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Caries experience in the primary dentition among French 6-year-olds between 1991 and 2000

Colette Adam[1], Ariane Eid[1], Paul J. Riordan[2], Maryse Wolikow[3] and Fabien Cohen[1]

[1]Department of Val de Marne, Agency for Health Intervention, Créteil, [2]Faculty of Dentistry, University of Auvergne, Clermont Ferrand, [3]Faculty of Dentistry, University of Paris V, Paris, France

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Abstract – *Background:* There are few national caries preventive policies for children in France. Various surveys suggest that in the late 1980s, oral health of the 6-year olds in France was poorer than in those of other European countries. In Val de Marne (a Department just east of Paris) a public dental service was established in 1991. A programme to inform preschool staff about dental diseases was commenced and volunteers brought oral health information to parents and health professionals. Periodical monitoring of primary tooth caries of 6-year olds was planned. *Aim:* The aim of the study was to evaluate changes in primary tooth caries in 6-year olds over the 10 years of the programme. *Methods:* Participating 6-year olds, randomly selected, were examined in schools by dentists. Clinical data were collected (WHO criteria). Sociodemographic data were collected through questionnaire. Statistical analysis involved comparison of mean values, variance analysis and chi-square test for categorical variables. *Results:* The proportions of children with caries experience were, 38.9%, 30.6% and 22.2% in 1991, 1995 and 2000 respectively ($P < 0.01$). The dft index decreased from 1.74 to 1.39 and 1.05 respectively. About 75% of children with dental caries remained untreated. Children of non-European native parents or belonging to low socioeconomic families remained those most affected by dental caries in 2000. *Conclusion:* Dental caries in 6-year olds improved between 1991 and 2000 in Val de Marne but caries remained a socially inequitable disease. Most children did not have access to dental care. The situation requires changes to the dental care provision system.

Key words: children; dental caries; dental prevention; epidemiology; France; social class

Dr Fabien Cohen, Direction de la prévention et de l'action sociale, Direction des interventions de Santé, Mission bucco-dentaire, 13-15 rue Gustave Eiffel, 94011 Créteil, France
Tel: +33 156728735
Fax: +33 156728755
e-mail: fabien.cohen@cg94.fr

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In 1987, a programme of regular epidemiological supervision of dental caries in children was set up in France, following the introduction of fluoridated salt. Studies conducted by Cahen (1, 2) in 1987 and 1991 showed that 32.2% and 46.8%, respectively, of 6-year-old children were caries free. Another series of cross-sectional studies in 1987 (3), 1990 (4) and 1993 (5) showed 27%, 39.5% and 56% of children, respectively, to be caries free. Despite the fact that the prevalence of dental caries has decreased in children in France, as in most industrialized societies, the proportion with no caries experience remains lower than in similar countries. In Finland, 78% of 5-year olds had no caries in 1993 (6). The corresponding value in Sweden in 1991 was 60% and in the district of Värmland, where a strong caries prevention programme was initiated in 1978, 72% (7). In France, except for fluoridated salt, there was no national dental public health programme. Some dental associations (e.g. the 'UFSBD', a grouping of private practitioners), some government agencies and certain health institutions have developed local preventive initiatives. Their activities focused on dental screenings and sometimes dental education sessions at schools. They generally targeted children older than 6 years and there was no follow-up.

The urban department of Val de Marne lies on the south-east boundary of Paris. There are 47 towns and 1.23 million residents. In 1991, the department's political leadership agreed to create a dental public health service. The service initiated a caries prevention programme for 0–11-year-old children, to improve children's dental health and to reduce the socially inequitable impact of caries (8).

In France, there are two categories of primary schools: the 'maternelle school' is for children between 3 and 5 years of age and the elementary school for children between 6 and 11 years. School caries preventive programmes have been shown to be efficient and effective (7, 9–11), and in Val de Marne a school-based programme for children between 5 and 11 years was planned. In maternelle schools, the programme focused on the 5-year olds and included a session of oral health education directed by a dentist and tooth-brushing sessions supervised by school staff. For each elementary school grade, an annual session of oral health education directed by a dentist and twice monthly mouth rinsing were initiated.

To prevent caries in 5-year olds, it is necessary to have access to the children at a younger age. Thus, the prevention programme included day care centres and in medical institutions for the very young children, called 'centre de protection maternelle et infantile (PMI)'. These centres promote infant health from a medical and social point of view (12). Activities are centred on the medical monitoring of psychomotor development and vaccination programmes and on studying behavioural interaction and the social integration of young children. Staff involved include doctors, paediatric nurses, auxiliaries, psychologists and social assistants but no dental professionals. All consultations and activities are free of charge for the families. These centres are generally located in disadvantaged districts, and are mostly used by families from low socioeconomic groups.

The first stage of the dental programme consisted of provision of general information on caries prevention for staff of the PMI centres and day care facilities. The second stage involved specific training for people who volunteered to become 'dental resource persons' capable of providing dental knowledge and dental education. These 'experts' formed a network covering the department and worked in close co-operation with the public health service. Parents and children who attended these centres received dietary and oral hygiene counselling. All children ≥2 years of age received toothbrushes and low-fluoride-concentration (450 mg/l) toothpaste. The paediatricians were knowledgeable about the benefits of fluoride in caries prevention.

Conjointly with the prevention programme, three epidemiological surveys to monitor caries experience, were scheduled for 1991, 1995 and 2000. The purpose of this paper is to present the dental caries status for 6-year olds in Val de Marne for the period 1991 to 2000.

Materials and methods

This study consisted of a series of cross-sectional clinical examinations in 1991, 1995 and 2000, on samples of children of the same age (6 years). The study protocol was submitted to the review board of the health and education agencies of the department for ethical clearance, which was accorded. Parents of children in the selected classes were informed about the study and signed consent forms. In case of refusal from parents or the child, the examination was not conducted.

Population and sampling

All participants were drawn from children attending public schools (i.e. schools run by the Department). In 1991, 94.7% of children in Val de Marne attended public schools, and the remainder were at private schools. In 1991, guided by experience in the neighbouring Department (Seine St. Denis), we aimed for a sample of 1000 children and to allow for absence and refusals, we tried to enroll 1200 persons. The sample was all children attending public schools who had been born in 1985. Children born in that year were stratified by town of residence. Classes were randomly selected, and participants were randomly drawn within each selected school class. This gave a study sample of 1260 for 1991. For 1995 (children born 1989) and 2000 (children born 1994), the target sample size was 1500. All children in the selected classes were offered an oral health screening with feedback to the parents, but only children randomly selected for inclusion were enrolled in the study.

Clinical examination

Each school made a room available for screening. Examiners used plane mirrors, frontal light and probe. For each child examined, oral health conditions were recorded and a note regarding his/her dental condition was sent to the parents.

Examinations were conducted by six calibrated senior dentists, accompanied by a secretary. Caries was diagnosed when there was a cavity and initial (precavitation) stages of caries were not recorded. Caries prevalence, when reported in this paper, refers to the presence of carious cavities. Radiographs were not used. Calibration sessions were conducted in 2000 only and consisted of repeat examination of a class (about 20 children) by an examining dentist and a reference dentist (A.E.). All staff were employed by the dental services of Val de Marne. All examinations were completed within a 3-month period.

Caries experience was measured using the dft index. Missing primary teeth were ignored. The prevalence of primary tooth caries was the proportion of children who had dft > 0. The need for primary tooth operative care was indicated by dt/dt + ft.

Demographic and background data

Demographic data about the child (sex, date and place of birth) were provided by the director of the school. Socioeconomic status was derived from the occupations of the parents using a standard classification of jobs published by the National Institute of Statistics and Economic Studies.

Statistical analyses

For each survey, mean caries experience and numbers of decayed and filled teeth (dt and ft) were calculated. Comparisons were made using analysis of variance and chi-square. Statistical significance was set at 0.05.

Results

Participation

From target groups of 1260, 1500 and 1500 in the three study years, the actual samples consisted of 1061, 1263 and 1225 people respectively. Failure to participate in the study were due to absence on the day, or to parental refusal or, occasionally, to the child refusing to participate.

Demographic variables

The mean age of participants was 5 years 10 months in 1991 and 1995 and 5 years 8 months in 2000. The distribution of sex and place of birth are shown in Table 1. Data on socioeconomic status were not provided by 14% of participants in 1991, 17% in 1995 and 25% in 2000. Socioeconomic data for 2000 differed substantially from the earlier years: in 2000, more fathers belonged to the lowest social class, and fewer to middle classes, than in the earlier years, and in 2000, more mothers were housewives and fewer were judged to be middle class, than in the earlier years.

Table 1. Comparison of characteristics of the samples of 6-year olds in different years

	Year					
	1991		1995		2000	
	No.	Prop. (%)	No.	Prop. (%)	No.	Prop. (%)
Sex[a]						
Male	549	51.7	644	51.3	655	53.6
Female	512	48.3	611	48.7	567	46.4
Total available data	1061	100	1255	100	1222	100
Country of birth[a]						
France	1016	95.8	1139	96.3	830	96.4
Other country	45	4.2	44	3.7	31	3.6
Total no. of participants	1061		1183		861	

[a]Pearson's chi-square between 1991–2000 and 1995–2000: not significant.

Clinical findings

The calibration sessions in 2000 resulted in kappa values varying from 0.74 to 0.80 on the basis of re-examination of one class of children each for four examiners. Table 2 displays findings relating to primary tooth caries experience. Mean caries experience declined over the period from 1991 to 2000, from dft 1.74 in 1991 to 1.05 in 2000. This decline was statistically significant. The major portion of the decline was a fall in the number of decayed teeth; the number of filled teeth was fairly constant over the period.

Table 3 shows the distribution of dft scores in children in three categories: dft = 0, 1 < dft < 4 and dft ≥ 4 and by the date of examination. The prevalence of caries experience (i.e. dft > 0) decreased significantly between the three periods, from 38.9% in 1991 to 30.6% in 1995 and 22.2% in 2000 ($P < 0.001$). At the same time, the number of children with caries decreased regularly for the two categories: 1–4 carious lesions and >4 carious lesions. In 1991, 25% of the children had 82% of the carious lesions, whereas in 2000, only 13% of the children had 82% of the lesions (data not shown).

Among children who had caries experience, the extent to which treatment needs had been met is

Table 2. Comparison of mean caries scores in the primary teeth of 6-year olds, Val de Marne, France – 1991, 1995 and 2000

	Year						*P*-value[a]	
	1991		1995		2000			
Caries indicator	Mean	SD	Mean	SD	Mean	SD	1991–2000	1995–2000
dt	1.45	2.50	1.15	2.38	0.83	2.21	<0.001	<0.001
ft	0.29	0.99	0.24	1.01	0.22	0.96	ns	ns
dft	1.74	2.81	1.39	2.65	1.05	2.54	<0.001	<0.001

[a]Analysis of variance.

Table 3. Distribution of children by dft score at each survey

	Year					
	1991		1995		2000	
Caries indicator (dft)	No.	Prop. (%)	No.	Prop. (%)	No.	Prop. (%)
dft = 0	648	61.1	877	69.4	953	77.8
0 < dft < 4	169	15.9	155	12.3	115	9.4
dft ≥ 4	244	23.0	231	18.3	157	12.8

Test: Pearson's chi-square: $P < 0.001$ between 1991 and 1995 and between 1995 and 2000.

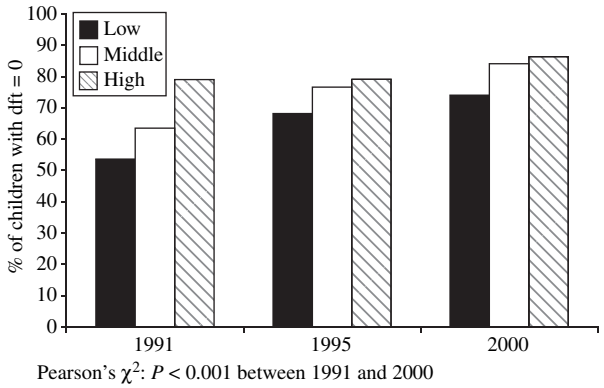

Fig. 1. Proportion of participants with dft = 0, by study year and father's socioeconomic level.

expressed by the relationship ft/ft + dt. This was 0.16 (SD = 0.32) in 1991, 0.17 (SD = 0.33) in 1995 and 0.19 (SD = 0.34) in 2000. There was no statistically significant difference between these values.

More than four children out of five either had not been treated at all or had been incompletely treated, regardless of the year of examination; in 1991, 9.3% of children with caries were completely treated, 15.7% were partially treated and 75% were untreated; in 1995, the results were 10.6%, 13.4% and 75.9% and in 2000, 11.4%, 15.4% and 73.2%, respectively. Again, there was no statistically significant difference between these values.

Place of birth and caries experience

In each study year, children born in France had better dental health: 38.3%, 29.4% and 22.6% had caries experience in 1991, 1995 and 2000 respectively ($P < 0.001$). The oral health of children of foreign origin also improved; the prevalence of caries experience (68.9%, 61.4% and 41.9%, respectively) declined at successive examinations in the same years ($P < 0.02$).

Caries prevalence decreased regularly between each study period whatever the economic level of the father (Fig. 1). For the lowest class, corresponding generally to blue collar workers and home workers, prevalence of caries was 46.4%, 31.8% and 26.0% in 1991, 1995 and 2000, respectively, but remained above the mean. For the middle class, the results were 36.5%, 23.4% and 15.9% for each period, respectively, below the mean. For children whose fathers belonged to the upper class, which correspond to executives or medical professionals, for example, corresponding caries prevalence was 21.0%, 20.9% and 13.7%, respectively, and were always below the mean in each period.

Although caries prevalence decreased with time, regardless of the mother's social class, there remained significant class-related differences (Fig. 2). Caries prevalence decreased for children whose mothers did not work from 50.4% in 1991 to 36.8% in 1995 and 33.7% in 2000. In cases where the mothers belonged to the lowest class, caries prevalence was 37.0%, 29.2% and 25.1% in 1991, 1995 and 2000 respectively. For children whose mothers belonged to the middle class, results were 27%, 24.5% and 9.7%, respectively, and for upper class mothers, the proportions were 25.0%, 19.8% and 16.5%, respectively. For upper and middle class mothers, caries prevalence was always below the mean on each occasion. For the housewives and

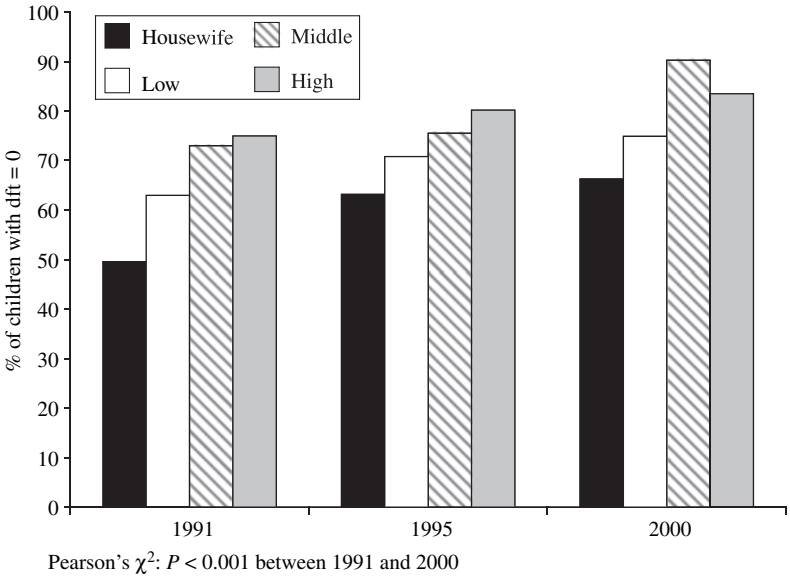

Fig. 2. Proportion of participants with dft = 0, by study year and mother's socioeconomic level.

mothers of lower social class, prevalence was always above the mean.

Discussion

This study was not a clinical trial. It was a sequence of observational studies and by its design, is not capable of documenting a causal relationship between the health educational intervention and changes in dental caries. The multifactorial nature of dental caries suggests in any case that many factors are likely to be involved, some possibly linked to the health educational interventions, and some to other factors not recorded in the study, such as the type of toothpaste used, the use of fluoridated salt, diet and possibly physiological factors (2).

Nevertheless, the study was conducted on each of the three occasions on groups drawn from the same geographical area using similar sampling methods. While there were minor differences in the demographic composition of the samples – for example, compared with 1995, in 2000 participants' fathers were slightly more likely to be of lower social class and mothers to be housewives without other work – these differences may represent demographic trends in the community rather than methodological shortcomings. Coupled with the facts that the clinical examinations used a protocol generally considered to have a good reliability, and that the examiners were regularly calibrated, we feel that the trends observed are a true reflection of changes in the dental caries of 6-year olds in Val de Marne. They are consistent with the results of an earlier national survey (2).

Between 1995 and 2000, the rate of nonresponse to questionnaires by parents increased. This may be linked to the demographic trends already noted – fewer middle class participants and a larger proportion from the lowest socioeconomic groups – but it is also likely that parents are increasingly being faced with questionnaires from their child's school on a wide range of topics, and there is questionnaire fatigue.

The results indicate that, in 1991, 1995 and 2000, 61.1%, 69.4% and 77.8%, respectively, of six-year olds had no caries experience and the mean dft index was 1.74, 1.39 and 1.05, respectively. The primary tooth dental caries status of these 6-year olds is thus approaching the level seen in countries like Ireland, Denmark and Sweden, where community prevention programmes have been in place for many years (13). Cahen et al. (2) reported that the corresponding values for 6-year olds in a national survey in France in 1991 were 46.8% and dft 2.48 so the children in our survey in 1991 seem to have had somewhat better dental health. Dental health education, the more widespread use of fluoridated toothpaste, the use of fluoridated salt, improved levels of dental hygiene or other factors are believed to have contributed to a general reduction of caries levels in France (2) and these factors have undoubtedly played a role in the health improvement we have registered in the Department of the Val de Marne. The relative contribution of these health-promoting factors to

the improvement in the Val de Marne remains a matter of speculation.

Comparisons with other countries, where systematic oral health promotion programmes have long been implemented, remain difficult. In those countries where caries prevalence in primary teeth is low, there are some recent indications of a reversal of the caries decline (6, 13, 14). We observed no such reversal: the improvement in the proportion of caries-free children was 12.0% between 1991 and 1995, and 10.8% between 1995 and 2000. There was, however, evidence that the rate of improvement was declining: children whose mothers belonged to upper classes had lower levels of dental caries than other children in 1991, but this difference did not increase over the most recent 5 years. It may be that the preventive strategy did not adequately target the whole infant population but focused on the vulnerable low socioeconomic section of the population, neglecting higher socioeconomic children.

The results of the study show that dental caries affected the children of immigrants from outside Europe and children of low socioeconomical background disproportionately more. These results are in accordance with those of other studies (13, 15, 16). For example, in Sweden, Wendt et al. (16) showed that the mean caries increment between 3- and 6-years olds was greater in the immigrant group. Azogui-Lévy et al. (17) documented that immigrant children in another Paris suburb, despite having a great need of care, were least likely to receive it.

These findings raise questions about access to preventive care and its usefulness for deprived populations. The first strategy of the programme was to reach these families in places other than the dental office. Watt et al. (18) pointed out the important role that infant-care institutions could play in a programme of oral health promotion. In their studies, Reisine and Douglass (15), Weintraub (19) and Hamilton et al. (20) proposed that dental disease prevention programmes be developed in general public health institutions and be linked to systematic check-ups and vaccination programmes for infants.

The second strategy was based on the idea that the children and parents receive appropriate oral health messages (18, 19, 21, 22). Any carer – whether from the dental field or not – might carry and deliver dental disease prevention messages. In France, there are three obligatory medical check-ups for children: on the eighth day after birth and at 9 and 24 months of life, and most vaccinations are completed before the age of 4 years. Children belonging to low socioeconomic background and their families visit the PMI centres for these services, and so in the present study, the health professionals of these centres were encouraged to participate in the prevention programme and distribute information and prevention messages.

It is important to note that not all 'high risk' children were reached by the programme. It was established progressively in day care centres and did not reach a large target population initially; children tended to drop out from organized health care after reaching about 3 years of age; and, many disadvantaged children seek care in public hospitals where the programme was not established. Thus, this oral health promotion programme has the potential to reach more people with improved organization, if there are indications that it has been successful.

Evaluation of this type of programme is difficult. There is a lack of appropriate evaluation tools, other than scoring dft values (23). Dental education programmes aim at behavioural change, and questionnaires and interviews are better adapted to evaluating such change than the dft index.

Evolution of the need for dental care

The results of the study show that there remains a great need for care for children under 6 years old in Val de Marne. Although dental conditions in the children have improved – fewer children have caries and the mean number of carious teeth per child has fallen – the study shows that 79% of the children with caries do not receive the treatment they need. One explanation can be the cost of dental care and the complex health insurance system in France (17), which requires patients to attend for dental care and pay the dentist for treatment received, then lodge a claim for reimbursement of the cost. This is off-putting for many parents and many dentists find the approved fees unattractive.

Apart from the financial obstacles (24), there are 'cultural' problems. Language difficulties, attitudes to treating primary teeth (25) and ignorance of the importance dental diseases all play a role. Another problem is the access to private dental offices for the youngest (26–28). The remuneration system for dentists makes the care of primary teeth unattractive. Many preventive procedures are not covered by insurance, and families have to pay to obtain them – expensive for low-income families.

There are some salaried dentists in dental clinics or hospital but they represented fewer than 10% of the total. There are a few hospital paedodontic units but access is limited. Källestål et al. (29) have demonstrated in a study comparing caries-preventive methods in four Nordic countries that dental professionals are strongly influenced by national recommendations. For France, a prevention-orientated oral health care policy would seem more advantageous than the present curative approach. An awareness campaign aimed towards professionals to interest them in the needs of youngsters would be necessary to start a debate with the different parties (health ministry, health insurance institutions and dental professionals) in France. Dental caries will continue to be a problem for at least some children. If access to care difficulties remain, then thought should be given to the need to establish a more appropriate model for dental care for children, such as exists in the Nordic countries.

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