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The prevalence and severity of dental pain in 14-15 year old Brazilian schoolchildren

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Objective To assess the prevalence and severity of dental pain and associated factors in Brazilian schoolchildren. ***Methods*** The study was a cross-sectional survey conducted in Recife, Brazil. The data were collected through questionnaires, personal interviews and clinical dental examinations of a random sample of 14-15 years old schoolchildren. The prevalence of dental pain and its characteristics were recorded using standard measures of pain. Dental caries, dental trauma and dental plaque were assessed using WHO criteria. Multiple logistic and ordinal polytomous regression were used to assess which factors were associated with the dental pain outcomes. ***Results*** 1,052 individuals participated in the study. The prevalence of reported toothache in schoolchildren in the last six months was 33.6% (31.1-36.8, 95% CI). The fully adjusted regression models showed a significant relationship between lower social class, later birth order, failure at school and attendance at the dentist only when in trouble with both the prevalence and severity of dental pain. The major predictor of the prevalence and severity of pain was pattern of dental attendance ($p<0.001$). ***Conclusions*** The prevalence of toothache in 14-15 years old schoolchildren was high. The major predictor of the prevalence and severity of pain was the pattern of dental attendance.

Key words: Dental attendance, dental pain, epidemiology, prevalence, socio-economic status.

Introduction

Dental pain is a common outcome of untreated dental diseases. However, despite the high prevalence of untreated dental caries, there is surprisingly little research on the prevalence and severity of dental pain in children. The highest prevalence of dental pain is in young age groups (Locker and Grushka, 1987a; Locker and Grushka, 1987b; Bassols *et al.* 1999; Vargas *et al* 2005). There are gender differences in the distribution of various types of pain, but no gender differences have consistently been reported for dental pain. Population based pain research has shown that women are more likely than men to report a variety of temporary and persistent pains and to report more severe pain, more frequent pain and pain of longer duration than men (Unruh, 1996). The majority of studies of dental pain did not find a significant gender difference (Locker and Grushka, 1987a; Locker and Grushka, 1987b; Unruh, 1996; Bassols *et al.* 1999; Jaafar, 1999; Shepherd *et al* 1999; Honkala *et al*., 2001; Vargas *et al* 2005).

The association between socio-economic position and prevalence of dental pain is equivocal. A higher prevalence of dental pain was reported in those from low socio-economic backgrounds (Miller and Swallow, 1970; Bailit, 1987; Honkala *et al*., 2001). On the other hand, few studies have reported a lack of association between socio-economic position and dental pain (Bassols *et al.* 1999).

Among the variables that have been associated with dental pain are untreated dental caries, pattern of dental attendance and frequency of toothbrushing. Dental pain has been consistently associated with untreated dental decay or caries experience. However, these studies did not control for the potential confounding effects of important variables such as pattern of dental attendance (Treasure and Dever, 1992; Jaafar, 1999; Vargas *et al* 2005).

Pioneering work on the association between pattern of dental attendance and reported dental pain started in the United Kingdom (Miller and Swallow, 1970). There was more dental pain among those with a poorer pattern of dental attendance. This has been supported by more recent studies carried out on dental emergencies (Blinkhorn *et al.*, 1991). A common finding from these studies was that the majority of people who sought emergency dental care, had a poor pattern of dental attendance and consequently had high levels of untreated dental decay and dental pain. However, other studies found that dental pain was still common in countries with a high coverage of dental service or in groups considered dentally fit by dental professionals (Jaafar, 1999; Honkala *et al*., 2001).

Other oral health related factors and the exposure to preventive methods have also been associated with dental pain. For example, frequency of toothbrushing was considered the main predictor of the prevalence of dental pain in Finland (Honkala *et al*., 2001). The exposure of children to fluoridated water was associated with a low prevalence of dental pain (Treasure and Dever, 1992).

The association between dental pain and oral health status and oral health behaviour appears to be straightforward, as dental pain is a typical disease related pain.

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There is a consistent association between levels of dental caries and socio-economic position. Those who are economically deprived have poorer oral health. In addition, even in countries with very low levels of caries these differences persist and in same cases are widening (Watt and Sheiham, 1999).

Systematic reviews on the epidemiology of pain and dental pain (Goodman and McGrath, 1991; Slade, 2001) concluded that more research is needed on the prevalence of dental pain to establish reliable population estimates of pain and its association with explanatory factors. The studies need to have a more robust study design and statistical analysis that control for potential confounding factors. Therefore, the objective of the present study was to assess the prevalence and severity of dental pain and its associated factors, in particular socioeconomic status, in a population of Brazilian schoolchildren.

Methods

Study sample

The present study used a population based sample and was cross-sectional in design. The minimum required sample size to test the hypothesis was calculated to be 964 children. This calculation assumed the prevalence of dental pain to be 30% in the last six months and had 80% power and a 5% significance level to detect an odds ratio of 1.5 or more. The study population were over sampled by 20% in order to avoid a sample smaller than the minimum required. Thus, the final number of children that were invited to participate in the study was 1,200.

A proportional two-stage stratified random sampling procedure was adopted. The first units were all secondary schools in the city of Recife, Brazil, and the second stage units, 14-15 year old male and female schoolchildren from different social backgrounds enrolled in them. In order to ensure that each child in the target population had an equal probability of being selected, the number of children selected from each school was proportional to the number of children in the age required for the study in each school. Thirty of the 62 secondary schools in Recife were selected. From those schools, 1,200 students out of a total of 20,307 secondary schoolchildren were selected for the study. The sampling frame, response rates and final sample size are shown in Figure 1

The data collected were of two types: clinical and non-clinical. They were collected through self-completed questionnaire, structured interviews and clinical examinations, which took place at the schools.

Instruments and measurements

Dental pain

In this study dental pain was characterised as a pain emanating from the teeth and supporting structures, or as a result of disease or injury to teeth. As dental caries is the main cause of dental pain, unless there was another apparent clinical cause such as traumatised teeth, it was assumed that the cause of pain was caries. The prevalence and severity of dental pain in the last six months was recorded. The pain assessment followed the Pain Context Model. Accordingly, pain was assessed by three dimensions; namely, pain intensity, pain affect and pain location. First, prevalence of dental pain was assessed through a dichotomous variable (presence/absence) (Locker and Grushka, 1987a, 1987b; Shepherd *et al* 1999). Second, the severity of dental pain were assessed by an ordinal variable, constructed and validated from multiple measurements using the Present Pain Intensity-PPI from the McGill questionnaire (Melzack and Katz, 1992), a VAS-visual analogue scale (Jensen *et al*., 1996) and the Coloured Analogue Scale-CAS (McGrath, *et al*., 2000). Although pain affect, which is the extent that a pain can interfere in life, is not a concept well established in children's pain assessment, the Facial Affect Scale-FAS (McGrath, et al. 2000) was also used. Finally, pain location was assessed using drawings of faces which children marked to indicate where they felt the pain.

Non-clinical data

The non-clinical data included information on socio-economic and psychosocial characteristics of the children and their families and their oral health behaviours. The families were categorised into two socio-economic groups: high and low social class. This division was based on an operational classification adapted to the Brazilian socio-economic characteristics where the social class of

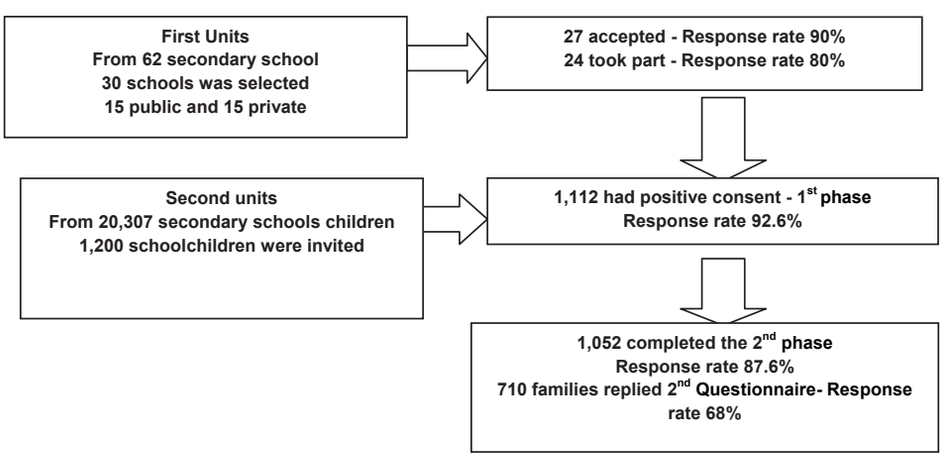

Figure 1. *Sampling frames and response rates of the survey*

the family is defined by the participation of the head of the family in the distribution and production processes (Lombardi *et al.,* 1988). The following data were also collected, family size, level of education of the mother and father, head of family's occupation and employment status and family income. Information was recorded on oral health behaviours related to patterns of dental attendance, the frequency and reason for going to the dentist, as well as type of dentist (private or salaried).

Clinical data

The clinical examination was carried out by the researcher (PSAG) and took place at school after the structured interview. He was previously trained and calibrated and the consistency of exams were assessed throughout the fieldwork. Standard clinical indicators were used to assess dental caries (WHO, 1997) and dental trauma (O'Brien, 1995). A record was made of whether the child was under orthodontic treatment at the time of the exam. The examiner was blinded as to the answers to the questionnaires

Validity and reliability of data

The validity and reliability of the dental research instruments developed for the present study, were first tested in pilot studies. To assess the reliability of the questionnaire and clinical data every tenth subject was re-examined (n=102) during the main study. The test-retest reliability of prevalence of dental pain reported in the last six months was assessed by Cohen's Kappa and showed a almost perfect correlation (Kappa=0.91). The PPI was significantly associated with the VAS and CAS ($r=0.6$, $p<0.01$) and ($r=0.2$, $p<0.05$) respectively. Even when the less frequent PPI categories (distressing/horrible/excruciating) were collapsed into a new category "severe dental pain", the correlation remained the same. The PPI were not correlated with FAS. As PPI was correlated with other measures of severity of pain, its use as a standard measure of severity for those who reported dental pain in the last six months is justified.

The consistency of clinical data regarding dental caries was assessed through the re-examination of the children one week after the first examination. Overall Kappa of the clinical data regarding dental caries was 0.83. Finally, correlation between the two sets of observations was calculated for other questions from the children questionnaire. The correlation was good with a correlation coefficient r ranging from 0.72 to 1.0.

Data analysis

The data were analysed using the Statistical Package for Social Sciences (SPSS 10.0/PC). Two outcomes were defined; prevalence of dental pain and severity of dental pain using PPI and categorised into no pain, mild, moderate and severe pain. The main explanatory variable for the study was socio-economic status and 16 variables were defined as confounders of the relationship between socio-economic status and the outcomes. The confounding variables were classified into demographic, oral health status, oral health behaviour and psychosocial variables.

Chi square tests were used to evaluate the relationships between each pair of variables. Logistic regression was used to test the association between the socio-economic status and dental pain and to assess the influence on this association of the potential confounding variables. Polytomous ordered regression was used when assessing the association with the severity of pain as the outcome. A proportional odds model was fitted where the odds ratio represents a comparison between category i (i=1,2,3,4) or below with categories above i for each value of i. The odds ratio is therefore an average of the three odds rations observed for each cut-off.

A three stage model building procedure for the prevalence of pain outcome was used. Firstly, gender was added to the model including socio-economic position, secondly the psychosocial variables that were related with pain were included, and finally the oral health status and oral health behaviour variables were added. The variables that were significantly associated with the risk of dental pain, along with gender and dental caries were considered for inclusion in the model for the severity of dental pain. The same three stage model building process was used. Estimated odds ratios and their 95% confidence intervals were obtained from the models and Wald tests were used to obtain the p-values. 5% was taken as level of significance in all analyses.

The Ethics Committee of the University of Pernambuco granted formal ethical approval for the project. Parents were asked for consent for their child to be included in the study.

Results

A total of 1,052 individuals participated in the study, representing a response rate of 88%. Of these, 448 (42.6%) were male and 604 (57.4%) female. 56.4% of the sample were classified in the lower social class grouping. The majority had visited a dentist and 54.8% attended regularly for a dental check up. The level of oral hygiene was good and the mean DMFS was 5.9, with 26.1% of the children being caries free (Table 1). The prevalence of dental pain in the last six months was 33.6% (31.1-36.8 95% CI). Of the children who had experienced any dental pain in the last six months, 12.1% (127) reported this as mild pain and 12.8% (135) discomforting pain. Only 8.7% (92) of the schoolchildren considered their pain as distressing, horrible and excruciating.

Initial bivariate analyses showed an association between social class and dental pain with those of a low social class having a greater prevalence of pain than those from a higher social class (40.5% versus 24.8%). A significant association was also observed between social class and dental decay ($p<0.05$) and between social class and satisfaction with dental appearance ($p<0.01$) and self-rated dental health ($p<0.01$). A higher percentage of adolescents from the high social class were under orthodontic treatment at the time of the examination ($p<0.001$). Since these dental status variables may also be related to dental pain, they may confound the relationship between social position and dental pain.

Results of unadjusted logistic regression analysis showed a highly significant association ($p<0.001$) between prevalence of dental pain and social class (Table 2). The

Table 1. Frequency distribution of the schoolchildren, by socio-demographic and psychosocial variables, oral health related behaviours and by dental status (n=1052).

	(n)	*Percentage*
Gender		
Male	448	42.6
Female	604	57.4
Socio-economic status		
High	459	43.6
Low	593	56.4
Failure at school		
No	658	62.5
Yes	394	37.6
Birth order		
First	393	37.4
Second	325	30.9
Third of later	334	31.7
Pain in other parts of body		
No	227	26.3
Yes	775	73.7
Oral cleanliness-Plaque score		
Low (≤1)	824	78.3
High (≥1)	228	21.7
Pattern of dental attendance		
Check-ups mainly	576	54.8
In trouble mainly	360	34.2
Non attenders/don't know	116	11.0
Type of dental care		
Private	621	59.0
Public	370	35.2
None	61	5.8
Under orthodontic care		
No	974	92.6
Yes	78	7.4
Dental health status Caries free		
DMFS =0	275	26.1
DMFS >0	777	73.9
D (Decay component of DMFS)		
D=0	759	72.1
D ≥ 1	293	27.9

unadjusted odds ratio was 2.1 (1.6-2.8 95% CI, p<0.001). In addition, a highly significant relationship (p<0.01) was found between dental pain and failure at school, pattern of dental attendance, type of dental care and being under orthodontic treatment. In the fully adjusted model children who came from a low social class (OR=1.6, 1.2-2.2 95% CI, p=0.001), those who were born third or later in the family (OR=1.4, 1.0-1.9 95% CI, p=0.048), those who had failed at school (OR=1.6, 1.2-2.1 95% CI, p=0.001) and those who attended the dentist when in trouble (OR=1.9, 1.4-2.6 95% CI, p=0.000) all had an increased risk of reporting toothache in the last six months. The effect of social class was weakened in the final model, but remained significant and the variable with the strongest association with the prevalence of toothache was pattern of dental attendance (p<0.001).

Results of simple polytomous ordered regression analysis showed a highly significant association between severity of dental pain and social class (Table 3). Adolescents who came from a low social class were more likely to report more severe dental pain than those from high social class; the unadjusted odds ratio was 2.0 (1.5-2.6 95% CI p<0.001). A highly significant relationship (p<0.001) was found between severity of dental pain and birth order, failure at school, pattern of dental attendance**.**

The results of the three stage multiple regression modeling procedure showed that the association between social class and severity of dental pain remained after adjustment for gender (p<0.001). The strength of the association decreased when adjusted for birth order, failure at school and oral health related variables. The severity of dental pain showed the same pattern of association as the prevalence of dental pain. The final model indicates that as well as those schoolchildren who came from a low social class (OR=1.5, 1.1-2.0 95% CI, p=0.007), those who were the third or later born child in the family (OR=1.4, 1.0-2.0 95% CI, p=0.023) those who had failed at school (OR=1.5, 1.1-2.0 95% CI, p=0.004) and those who attended the dentist when in trouble (OR=1.7, 1.3-2.2 95% CI, p=0.000), all had an increased risk of reporting severe dental pain in the last six months compared with other children (Table 3). The variable with the strongest association with the severity of toothache was pattern of dental attendance.

Discussion

It is difficult to compare the findings of the present study with previously published prevalence studies of dental pain. The difficulties, also found in the epidemiology of general pain, include variation in pain definitions, pain measures used, the health profile of the population being sampled and socio-demographic characteristics such as age, gender and socio-economic position (Crombie and Davies, 1998). Considering the studies which have included adolescents, the prevalence rate found in our study for six months was lower than that found in Finland using two and a half years as its time frame (Honkala *et al*., 2001) and that reported in Malaysian adolescents (Jaafar, 1999) but higher than Bastos *et al.* (2005) reported in 18-year-old males in Southern Brazil. It is of interest that the prevalence of dental pain in our Recife adolescents was very similar to the 39% prevalence found in 8- to 9-year-old Brazilian children in Belo Horizonte (Barretto *et al* 2004).

One finding that lends credibility to our study was the strong association of dental pain, not only with the prevalence of dental decay, but also with severity of dental decay. Dental pain has always been considered a disease specific pain. Untreated dental decay has been associated with dental pain in different age groups (Treasure and Dever, 1992; Shepherd *et al*. 1999; Vargas et al 2005; Bartos *et al.* 2005).

Gender was not associated with the prevalence and severity of dental pain before or after full adjustment in the multiple regression analysis in the present study

Table 2. Results of multiple logistic regression of reported toothache in the last six months of schoolchildren aged 14-15 years old (n=1052).

	Yes n (%)	*No n (%)*	*Unadjusted OR 95% CI*	*p-value*	*Adjusted[a] OR 95% CI*	*p-value*	*Adjusted[b] OR 95% CI*	*p-value*	*Adjusted[c] OR 95% CI*	*p-value*
Social class										
High	114 (24.8)	345 (75.2)	1		1		1		1	
Low	240 (40.1)	353 (59.1)	2.1 (1.6-2.8)	<0.001	2.1 (1.6-2.7)	<0.001	1.7 (1.3-2.2)	<0.001	1.6 (1.2-2.2)	0.001
Gender										
Male	140 (31.3)	308 (68.8)	1		1		1		1	
Female	214 (35.4)	390 (64.6)	0.9 (0.7-1.1)	0.278	1.2 (0.9-1.6)	0.186	1.3 (0.9-1.7)	0.082	1.3 (0.9-1.6)	0.111
Birth order										
First born	122 (31.0)	271 (69.0)	1	<0.001			1	0.009	1	0.014
Second born	91 (28.0)	234 (72.0)	0.9 (0.6-1.2)	0.600			0.9 (0.6-1.2)	0.388	0.8 (0.6-1.2)	0.322
Third born and others	141 (42.2)	193 (57.8)	1.6 (1.2-2.2)	0.001			1.4 (1.0-2.0)	0.028	1.4 (1.0-1.9)	0.048
Failure at school										
No	184 (28.0)	474 (72.0))	1				1		1	
Yes	170 (43.1)	224 (56.9)	2.0 (1.5-2.5)	<0.001			1.6 (1.2-2.2)	0.001	1.6 (1.2-2.1)	0.001
Pattern of dental attendance										
Check-ups mainly	162 (28.1)	442 (71.9)	1	<0.001					1	0.000
In trouble mainly	158 (43.9)	202 (56.1)	2.0 (1.5-2.6)	<0.001					1.9 (1.4-2.6)	0.000
Non attenders	34 (29.3)	82 (70.7)	1.0 (0.7-1.6)	0.796					1.2 (0.7-2.1)	0.428
Time since from the last dental visit										
Visited the dentist last year	211 (34.1)	408 (65.9)	1	0.343					1	0.008
Not visited in last year	94 (35.6)	170 (64.4)	1.1 (0.8-1.4)	0.664					0.7 (0.5-0.9)	0.019
Don't know	49 (29.5)	120 (71.5)	0.8 (0.5-1.1)	0.213					0.5 (0.3-0.8)	0.007
Under ortodontic treatment										
No	339 (34.8)	635 (65.2)	1						1	
Yes	15 (19.2)	62 (80.8)	0.5 (0.3-0.8)	0.006					0.6 (0.4-1.2)	0.148
Severity of dental decay										
Non dental decay	239 (31.5)	520 (68.5)	1	0.033					1	0.528
Enamel or dentine	73 (41.7)	102 (58.3)	1.6 (1.1-2.2)	0.010					1.2 (0.8-1.7)	0.327
Pulpar involvement	42 (35.2)	76 (64.4)	1.2 (0.8-1.8)	0.375					1.0 (0.6-1.4)	0.734

[a]Adjusted for gender

[b] Adjusted for the stage a+ birth order + failure school + pain in other parts of the body.

[c] Adjusted for the stage b + oral health behaviour and oral health status related variables.

Table 3. Results of multiple ordinal regression of severity of toothache in the last six months of 14-15 years old schoolchildren (n=1052).

	Unadjusted OR 95% CI	*p-value*	*Adjusted [a] OR 95% CI*	*p-value*	*Adjusted [b] OR 95% CI*	*p-value*	*Adjusted [c] OR 95% CI*	*p-value*
Social class								
High	1		1		1		1	
Low	2.0 (1.5-2.6)	<0.001	2.0 (1.5-2.6)	<0.001	1.6 (1.2-2.1)	0.001	1.5 (1.1-2.0)	0.007
Gender								
Male	1		1		1		1	
Female	1.2 (0.9-1.52)	0.258	1.2 (0.9-1.5)	0.148	1.2 (0.9-1.6)	0.067	1.3 (1.0-1.6)	0.063
Birth order								
First born	1				1		1	
Second born	1.0 (0.6-1.2)	0.549			0.9 (0.6-1.2)	0.492	0.9 (0.6-1.2)	0.378
Third born and others	1.7 (1.3-2.3)	<0.001			1.5 (1.1-2.0)	0.008	1.4 (1.0-2.0)	0.023
Failure at school								
No	1				1		1	
Yes	2.0 (1.5-2.6)	<0.001			1.6 (1.2-2.0)	0.001	1.5 (1.1-2.0)	0.004
Pattern of dental attendance								
Check-ups mainly	1						1	
In trouble mainly	1.8 (1.1-2.9)	0.811					1.7 (1.3-2.2)	<0.0001
Non attenders	0.9 (0.6-1.5)	0.011					1.0 (0.6-1.5)	0.854
Severity of dental decay								
No dental decay	1						1	
Enamel or dentine caries	1.6 (0.9-2.2)	0.062					1.2 (0.9-1.5)	0.202
Pulp involvement	1.5 (1.1-2.2)	0.008					1.0 (0.7-1.5)	0.886

[a] Adjusted for Gender
[b] Adjusted for the stage a+ birth order + failure at school
[c] Adjusted for all var

confirming other's findings (Locker and Grushka, 1987a, 1987b). A large survey of multiple pain in a general population found a significant gender difference for all types of pain investigated, except dental pain (Bassols et al, 1999). The differential reporting of severity of pain may be a function of biological, cultural, and psychological differences, divergent social role expectations, situational factors and an individual's past history (Rilley *et al.,* 1998).

The prevalence and severity of dental pain was strongly associated with socio-economic position. The higher prevalence of dental pain in those from low socio-economic position has been reported (Miller and Swallow, 1970; Bailit, 1987; Bartos *et al.* 2005). The measures of socio-economic position used in these studies are not comparable with each other or with the one used in our study. On the other hand, some studies have reported a lack of association between socio-economic position and dental pain (Locker and Grushka, 1987a, 1987b). None of them reported an inverse relationship. The association between severity of dental pain and socio-economic position has not been reported before.

Two important findings emerge from our analyses. First, the relationship between the prevalence and severity of dental pain and socio-economic position remained after controlling for important confounding variables. Second, the pattern of dental attendance was the main predictor of the prevalence of dental pain. Children who had an irregular pattern of dental attendance, going to the dentist only when they had trouble, were more likely to

report dental pain. Irregular pattern of dental attendance has been associated with untreated dental decay and socio-economic position in a number of studies (Lissau *et al.,* 1989; Freire, *et al.* 2001). A possible explanation for the association between socio-economic status and dental pain might be that those from low socio-economic backgrounds had more untreated dental decay and poorer patterns of dental attendance and a higher prevalence of dental pain. However, given that the pattern of dental attendance and level of dental decay did not confound the relationship between socio-economic position and dental pain, this is unlikely to be the full explanation. Also the pattern of dental attendance was found to be an effect modifier of the socio-economic position and dental pain such that the effect of social class was stronger in those who had a good pattern of dental attendance from higher socio-economic background than their counterparts from low socio-economic backgrounds. The association between dental attendance and socio-economic position has been reported in a number studies, but this is the first time that an interaction between pattern of dental attendance and socio-economic position with dental pain has been reported.

Among the factors that could be responsible for the persistent association between socio-economic position and the prevalence and severity of dental pain are the influences of other psychosocial factors related with dental disease and ethnicity. These variables are also associated with a high level of dental caries (Petridou *et al.,* 1996; Freire *et al.,* 2001) and are linked with dental pain. In our analyses, although these variables were responsible for the greatest reduction in the size of the effect of social class, they did not explain the relationship entirely.

.This study does have limitations. One major problem was the lack of a standardised recall period to establish time prevalence of dental pain. The problem was partially overcome by having a detailed measurement of dental pain in the last four weeks, with a validation of six months as a time frame for recall of dental pain for this age group. Six months has been shown to be a convenient time for pain recall. This issue requires further research.

In conclusion, the prevalence of dental pain in the study population was high. The pattern of dental attendance was the most important predictor of dental pain. Socio-economic position was associated with the prevalence and severity of dental pain and this association remained after adjustment for potentially important confounding factors. The results indicate that conventional dental services and strategies are not coping adequately with dental problems, particularly those that are used by the children from low social classes.

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