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# Caries prevalence and fluoride use in low SES children in Clermont-Ferrand (France)

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***Objective*** To evaluate the association between dental caries experience and preventive behaviours of children residing in a deprived area in Clermont-Ferrand (France). ***Participants and methods*** All 4-5 yr-olds attending nine schools in deprived areas of the city were invited to participate and 81% (n=282) consented and were examined. Dental caries was recorded at the dentine threshold. Parents completed a questionnaire concerning family demographics and the child's use of fluoride. Non-parametric tests and logistic regression assessed the relative importance of SES and fluoride variables on dental status (dt>1). ***Results*** Fifty four (19%) of the examined children were living in families with an immigrant background, 33% were fully covered by the national health insurance programme for deprived families. Caries experience was high; mean dft was 1.94 (3.31) and 30% of the children had >1 carious teeth. Thirty percent of the families reported using fluoridated salt. Tooth brushing once daily was reported for 39% and twice daily for 26%. Parents declared supervising tooth brushing for 60%. Two thirds of the children, according to their parents, used fluoride supplement between birth and two years. Supervised tooth brushing was significantly correlated with lower mean dt scores. Systemic fluoride use was poorly related to dental caries Immigrant background, family size, type of health insurance and mother's unemployment were significantly correlated with caries prevalence. In multivariate analysis, immigrant status, supervised tooth brushing and parental knowledge about fluoride in toothpastes were significant caries predictors. ***Conclusions*** The majority of low SES children did not practice effective caries prevention; few reported twice daily brushing with fluoride toothpaste. Caries experience was very high and much was untreated. Immigrant status, supervised tooth brushing and parental knowledge about fluoride in toothpastes were significant caries predictors.

*Key words : Children, dental caries, fluoride, inequalities, socio-economic status*

## Introduction

The prevalence of dental disease in French children has decreased significantly during recent decades (Cahen *et al.*, 1993). The main reason put forward is the widespread use of fluoride, particularly from toothpastes (Marthaler, 2003). Levels of caries in the teeth of children are low compared with earlier generations but this improved dental health is not evenly distributed.

In children from low SES backgrounds, the prevalence of caries is higher than for other children, there is more untreated disease and they make fewer dental visits (Azogui-Levy *et al*., 2003; Adam *et al.*, 2005; Enjary *et al.*, 2006). Several factors, such as immigrant status, occupation of the head of the household and low maternal educational level have been found to be consistently related to the occurrence of caries in children age six years and under (Harris *et al.*, 2004). The caries-SES relationship remains significant when the effects of other variables are included in statistical models (Reisine and Psoter, 2001). Such inequalities are particularly noticeable in countries like France where, although the cost of dental care may be reimbursed, there is not a comprehensive service for all children (Ismail and Sohn, 2001).

In France, dental services are provided by private dental practitioners. The cost of operative interventions is reimbursed by insurance funds. Little preventive care is provided by French dentists (Domejean-Orliaguet *et al*., 2004). Fluoride toothpastes dominate the market. There are no fluoridated water supplies and naturally fluoridated water reaches few people. Salt fluoridation, available since 1986 has been weakly promoted. Local surveys suggest F salt is used by less than 30% of schoolchildren and these estimates agree with information provided by the salt producers (Fabien *et al.*, 1996; Tubert-Jeannin and Riordan 2003). Fluoride supplements are available but recommendations about their use vary. A Ministry of Health agency recommends systematic administration of fluoride supplements from birth to two years (AFSSAPS, 2002). This recommendation is currently (2008) under revision. A second set of recommendations, produced by two dental organizations, encourage the use of fluoridated salt and advises fluoride supplements for high risk children after the age of six months (Bourgeois *et al.*, 2000).

Thus, the caries preventive advice offered in France is confusing to both dental public health and private dental practitioners. To what extent it is followed, especially by children, is not known, nor what association, if any, there is between caries preventive strategies and dental caries prevalence and severity. Low-SES children have a high caries burden but it is not known what caries preventive practices are available for those children in France. The objective of this study was to assess the

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caries prevalence and severity of children residing in deprived areas of Clermont-Ferrand and simultaneously to collect information about their social backgrounds. In addition the extent to which these children have access to and use standard methods of preventing caries and the relationship between their caries experience and their oral health behaviours was ascertained.

## Method

Clermont-Ferrand (pop. 150,000) is an industrial and administrative city situated in the centre of France. There are 35 public schools in the town. Nine schools, all previously shown to have high caries prevalence in a survey conducted in 2003/04 (Enjary *et al*., 2006) and all situated in deprived areas as defined by the Department of National Education ("Zone d'Education Prioritaire") or by the Municipality ("Politique de la Ville"), were selected. These schools have been participating in a health education campaign since January 2006. All the children (n =348) aged 4-5 years attending the nine selected schools were invited to participate in the survey. The study protocol was approved by the local primary education and health authorities. Each school was approached through the municipal school nurse system. Consent forms and explanatory letters were sent to parents. Only children whose parents returned the consent form were included in the study. The study took place in October 2005.

Parents were asked to complete a questionnaire concerning the family and child demographic background: family status (single, couple), number of children in the family, activity of the mother (work/do not work outside the home), country where the parents were born (France/elsewhere), family health insurance (70% basic health cover, basic + private complementary insurance, full cover for economically deprived people ["CMU"]). Information about income and level of education were not collected, to avoid discouraging parental participation. Parents were also asked to answer questions relating to their child's use of fluoride, toothbrushing frequency (less than once/once/twice a day), use of fluoride toothpaste (yes/no/unknown), supervision of toothbrushing (brushing done by the child/supervised by the parents/done by the parents), use of fluoride supplement (use from 0 to two years/irregular use/continuous use/never used), and use of fluoridated salt (yes/no/unknown).

Dental examinations were conducted at school by two dentists using World Health Organization procedures and diagnostic criteria without radiographs (WHO, 1997) and a standardised portable light source. Examiner calibration exercises were carried out during two half-day sessions before the beginning of the survey. Dental caries was recorded at the dentine (D3) threshold so caries detection was based on the presence of a distinct cavity. Lesions were not probed but debris was removed if necessary, using an explorer. Caries experience was recorded as dmft and dt. Missing anterior teeth were not included in the calculation of the dmft index. The dt index was chosen as the main dependant variable. Intra-examiner (n=61) and inter-examiner (n=34) variability was measured. Weighted kappa coefficients $\geq 0.80$ were found for the calculation of the dt scores which indicated a good agreement.

### Statistical analysis

As the mean dt was not normally distributed, non-parametric tests were used to study the association with social or fluoride variables (Mann-Whitney or Kruskal-Wallis tests). SPSS software was used. The level of significance was arbitrarily set at 0.05. Logistic regression analysis was conducted to determine the relative importance of the SES and fluoride variables on dental status. The dependant variable was dt>1. The independent variables included in the models were all the fluoride and SES variables recorded. A stepwise entry technique was not used. Mantel-Haenszel chi-square analysis revealed some statistically significant associations particularly for the parent's immigrant background and type of dental insurance. In multivariate analysis, the numbers involved were too small to allow further analysis of these interactions.

## Results

Of the children initially selected, 81% participated in the survey and 282 children were thus examined; 65 were born in 2001 and 217 in 2000. Boys (n=147) made up 52% of the participants. Dental status is presented Table 1. The mean dmft was 1.94, 43% of the children had at least one tooth affected (dmft>0) and 30% had more than one carious tooth (dt>1).

The children had low socio-economic background; all the schools were situated in deprived areas as defined by the educational and municipal authorities. Individual SES variables were associated with caries experience (Table 2). At least one parent had an immigrant background in 53.5% of the families; their children had more dental caries. Fewer than 40% of all mothers were actively employed; their children experienced significantly more untreated dental caries. Five percent of the families did not have private complementary dental insurance and 33.6% benefited from the full dental insurance cover provided for economically disadvantaged families; these children had higher mean dt scores. In families with more than four children, the number of untreated dental caries was higher than in smaller families.

Only 29.5% of the families used fluoridated salt and 17.8% did not know if they used F salt or not (Table 3). Children whose parents did not know what kind of salt they use experienced more dental caries. Parents seemed to follow the recommendations of the Ministry of Health: 66.3% of the children had used fluoride supplements from birth to two years old. Caries experience did not vary according to the different patterns of fluoride supplement use. Children who had never used fluoride supplements had a higher number of carious teeth compared with other children (Mann-Whitney, p=0.05). Only 26% of the children brushed their teeth twice a day. Toothbrushing frequency was not related to the number of carious teeth. Six parents out of ten claimed to supervise their children's toothbrushing and toothbrushing supervision was significantly associated with the child's caries experience. Fluoride toothpastes dominate the market but 21,7% of the parents did not know whether their child used a F toothpaste. Children whose parents knew that toothpastes were fluoridated had lower dt scores.

**Table 1.** Dental status of the children (n=282)

| *Dental status* | *Mean (sd)* |
|---|---|
| Number of permanent teeth | 0.63 (1.64) |
| Number of primary teeth | 19.57 (1.19) |
| dt | 1.54 (2.68) |
| mt | 0.06 (0.42) |
| ft | 0.33 (1.15) |
| dmft | 1.94 (3.31) |

**Table 2.** Relationship between children's caries experience and SES variables (n=258)

| | *n†* | *dt (mean and sd)* | *p* |
|---|---|---|---|
| *Family status (n=255)* | | | *p>0,05* |
| Single | 83 | 1.84 (3.00) | |
| Couple | 172 | 1.53 (2.66) | |
| *Parents' immigrant background (n=256)* | | | *p<0.0001* |
| no immigrant background | 119 | 0.81 (2.11) | |
| immigrant background | 137 | 2.21 (2.92) | |
| *Mother's employment (n=248)* | | | *p=0.02* |
| No job | 154 | 1.86 (2.89) | |
| Job | 94 | 1.21 (2.44) | |
| *Basic dental insurance (n=255)* | | | *p=0.001* |
| + Private | 158 | 1.25 (2.46) | |
| + No complementary insurance or state aid | 97 | 2.26 (3.13) | |
| *Family size (n=249)* | | | *p=0.003* |
| 1 to 3 children | 211 | 1.25 (2.18) | |
| 4 and more children | 38 | 3.42 (4.16) | |

Not all participants answered all questions.
Kruskal-Wallis or Mann-Whitney tests

**Table 3.** Relationship between children's caries experience and fluoride use (n=258)

| | *n†* | *dt (mean, sd)* | *p* |
|---|---|---|---|
| *Use of fluoridated salt (n=258)* | | | *p=0.044* |
| yes | 76 | 1.11 (2.09) | |
| no | 136 | 1.57 (2.74) | |
| unknown | 46 | 2.65 (3.48) | |
| *Use of fluoride supplements (n=255)* | | | *p>0.05* |
| use from 0 to 2 years | 169 | 1.40 (2.49) | |
| Actual, continuous use | 14 | 1.43 (2.59) | |
| Actual, irregular use | 23 | 1.57 (3.06) | |
| never used | 49 | 2.47 (3.42) | |
| *Frequency of toothbrusing (n=257)* | | | *p>0.05* |
| less than once a day | 90 | 1.83 (2.75) | |
| once a day | 100 | 1.75 (3.14) | |
| twice a day | 67 | 1.15 (2.09) | |
| Supervision of toothbrushing (n=258) | | | |
| *done by the child, not supervised* | *103* | *2.29 (3.02)* | *p=0.003* |
| done by the child, supervised | 133 | 1.28 (2.63) | |
| done by the parents | 22 | 0.59 (1.01) | |
| *Use of fluoride toothpaste (n=258)* | | | *p<0.0001* |
| yes | 186 | 1.24 (2.35) | |
| no (n=16) or unknown | 72 | 2.63 (3.43) | |

† Not all participants answered all questions.
Kruskal-Wallis or Mann-Whitney tests

**Table 4.** Odds Ratios (95% CIs) derived from logistic regression with dt>1 as dependent variables and different SES and fluoride measures as independent variables ($r^2 = 0.20$).

| *Independent variables* | *Or ( 95% CI)* | *p* |
|---|---|---|
| *Family status* | | |
| couple vs single | 0.76 (0.39, 1.49) | >0.05 |
| *Parents' immigrant background* | | |
| yes vs no | 2.51 (1.32, 4.76) | 0,005 |
| *Mother's employment* | | |
| job vs no job | 0.86 (0.45, 1.68) | >0.05 |
| *Basic dental insurance +* | | |
| with state aid vs private | 1.75 (0.90, 3.42) | >0.05 |
| *Family size* | | |
| 4 and more vs 3 to 1 | 1.28 (0.56, 2.91) | >0.05 |
| *Use of fluoridated salt* | | |
| no vs unknown | 1.29 (0.57, 2.91) | >0.05 |
| yes vs unknown | 1.3 (0.53, 3.23) | >0.05 |
| *Use of fluoride supplements* | | |
| regularly or occasionally used vs never used | 0.91 (0.32, 2.57) | >0.05 |
| used from birth to 2 yrs vs never used | 1.05 (0.49, 2.24) | >0.05 |
| *Frequency of toothbrusing* | | |
| once a day or less vs twice a day | 1.15 (0.59, 2.25) | >0.05 |
| *Toothbrushing supervision* | | |
| supervised or done by the parents vs child alone | 0.52 (0.29, 0.95) | 0,03 |
| *Use of fluoride toothpaste* | | |
| unknown or no vs yes | 1.92 (0.99, 3.71) | 0,05 |

Logistic regression analysis was conducted to determine the relative importance of the social and fluoride variables on dental status (Table 4). The dependant variable was dt >1. The main explanatory variables were parental immigrant background, the use of fluoride toothpaste and supervision of toothbrushing. Children of parents with immigrant background were two to three times more likely to have more than one untreated carious tooth compared with other children. Children whose parents did not supervise toothbrushing suffered more frequently from untreated dental caries. Having a parent who knew that children's toothpastes were fluoridated was also an important factor associated with the level of disease. In multivariate analysis, systemic fluoride use was unrelated to caries prevalence.

## Discussion

Before commenting on the implications of these findings, several limitations should be noted. This cross-sectional survey concerned a relatively small sample from one community in central France. In this survey, SES variables which have been shown to be related to children's dental status were considered (Enjary *et al*., 2006) but income and education were not recorded. Income was indirectly evaluated by considering the type of dental insurance. Fluoride and oral hygiene behaviors were evaluated by using a questionnaire. Thus, data are based on the parent's declarations. No collection of dietary or microbiological data was undertaken.

This study found that experience of dental caries in this sample of low SES French children was very high as compared to other French studies. Caries experience was close to that of 6-year-olds in the national survey conducted in 1991 (Cahen *et al*., 1993) despite the younger age of the children in the present study and the time between the two studies. The children in this survey should have had lower caries experience as there is an ongoing improvement in children's dental health in France. Caries prevalence (30% with dt>1) was also higher than that observed recently in a study on the general and dental health of the 30,000 5-6-year-old French children attending kindergarten in 2000; only 9.5% of those children had dt>1 (Guignon and Niel, 2003). Children in Clermont-Ferrand with low SES have much poorer dental health and have received much less care than national averages or children with a more favourable social background.

The relationship between household indicators of SES and the distribution of caries experience were examined. The dental status of the children was associated with variables such as place of birth, parents' employment status, type of health insurance and number of children in the family. Previous French surveys have reported similar findings and father's occupation and immigrant background have also been found to be related to caries experience (Azogui-Levy *et al*., 2003; Adam *et al*., 2005). The relationship between SES and dental status remained important even when other factors such as fluoride use were included in a multivariate analysis (Reisine and

Psoter, 2001). The immigrant status of the parents was the most important explanatory variable in the regression model. Children of parents with immigrant background, regardless of fluoride use, had more untreated caries than other children. The difference was substantial and because of the irreversible nature of dental disease, children with dental caries are doomed at a young age to be high treatment need patients for most of their lives. These children have access to insurance schemes which cover the cost of care provision, but this was not enough to eliminate class-based differences in health status.–

The Ministry of Health recommends systematic administration of fluoride supplements to young children in France (AFSSAPS, 2002). This recommendation is not in accordance with the actual international trends concerning the use of fluoride tablets. Nevertheless, it seems that it has been followed by the paediatricians as 66% of the children took fluoride supplements from birth to two years. The use of fluoride supplements was correlated with caries experience at the age of five years in the univariate analysis. This relationship disappeared when SES and other fluoride strategies were taken into account in the multivariate analysis. Some studies have found a positive effect of the regular use of fluoride tablets in children after control of some other risk factors (Perinetti *et al*., 2005; Vanobbergen *et al*., 2001) but several surveys have also shown that fluoride supplements have little effect on caries experience when SES factors are taken into account (Tijmstra *et al*., 1978; Kalsbeek *et al*., 1992). Fluoride supplement regular users tend to belong to high SES groups (Levy *et al*., 1998) and this fluoride source has little effect in low SES children because compliance with health advice is poor (Winnick *et al*., 2005). A simple comparison of caries experience between fluoride supplement users and non-users cannot provide conclusive evidence of an effect when those confounding factors are not considered. A reliable evaluation of the benefit of fluoride supplement use requires the use of a placebo control. Few such studies have been undertaken (Riordan, 1999). One large, placebo-controlled study on children reported only a marginal preventive effect and did not recommend the use of supplements (Driscoll *et al*., 1992). Hence fluoride supplements have not been shown to be effective caries preventive agents. Parents in the present study seem to have been advised to give fluoride supplements to their children in preference to brushing their children's teeth with fluoride toothpaste; only 26% brushed their teeth twice a day. Toothbrushing with fluoride toothpaste is known to be effective in caries prevention.

Only one third of the families had used fluoridated salt. This estimate is in accordance with findings from other local surveys and agrees with information provided by the salt producers (Fabien et al., 1996; Tubert-Jeannin *et al.,* 2003). F salt has been weakly promoted. There are also confusing messages about the fluorosis risks and preventive benefits of the different sources of systemic fluoride due to the diffusion of contradictory recommendations (AFSSAPS, 2002; Bourgeois *et al*., 2000). In the present study, caries experience did not differ between claimed F salt users and non-users but children whose parents did not know what kind of salt they used had higher caries experience. These results suggest that it is the level of parental knowledge that is associated with the dental status of the children rather than the F salt consumption. Several previous studies conducted in France have failed to find a significant relationship between F salt use and dental status (Fabien *et al.,* 1996; Schulte *et al.,* 2001). The poor level of use of F salt in France, particularly among low SES families (Tubert-Jeannin and Morel 1994; Fabien *et al.,* 1996) reduces the potential preventive effect of this measure.

Our results indicate that factors related to "toothbrushing with fluoride toothpaste" were strongly associated with the dental status of children. This is in accordance with the literature (Marinho *et al.,* 2003). Children whose parents supervised toothbrushing had fewer carious teeth, even when SES was taken into account. This kind of information helps dental health education planning and could be used to focus attention in low SES populations on the strategies available to parents for their children's dental health. No relationship was found between toothbrushing frequency and the children's dental status. Nevertheless, it appeared that toothbrushing frequency was very low among these young children. Low SES children seem not to have sufficient access to caries preventive activities. Children whose parents believed toothpaste is not fluoridated experienced higher caries experience, confirming the fact that parents' knowledge and attitudes concerning oral health have a great influence on children's dental health. Prospective interventions that enhance parenting skills could be an effective way of preventing caries in low SES children.

## Conclusion

Low SES children in this study had high levels of untreated dental disease. They did not practice effective caries prevention. Few reported regular supervised twice daily brushing with fluoride toothpaste. Fluoridated salt was not widely used but children ingested fluoride supplements from birth to two years old. The use of fluoride toothpaste was significantly correlated with lower caries experience while systemic fluoride had almost no influence. Those results are consistent with the contradictory advice on the use of fluoride provided by the government and dental bodies in France. There is a need to establish a unique, evidence based, recommendation on fluoride use in France.

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