

# Assessment of dental caries prevention program applied to a cohort of elementary school children of Kebemer, a city in Senegal

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## Abstract

**Objective:** Dental caries is frequently observed in children, particularly among those residing in developing countries. The most adapted strategies against this pathology remains prevention based on information, education, and communication (IEC), as well as on early diagnosis and treatment. We carried out a study that aimed to analyze the development of dental caries in a cohort of school children followed during their primary education. The objective was to assess the evolution of the dental status of a cohort of students during their elementary curriculum.

**Materials and Methods:** A cohort of school children was followed during 6 years from the first grade to the sixth grade. Monitoring of these school children focused every year on IEC based on learning methods of brushing messages, dietary advice, systematic visits, fluoride use, and primary dental care. During the school year, the students were periodically subjected to education and communication briefings (IEC). Primary care consisted of extracting and descaling rhizalized teeth in the same period. The data from this review were collected using the World Health Organization questionnaire, and statistical analysis was performed with the software Epi-info version 6.04 d. **Results:** The mean age of the 171 school children was 6 years in the first grade and 11 years in the sixth grade. In the first grade, the decayed permanent teeth prevalence was 31.6% and the In permanent teeth: Decayed, missing or filled teeth (DMF/T) was 0.47. The decayed primary teeth prevalence was 75% and the in primary teeth: decayed or filled teeth (df/t) 2.23. In the sixth year, the prevalence of decayed permanent teeth was 51% and DMF/T 0.36 whereas the decayed primary teeth prevalence was 12% and the df/t was 0.19. The prevalence of decayed permanent teeth increased from 31.6 to 51% whereas the mean DMF/T was not statistically different between school children of the first and sixth grade class. **Conclusion:** The promotion of oral health by IEC messages and monitoring of children constitute an effective preventive method for children's oral care.

**Key words:** Assessment, dental caries prevention program, primary school, school children cohort

## INTRODUCTION

Over the past 20 years, oral health status of populations in industrialized countries has improved significantly, including a significant decline in the prevalence of caries

and periodontal diseases because of preventive strategies.<sup>[1]</sup> Dental caries are preventable and can theoretically be controlled by altering bacterial flora in the mouth, modifying diet, increasing acid resistance of teeth, or

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reversing demineralization.<sup>[2]</sup> In Canada, dental services are largely privatized where payments for dental care are usually out of pocket or through employer-sponsored private insurance. Issues of equity exist for oral health outcomes for disadvantaged Canadians, and data consistently show unequal access to dental services. School-based programs that are available to all children or targeted to those with the greatest need may help to reduce inequities in oral health.<sup>[3]</sup> In USA, the school-based preventive dental programs provide dental screenings, prophylaxis, topical fluoride mouth rinses, and linkages to restorative treatment. These preventive services are also provided in other states. School-based dental programs have the opportunity to enhance access for children through the expansion of integrated health systems.<sup>[4]</sup>

However, this improvement, due to both effects of oral health preventive and promotional measures at the community and individual level, seems less significant in children and disadvantaged populations of these countries.<sup>[5,6]</sup> In developing countries, an increase of these conditions is observed due the observed changes in eating habits and lack of other prevention policies.<sup>[7,8]</sup> Thus, 80% of the people carrying carious lesions around the world are living in these countries.<sup>[9]</sup> Many of them have developed different strategies to abate and eliminate dental caries from schoolchildren by conducting various studies in dental caries. As of now, these studies have given satisfactorily concluding results by implementing water and salt fluoridation and by conducting dental health awareness programs and school dental health programs, however, availability of all these resources in developing country like India is still scanty.<sup>[10]</sup> In Senegal, some preventive activities are carried out; it is the same for studies to test these preventive measures. Promoting health where people live, work, or study is a creative way that has the best cost-effectiveness to improve oral health.<sup>[11]</sup> For children and adolescents, school is therefore an ideal place for the promotion of oral health because school children are easily accessible. We carried out this study with the aim to analyze the development of dental caries in a cohort of school children following them during their primary education. The objective was to assess the evolution of the dental status of a cohort of school children during their elementary curriculum.

## **MATERIALS AND METHODS**

### **Localization of the study**

Kebemer is the western department of Louga Region in Senegal, 100 kilometers from the capital, Dakar, in

the north east. It is a department covering an area of 1352 km<sup>2</sup>. According to the 2012 census, the sanitary district had 19203 households with a population of approximately 252862 inhabitants. The rate of scholarized children between 6 and 7 years of age was one of the lowest of the country (35%). In 1995, 3352 children were registered in primary schools.

### **Study type**

The present study was a series of repeated prevalence surveys on dental caries each year in a cohort of school children attending an elementary school followed for 6 years, from the first elementary year to last elementary class and receiving information, education, communication (IEC), as well as information on primary care.

### **Study period**

The study was conducted from July 1 2015 to January 31 2016.

### **Study population, criteria of selection, and size of the cohort**

This study involved a cohort of children of both genders who began their primary education in 2010. The average age of the children was 6 years in the first elementary year and 11 in the last elementary class.

Any school child in this school who started their first class in 2010 and remained until 2015 or who left school before but had received education and information communication (IEC) and/or primary care was included in the study.

The size of the cohort was 171 school children from the first class to fourth elementary year. Four school children who had left the school after a transfer to another school reduced the number of students to 167 in the primary school, fifth year, and last year. Signed academic permissions and parental consent was obtained before the start of the study.

### **Method of the study**

Monitoring these students focused on IEC based on learning methods of brushing messages, dietary advice, systematic visits, fluoride use, and primary dental care. During the school year, the school children periodically underwent to education and communication briefings (IEC). Primary care consisted of extracting and descaling rhizalized teeth in the same period.

The IEC materials consisted of flip albums illustrating the dental morphology and evolution of caries and gingivitis and tooth brushes of dental arch models. Manual scaling was followed with fluoride application.

**Indicators and measures**

The oral clinical examination was carried out in the classroom, with the child sitting on a bench in natural light. The caries experience was measured by DMF/T and df/t.

**Statistical analysis of the data**

The data from this review were collected on the world health organization (WHO) questionnaire and statistical analysis was performed with the software Epi-info version 6.04 d. Continuous variables were compared using the Student *t*-test. Reports of proportion between school children with or without DMF/T were made with a 95% confidence interval, as well as the proportion of school children interactions with and without df/t. The Chi square test for trend was used when necessary. The test was significant when *P* value was less than 0.05.

**Ethical considerations**

We sent a request for authorization to conduct the survey to the Director of the School, explaining the benefits and advantages connected with this study. The director agreed by signing a circular letter to all school teachers as well as parents of students by asking them to allow their children to be part of the project and for their consent.

**RESULTS**

The prevalence of permanent teeth decayed was 31.6% during the first class and 51% in the last elementary year.

The prevalence of primary teeth decayed was 75% in the first year and 12% in the last class. The mean

DMF/T was 0.47 in the first year and 0.36 in the last class (*P* = 0.15); we found no significant difference between the mean DMF/T in the first class and the last year. In contrast, the mean df/t was 2.23 and 0.19 in the first and the last year. The difference was statistically significant between the first and the last class (*P* < 0.01). Peak df/t was found in the children between 6 and 7 years, i.e., between the second and third class in the elementary school.

Regarding comparison of proportions between school children with DMF/T and no DMF/T, the linear trend Chi-square was 2.98 with *P* = 0.08. The evolution of the number of DMF/T depending on the class showed no linear trend [Table 1].

Regarding comparisons between proportions of school children with df/t and no dental caries, Chi-square linear trend was 22.27 with a *P* less than 0.01. The number of df/t according to the study class showed a linear trend with a decreasing curve of the first to the last class [Table 2].

**DISCUSSION**

In a developing country like Senegal, caries prevalence is high because people ignore prevention measures. There are no sufficient prevention programs applied to the population. Therefore, we applied this program to reduce the prevalence of caries in elementary school children. Many factors, such as changing patterns of sugar consumption and lifestyle, might be responsible for the increase in caries rate, especially in developing countries.<sup>[12]</sup> Brushing after every meal and also before going to sleep at nights is very helpful in the prevention of dental diseases.<sup>[13]</sup>

Education for oral health is a good strategy in organized structures such as schools where children are already receptive and can serve as vectors of educational information in homes where many prejudices, taboos, and lack of resources remain.<sup>[14]</sup> This study is the first ever research between Department of Odontology of

**Table 1: Comparison of proportions between school children with DMF/T and no DMF/T**

| Class                       | School children with DMF/T N (%) | School children without DMF/T N (%) | Rapport of proportions | CI 95%      |
|-----------------------------|----------------------------------|-------------------------------------|------------------------|-------------|
| 1 <sup>st</sup>             | 57 (33.3)                        | 114 (66.7)                          | 1                      | réf         |
| 2 <sup>nd</sup>             | 81 (47.4)                        | 90 (52.6)                           | 1.80                   | (1.77-1.83) |
| 3 <sup>rd</sup>             | 87 (50.9)                        | 84 (49.1)                           | 2.07                   | (2.04-2.10) |
| 4 <sup>th</sup>             | 90 (52.6)                        | 81 (47.4)                           | 2.22                   | (2.19-2.25) |
| 5 <sup>th</sup>             | 85 (51.0)                        | 82 (49.0)                           | 2.07                   | (2.04-2.10) |
| 6 <sup>th</sup> (last year) | 85 (51.0)                        | 82 (49.0)                           | 2.07                   | (2.04-2.10) |

*Chi square is 2.98 with P=0.08*

**Table 2: Comparison between proportions of school children with df/t and no dental caries**

| Class                       | School children with df/t N (%) | School children without df/t N (%) | Report of proportions | CI 95%      |
|-----------------------------|---------------------------------|------------------------------------|-----------------------|-------------|
| 1 <sup>st</sup>             | 129 (75.4)                      | 42 (24.6)                          | 1                     | réf         |
| 2 <sup>nd</sup>             | 106 (62.0)                      | 65 (38.0)                          | 1.53                  | (1.50-1.56) |
| 3 <sup>rd</sup>             | 99 (58.0)                       | 72 (42.0)                          | 0.45                  | (0.42-0.48) |
| 4 <sup>th</sup>             | 78 (46.0)                       | 93 (54.0)                          | 0.27                  | (0.24-0.30) |
| 5 <sup>th</sup>             | 20 (12.0)                       | 147 (88.0)                         | 0.4                   | (0.38-0.42) |
| 6 <sup>th</sup> (last year) | 20 (12.0)                       | 147 (88.0)                         | 0.4                   | (0.38-0.42) |

*Chi square is 22, 27 with P less than 0.01*

the Faculty of Medicine and Department of Odontology of the Ministry of Health in Senegal. We monitored a cohort of 171 children in a primary school in Kebemer for 6 years corresponding to the duration of their primary education. However, we lost 4 school children because of transfers. This program introduced at the primary school allowed the children to get used to the methods of hygiene and oral prevention from an early age. The introduction into the training curricula of prevention methods is also an oral promoting asset with children who will in turn become vectors of disclosure and promotion of oral health in their families. Emergency care applied in these children will push them to become more familiar with the dental staff while allowing it to dispel the fear of the dentist and have regular consultations in the absence of pain. However, some limitations of the study were noted, in particular the lack of control monitoring of the program by families who generally ignore oral prevention methods. In poor families, the problems related to the availability and accessibility toothpastes makes the implementation of preventive measures in children difficult. Although satisfactory results were obtained, the absence of a continuing program after elementary school may be forgetting some long-term prevention or lack of motivation in the absence of monitoring.

### Dental caries in permanent teeth

The mean DMF/T did not vary significantly between school children in the first and the last class ( $P = 0.15$ ), suggesting that few new units caries in permanent teeth would have developed [Table 1]. The linear trend Chi-square was 2.98 with  $P = 0.08$ . The evolution of the number of DMF/T depending on the class showed no linear trend [Figures 1 and 2].

However, the proportion of school children with DMF/T in the last class was higher than in the first year in elementary school.

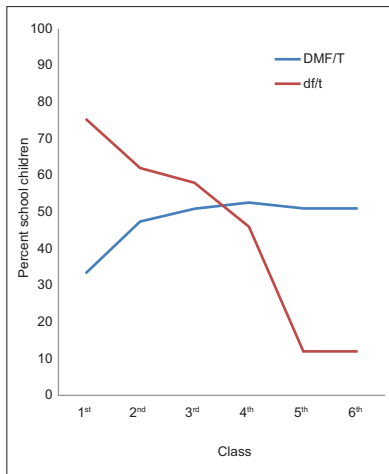
The mean DMF/T of our study population in the last year was 0.36, well below that of children aged

12 years in Senegal, which was 2.6 in 1999 according to Sembène.<sup>[7]</sup> In other African countries such as Ivory Coast in 1999<sup>[8]</sup> and Nigeria in 1984,<sup>[9]</sup> DMF/T values found in children aged 12 years were more than that obtained in the present study. It is possible that the lack of functional dental structures and staff predisposed surveyed children to poor hygienic conditions. The child received almost no information about his oral health. DMF/T, therefore, tended to increase. In children tracked in Benin and South Africa in 2000, DMF/T was less than 1.<sup>[15,16]</sup> This figure shows a good oral health, which confirms that the mean DMF/T is largely influenced by the introduction of preventive measures and early follow-up.

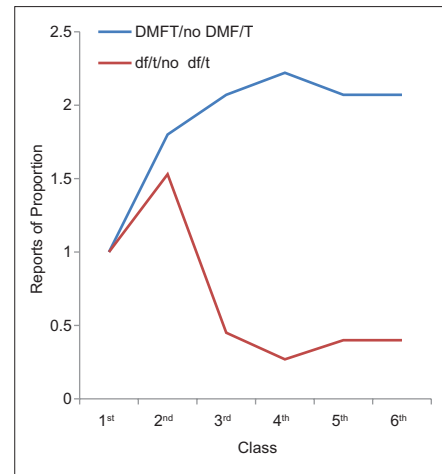
In Tanzania in 1995, to justify the improvement of DMF/T index which was of 0.4, Massalu showed the importance of IEC in oral health and the attitude and behavior of mothers toward their children's hygiene.<sup>[17]</sup>

In developed countries, industrialization and change in lifestyle had pushed them to focus on the widespread commercialization of fluoridated toothpaste, fluoridated cooking salt, and salting to reduce oral dental diseases. This is the case in Germany in 2000 when the DMF/T ratio was 1.2, Denmark in 2001 with a DMF/T equal to 1.2, and France in 1998 with a DMF/T of 1.9.<sup>[18]</sup> Bosnia and Herzegovina in 2001 showed DMF/T equal to 6.1. According to Moallice, this increase in DMF/T was linked to the political instability and war in this country.<sup>[15]</sup> USA and Canada had DMF/T of 1.8 in 2000 and 1.4 in 1991, respectively. Other countries such as Guatemala, Argentina, and Brazil had a DMF/T much higher than USA and Canada. The Pan American Health Organization seemed to link the DMF/T to economic conditions. The increase in DMF/T was largely related to the lack of families and the community resources.<sup>[18]</sup>

However, DMF/T alone cannot be used to compare countries health. The knowledge of the components of this index is more than necessary to the extent that two



**Figure 1:** Percentage of school children (with DMF/T or with df/t) per class



**Figure 2:** Reports of proportion (DMFT/no DMFT/T, df/t/no df/t) per class

countries with the same DMF/T index do not always have the same concerns.

### Dental caries in primary dentition

Comparing the df/t between different classes, our study showed that the number of children with df/t tended to decrease with the root resorption of the deciduous teeth, to tend to zero to last year of primary school [Table 2]. The number of df/t according to the study class shows a linear trend with a decreasing curve of the first to the last class [Figures 1 and 2]. It naturally decreases with the loss of deciduous teeth. It is in the age group of 6 to 7 years that we found our peak df teeth. The difference between peak df/t found in Senegal and European children is the fact that eruption among black people would be earlier, lying between 4 and 6 months according to Yam.<sup>[19]</sup> Therefore, the risk of exposure to disease is earlier; it should also be noted that, at this age, children have not received a lot of information on hygiene and prevention of oral diseases. Moreover, deciduous teeth, since the second year of life, have long been exposed to an environment where the child has not experienced the importance of good oral hygiene.

Oral health education (awareness and motivation) is, therefore, an important element for improving oral hygiene. It must start early from the preschool. In fact, the first permanent molar (tooth of six years) tends to be decayed since its eruption if the child does not brush regularly and properly. The importance of hygiene on oral diseases prevention is a reality. The probable precursor role of oral diseases in the occurrence of noma, a mutilating affection of the face in children in Africa, should further motivate health officials to

develop this program in all schoolchildren and in rural areas.<sup>[20]</sup> The messages must be focused on the integration of oral health on the body, on food hygiene correcting bad habits, and avoiding snacking between meals. Similarly, periodic routine visits to the dental practitioner, the use of fluoride in areas where fluoride content is low, and screening and early treatment should be the essential points of messages for the children. This study conducted on school children who benefited from awareness and motivation in oral hygiene during their elementary school curriculum showed a relatively low and invariable DMF/T that would be probably due to the IEC sessions.

Certainly our study did not show a significant decrease in DMF/T but caused a change in behavior among students. It is true that behavioral change is a slow and long process, and therefore, the impact on the oral health of students can be experienced in adulthood.

### CONCLUSION

The promotion of oral health by IEC messages and monitoring of children constitutes an effective preventive method for improving children's oral care. Child care must also start early from preschool given the importance of the tooth of 6-year-old children, which tends to be decayed since its eruption if the child's oral hygiene is precarious or unfavorable.

The fact that our study did not reduce the DMF/T shows that future research should include mothers and teachers. Sessions of application of fluoride toothpaste for each student in the class everyday makes the most efficient project.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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