>11-13 year olds</i>				
D ₁₋₂ S	1.91 [1.36-2.47]	2.83 [2.34-3.32]	1.92 [1.52-2.32]	0.674
D ₃₋₆ S	4.29 [2.33-6.24]	5.41 [4.43-6.40]	5.13 [4.36-5.89]	0.361
MS	0.14 [-0.06-0.34]	0.00 [0.00-0.00]	0.16 [0.00-0.31]	0.409
FS	1.03 [0.54-1.52]	1.10 [0.61-1.59]	0.59 [0.35-0.83]	0.007
D ₃₋₆ MFS	5.46 [3.23-7.69]	6.51 [5.50-7.53]	5.87 [5.00-6.75]	0.775

P value for trends calculated using negative binomial regression models

In **Table 3** are presented the negative association with the baseline characteristics. binomial regression models for d₃₋₆mfs in

Table 3. Regression models for the association between age, sex, SEP, caregiver, oral health behaviors and number of decayed, missing, filled surfaces (d3-6mfs) in first year schoolchildren from Iasi at baseline (n=306)

Characteristics	Unadjusted	Model 1	Model 2
	RR [95% CI]	RR [95% CI]	RR [95% CI]
<i>Age in years</i>	1.05 [0.84-1.32]	1.07 [0.84-1.35]	0.99 [0.78-1.26]
<i>Sex</i>			
Girls	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Boys	0.97 [0.77-1.23]	1.02 [0.81-1.30]	0.96 [0.74-1.23]
<i>Socio-economic position</i>			
High	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Medium	1.57 [1.17-2.11]**	1.57 [1.17-2.10]**	1.51 [1.10-2.07]*
Low	1.67 [1.27-2.20]***	1.69 [1.28-2.23]***	1.83 [1.34-2.48]***
<i>Caregiver when child not at school</i>			
Parents	1.00 [Reference]		1.00 [Reference]
Relatives	0.94 [0.70-1.26]		0.99 [0.73-1.36]
Other	1.16 [0.73-1.85]		1.32 [0.79-2.20]
No one	1.28 [0.89-1.84]		1.24 [0.85-1.83]
<i>Sugary food between meals</i>			
No	1.00 [Reference]		1.00 [Reference]
Yes	1.75 [1.28-2.39]**		1.60 [1.15-2.22]
<i>Reason for the last dental visit</i>			
Dental check	1.00 [Reference]		1.00 [Reference]
Dental pain	1.68 [1.13-2.50]*		1.54 [1.01-2.34]*
Treatment	1.40 [1.04-1.89]*		1.42 [1.05-1.93]*
Never been to the dentist	0.92 [0.67-1.25]		0.75 [0.53-1.06]
<i>Toothbrushing frequency</i>			
Once a day or less	1.00 [Reference]		1.00 [Reference]
Twice a day or more	0.86 [0.67-1.12]		0.89 [0.67-1.18]
<i>Oral hygiene status</i>			
Very good oral hygiene	1.00 [Reference]		1.00 [Reference]
Good oral hygiene	2.03 [1.45-2.85]***		1.79 [1.26-2.55]**
Less good oral hygiene	2.44 [1.65-3.62]***		2.27 [1.51-3.41]***
Poor oral hygiene	3.00 [1.89-4.77]***		3.01 [1.82-4.99]***

Negative Binomial regression models were fitted and rate ratios reported (RR).

Model 1 adjusted for SEP and child's sex and age, and Model 2 further adjusted for caregiver when child not at school, sugary food between meals, reason for the last dental visit, toothbrushing frequency and oral hygiene status.

* p<0.05, ** p<0.01, *** p<0.001

As shown, for 6-8 years old children, SEP, reason of treatment and dental pain for the sugary food consumption between meals, the last dental visit and oral hygiene status were

found to be significantly associated with dental caries experience in the unadjusted models. In children living in families with low and moderate SEP the $d_{3-6}mfs$ increased by 57% and 67% compared to those from high SEP families. This association was attenuated but remained significant after adjusting for demographic factors (Model 1) and child's caregiver, dental behaviours and oral hygiene status (Model 2).

Diet, as a person's preferences for a kind of food (healthy or fast food with high level of carbohydrates), and purchasing power can be associated with an increase level of caries offering a materialist explanation for inequalities in oral health. In industrialized societies, lower socioeconomic groups purchase higher amounts of sugars, and refined carbohydrates increasing risk factors for oral diseases such as dental caries, than higher income groups. Healthier diets containing higher amounts of fruit and vegetables are more expensive, and may therefore be out of reach to low-income families [16, 17, 18].

Oral hygiene status which was found to be significantly associated with dental caries experience could be argued by the presence

of calculus which is a confounding factor with oral disease and can be used as a marker of oral hygiene behavior [19]. Cleanliness of teeth, as measured by plaque and calculus, plays an essential role in periodontal health [20] and tooth loss [21]. Calculus is also associated with dental plaque and oral hygiene related behaviors [22].

Children having sugary snacks are 1.75 times (95% CI: 1.28-2.39) more likely to have a high $d_{3-6}mfs$ score than those who don't eat sugary food between meals. However, this association was no longer significant after adjustment (Model 2). Dental pain and treatment, as reasons for the last dental visit, were also associated with high levels of caries experience than those who went to the dentist for dental check-up, in which case $d_{3-6}mfs$ increased by 68% and 40%, respectively, and this association was attenuated but remained significant after adjustment. In children having a good, less good or poor oral hygiene status the $d_{3-6}mfs$ increased by 103%, 144% and 200%, respectively, than in those who have a very good oral hygiene status and this association was attenuated but remained significant after adjustment (Model 2).

Table 4. Regression models for the association between age, sex, SEP, caregiver, oral health behaviors and number of decayed, missing, filled surfaces (D3-6MFS) in sixth year schoolchildren from Iasi at baseline (n=278)

Characteristics	Unadjusted	Model 1	Model 2
	RR [95% CI]	RR [95% CI]	RR [95% CI]
<i>Age in years</i>	1.16 [0.91-1.48]	1.17 [0.92-1.50]	1.13 [0.86-1.47]
<i>Sex</i>			
Girls	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Boys	0.91 [0.71-1.18]	0.89 [0.69-1.16]	0.87 [0.67-1.14]
<i>Socio-economic position</i>			
High	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Medium	1.19 [1.85-1.69]	1.18 [0.83-1.67]	1.24 [0.86-1.80]
Low	1.08 [0.78-1.48]	1.07 [0.77-1.47]	1.13 [0.79-1.61]
<i>Caregiver when child not at school</i>			
Parents	1.00 [Reference]		1.00 [Reference]
Relatives	1.41 [1.02-1.93]*		1.41 [1.00-1.98]*
Other	1.22 [0.28-5.43]		0.99 [0.21-4.70]
No one	0.69 [0.47-1.01]		0.72 [0.48-1.09]
<i>Sugary food between meals</i>			
No	1.00 [Reference]		1.00 [Reference]

Yes	1.07 [1.14-1.72]	1.12 [0.79-1.59]
<i>Reason for the last dental visit</i>		
Dental check	1.00 [Reference]	1.00 [Reference]
Dental pain	0.93 [0.64-1.33]	0.98 [0.65-1.49]
Treatment	1.06 [0.76-1.46]	0.99 [0.70-1.39]
Never been to the dentist	0.67 [0.41-1.07]	0.66 [0.40-1.09]
<i>Toothbrushing frequency</i>		
Once a day or less	1.00 [Reference]	1.00 [Reference]
Twice a day or more	1.20 [0.93-1.55]	1.17 [0.90-1.51]
<i>Oral hygiene status</i>		
Very good oral hygiene	1.00 [Reference]	1.00 [Reference]
Good oral hygiene	1.78 [1.20-2.63]**	2.01 [1.34-3.03]**
Less good oral hygiene	2.19 [1.46-3.30]***	2.40 [1.56-3.68]***
Poor oral hygiene	2.12 [1.31-3.45]**	2.71 [1.61-4.57]***

Negative Binomial regression models were fitted and rate ratios reported (RR).

Model 1 adjusted for SEP and child's sex and age, and Model 2 further adjusted for caregiver when child not at school, sugary food between meals, reason for the last dental visit, toothbrushing frequency and oral hygiene status.

* p<0.05, ** p<0.01, *** p<0.001

In **Table 4** are presented the negative binomial regression models for D₃₋₆MFS in association with the baseline characteristics. For 11-13 years old children, for those supervised by relatives (especially grandparents) when not at school, the D₃₋₆MFS score significantly increased by 41% in both unadjusted and adjusted models. Good, less good or poor oral hygiene status were also associated with high levels of caries experience than those who had a very good oral hygiene, in which case D₃₋₆MFS score increased by 78%, 119% and 112%, respectively, and this association significantly increased after adjustment (Model 2). Our findings show that all the other factors were not significantly associated with caries experience in both unadjusted and adjusted models. A systematic review of previous literature confirmed a fairly strong evidence for an inverse relationship between SEP and the prevalence of caries among children [23]. A study on 13 year olds concluded that dental caries experience and oral hygiene status of children were strongly correlated to socioeconomic status [24, 25].

Behavioral risk factors do not occur in

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isolation but are by socio-environmental factors. Higher levels of caries experience might be expected in areas less supportive socio-environmental condition [11].

CONCLUSIONS

Our study has concluded that:

- Frequency of sugar intake, snacking frequency (between meals) and socio-economic status may play an important role in caries experience of schoolchildren.
- Systematic community-oriented oral health promotion programmes are needed to target lifestyles and the needs of children, particularly for those in low socio-economic position. A prevention-oriented oral health care policy would seem more advantageous than the present curative approach.
- Adjusting for health-related behaviors attenuated but did not eliminate the socioeconomic disparities in oral health.
- Oral health policies which aim changing behaviors are unlikely to completely eliminate disparities in oral health.

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