



Evolution of Dental Caries in Schoolchildren in Senegal from 1966 to 2014: Literature Synthesis

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Abstract

Context: Dental caries remains a common condition in children, due to diet, lifestyle changes and inadequate management. The aim of this study was to describe the evolution of dental caries experience (measured as decayed, missing and filled primary and permanent teeth (dmft, DMFT)) and caries prevalence data in Senegalese school children. It was a literature synthesis including data published or unpublished and available in all libraries in the university.

Method: Reports of studies carried out among Senegalese school children as far back in time as possible were sought. The research was both manual and electronic and took place either in the library of the Department of Odontology of the Faculty of Medicine, Pharmacy and Dentistry or in the university central library of Cheikh Anta Diop University in Dakar.

Results: Dental caries experience (DMFT) among 12-year-olds ranged from 0.86 in 1972 to 2.86 in 2002. Then, from 2003 to 2010, it appeared to be decreasing to a value of 0.64. The change in prevalence paralleled the DMFT except in the period from 2003 to 2009 when it peaked at age 12 years (83.5%).

Conclusion: Dental caries prevalence and experience in Senegalese schoolchildren reflect a lack of effectiveness of prevention policies and programs, which should focus on information, education, communication and capacity-building strategies for school stakeholders.

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Keywords: Evolution; Dental caries; School children; Senegal

Introduction

Despite considerable progress in the area of oral health, problems remain in many communities, particularly among disadvantaged groups in developed and developing countries [1]. The distribution and severity of oral diseases vary across continents and within countries and regions. In industrialized countries, the incidence of dental caries tends to decline, while in developing countries it is progressing, influenced by caries-favourable lifestyle changes and a lack of effective prevention policies [2]. According to the WHO World Oral Health Report in 2003, among children aged 12 years, caries experience (Decayed, Missing and Filled Teeth, DMFT) is 3.4 [2]. The age of 12 years is an indicator age for WHOM; at this age all the permanent teeth except the third molars will have erupted in the mouth. In addition, because most children are still at school and thus easily examined, this is the most frequently used age for international comparisons and monitoring of the disease. Several epidemiological surveys carried out in Senegal in this age group showed varying prevalence of caries: 68% in 1987 in Dakar; 67% in 2003 in Diourbel; 59.8% in 2002 in Sebikotane; 51% in 2014 in Senegal [3-7]. No studies have been done on the totality of data collected on dental caries in children. It is thus of interest to conduct a study on the evolution of dental caries from epidemiological surveys that have been carried out among school children. The aim of this study is to describe the evolution of dental caries prevalence and DMFT among children in Senegal from 1966 to 2014.

Method

Type settings

There is a synthesis of the literature based on existing data on caries experience (DMFT) and prevalence of dental caries in school children in Senegal. The research is based on all relevant and scientifically documented literature from all dental caries studies carried out in Senegal in school

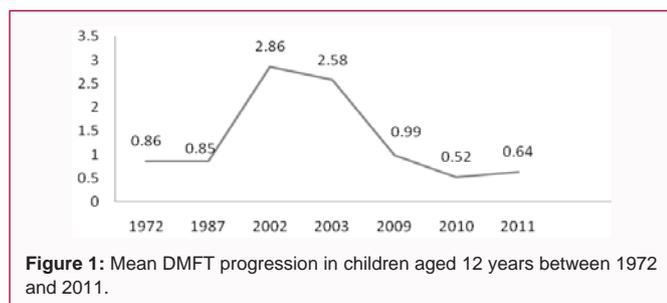


Figure 1: Mean DMFT progression in children aged 12 years between 1972 and 2011.

children.

Selection criteria

Documents at our disposal selected were:

- Articles, theses or reports about dental caries in school children in Senegal;
- Articles, theses or reports for which the mean DMFT value and the prevalence are used as indicators of dental caries.

Other documents about dental caries among schoolchildren presenting data that did not include DMFT or prevalence in Senegal, or data that did not involve Senegal, or were published in languages other than English or French, were not selected.

Indicators studied

DMFT Index: The DMFT or Klein and Palmer index which characterizes the severity of the carious lesion for permanent teeth corresponds to the average number of Decayed (D), Missing (M), or Filled (F) Teeth (T) in the studied population.

Decayed (D), Lost (L) or Filled (O) (DLO) Index: The lost teeth (L) were either extracted teeth or teeth for which extraction is required. The DLO score is equivalent to the DMFT score, because each score totalises all decayed, required extraction or missing and filled teeth [8].

Decayed (d) and filled (f) teeth (t) (dft) index in primary teeth: In primary dentition the missing teeth are not considered, because it is difficult to distinguish « absent » due to caries from lost due to normal natural phenomena.

Prevalence: The prevalence of dental caries refers to the proportion of children in a group (population) with at least one carious cavity.

Research and data collection strategy

The strategy was based on a process with four main steps:

- Formulation of the research topic: Evolution of dental caries in Senegalese school children: synthesis of available data;
- Identification of the main concepts: Dental caries; Children; Evolution; Senegalese school environment;
- Search for appropriate vocabulary: Words such as: Tooth decay - prevalence - DMFT index - children-school environment - caries prevalence - dental caries - children - 12-year-old-Senegal;
- Formulating search equations with Boolean operators: AND, OR, NOT

Depending on whether the research was done on the internet or at the library, the approach was different.

On the Internet: With Google or Google Scholar, the research was undertaken with keywords or combinations of keywords such as: dental caries - children - schooled - Senegal. With Medline, research by the names of some authors who worked on childhood dental caries resulted in abstracts of articles.

At the library: Data collection focused on theses, documents, and data recorded (reports) in a registry. Some of these documents were digitalized. Non-digitized physical documents were consulted on the spot, while others required borrowing. For the digitized theses, the files were downloaded on a USB key. For theses that were not available in the library of the Department of Odontology, they had to be found at the large university library. For documents that were available only at the library of the Department of Odontology, consultation was done on site.

Sources of data and analysis

Final data came from 19 theses, five articles, two documents and two reports.

The analysis consisted of identifying the reliable documents and storing the data in relation to time. The work was classified according to DMFT or dmft data or prevalence of tooth decay. Other characteristics that were included in the presentation of the results were: the year (defence for a thesis or document, publication for an article or a report), place where the study was conducted, the type of document, the author name, sample size.

Results

Mean DMF index among 12-year-old children

Showed the maximum and the minimum DMFT was 3.93 DMFT in 2000 and 0.3 in 2014 in Dakar, the capital (Table 1). From 2002 to 2010, the severity of dental caries appeared to be regressing and the mean DMFT decreased from 2.86 to 0.52 teeth (Table 2 and Figure 1). The DMFT value of 0.52 was found in an endemic fluorosis area in Senegal (Kaolack).

Prevalence of caries among 12-year-old children

The evolution of the prevalence of dental caries parallels that of the DMFT with a difference between 2003 and 2009 when it increased to its maximum in 2009 (Figure 2). Between 1972 and 1994, the prevalences observed in the present study were 48%, 24.12%, 35.87%, 52.10% and 53.52% (Table 3).

Discussion

This study, although interesting, cannot be generalized to a very large school population. Especially since, in the African context, children attend school from the age of 7 or 8 years. The absence of restrictive age criteria can help to minimize this distortion. The age

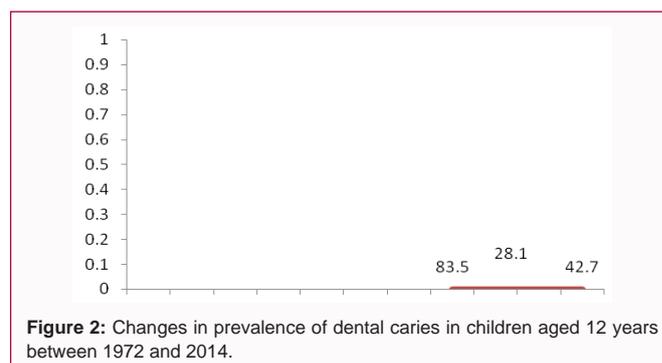


Figure 2: Changes in prevalence of dental caries in children aged 12 years between 1972 and 2014.

Table 1: Dental caries situation in Senegal from 1966 to 2014.

Years	Localities	Type of document	Author	Simple size	DMFT average	Prevalence (%)
1966	Dakar	Monograph	Grappin G [9]	202	Not reported	Not reported
1972	Dakar	Monograph	Di-Pascale CH [10]	595	Not reported	Not reported
1972	Niakhar	Thesis	Coudon-Dussol N [11]	134	Not reported	45.06
1974	Dakar	Thesis	Fowler J [12]	733	4 (CPO)	Not reported
1987	Dakar	Thesis	Cissé D [3]	2069	Not reported	Not reported
1989	Senegal	Article	Sembéne et al. [13]	300	1.3	Not reported
1994	Senegal	Article	Sembéne et al. [13]	300	1.2	68
1994	Dakar	Thesis	Diop A [14]	300	Not reported	54.33
2000	Dakar	Article	Lo et al. [15]	268	3.93	82.9
2001	Dakar	Thesis	Thiaw ON [16]	477	1.26	62.3
2002	Thies	Thesis	Fall A [17]	1010	2.86	49.9
2002	Sebikotane	Thesis	Hanne O [5]	607	1.85	68.3
2003	Tivaoune	Thesis	Mbengue AW [18]	1000	1.02	34.1
2003	Diourbel	Thesis	Fall TM [4]	1000	2.5	67
2004	Gandiaye	Thesis	Ndiaye K [19]	300	0.52	48.66
2005	Dakar	Article	Faye M et al. [20]	200	5.85	94
2005	Dakar	Thesis	Samb A [21]	577	1.75 ± 1.11*	33.27
2007	Fatick	Thesis	Diogue K [22]	962	0.8	31.8
2007	Senegal	Thesis	Sylla M [23]	293	1.77	51.9
2007	Senegal	Thesis	Samé DS [24]	623	2.06	52.8
2009	Kelkom	Thesis	Séne SAKM [25]	541	0.996	83.5
2009	Dakar	Article	Cissé et al. [26]	168	Not reported	68
2010	Kaolack	Thesis	Diouf M [27]	253	0.52	28.1
2011	Dakar	Article	Leye B et al. [28]	621	0.644	41.8
2014	Kebemer	Thesis	Kébé A [29]	300	Not reported	14.7
2014	Senegal	Article	Aidara et al. [6]	677	0.3	42.7
2014	Dakar-Saint Louis-Kaolack	Thesis	Niang AM [30]	901	0.0064 1.8*	42

*: dmft

Table 2: Mean DMFT among 12-year-olds between 1972 and 2011.

Years	1972	1987	2002	2003	2009	2010	2011
DMFT average	0.86	0.85	2.86	2.58	0.99	0.52	0.64

Table 3: Prevalence of dental caries in children aged 12 years between 1972 and 2014.

Years	1972	1974	1987	1989	1994	2002	2003	2009	2010	2011	2014
Prevalence (%)	48	24.1	35.8	52.1	53.5	68.3	66	83.5	28.1	41.8	42.7

of 12 years is particularly important because it is the age at which children generally leave or are about to leave elementary school. As a result, in many countries it is the last age at which a reliable sample can easily be obtained through the school system. Moreover, at this age most permanent teeth, except the third molars, have erupted. For these reasons, the age of 12 years was chosen as a standard indicator by the World Health Organization in international comparisons, trends and surveys of oral diseases. In some countries, however, many school-aged children do not attend the so-called Western school. If they are not on the streets, these children attend Arabic or Koranic schools or outright Franco-Arabs. This is why it is necessary to study the oral health of these children despite the difficulties of recruiting them for such an exercise.

Mean DMF index among 12-year-old children

Di-Pasquale et al. [9] in 1972 and Cisse in 1987 (Table 1) showed that the mean DMFT was respectively 0.86 and 0.85 in Dakar [3]. These indicators are very low, according to the WHO classification criteria for the severity of dental caries (DMFT <1.2=very low) (Figure 2). These results are comparable to those of many African countries before the 2000s. This is the case in Benin and in South Africa, with respective DMFT means of 0.83 and 0.92 in 1999 [10,11]. These are typical figures in developing countries which are very different from those found in some South American countries at the same time, such as Mexico in 1994 and Brazil in 1996 with respectively mean DMFT values of 6.74 and 6.5 [12,13].

Subsequently, this index has increased to 2.86 teeth in 2002 in Senegal which brings it to the WHO moderate level category (mean

DMFT between 2.7 and 4.4=moderate) [14]. This result showed that the WHO target in 2000 among 12-year-old children, with a mean DMFT less than 3 was reached for some (Table 2).

In the same period, some sub-Saharan African countries in very low and low caries experience means. For example, in Nigeria, Burkina Faso and South Africa, the mean DMFT was respectively 0.46 in 2003, 1.72 in 2000 and 1.1 in 2004 [15-17]. On the other hand, the results found in this study were comparable with those found in some more developed countries in the 1980s and 1990s, such as Brazil in 1994 with a mean DMFT of 3.8 and Israel in 1986 with a mean DMFT of 3.5 [18,19].

The increase of these oral indicators is ascribed to frequent consumption of sweets, inadequate infrastructure and ineffective prevention programs in oral health, as well as difficult access to dental care.

From 2002 to 2010, the severity of dental caries appeared to be regressing and the mean DMFT decreased from 2.86 to 0.52 teeth (Table 1 and Figure 1). Referring to WHOM, the DMFT index of 0.52 is very low, which may suggest that the fight against dental caries is succeeding. However, it can be noted that the DMFT value of 0.52 was found in an endemic fluorosis area in Senegal (Kaolack) where the prevalence of caries is likely to be low, given the caries preventive effect of fluoride.

The physical environment in Kaolack, where tap water is rich in fluoride, contrasts with that of Dakar where tap water contains only traces of fluoride. This may explain the DMFT of 0.64 found in Dakar between 2010 and 2011. Folayan's et al., [20] paper in Nigeria showed a mean DMFT of 0.09 teeth in children aged 8 to 12 years. In India, a study conducted in 2014 by Batra et al., [21] among 12-year-olds showed a DMFT of 3.4 ± 1.8 teeth. The DMFT among 12-year-old children in the United Arab Emirates varied from 1.6 to 3.24 teeth, according to Al-Bluwai [22].

All the studies carried out or published in the year 2014 (Table 1) present DMFT indices with overlapping confidence intervals, suggesting that their data are comparable. However, some of these studies included children under or over the age of 12 years, probably under- or over-estimating the average DMFT.

The shape of the DMFT curve, which sometimes decreases and increases (Figure 1), suggests a lack of a coherent and sustained policy or different caries-diagnostic criteria, despite the hope of considering these decreases in DMFT as the result of prevention and promotion of oral health in the school communities.

If appropriate oral health promotion and prevention measures are not taken, Senegal may fail to meet the WHO 2020 target for 12-year-olds' caries experience, $DMFT \leq 1.5$ [2].

Prevalence of caries among 12-year-old children

The evolution of the prevalence of dental caries parallels that of the DMFT with a difference between 2003 and 2009 when it increased to its maximum in 2009 (Figure 2).

Between 1972 and 1994, the prevalences observed in the present study were 48%, 24.12%, 35.87%, 52.10% and 53.52% (Table 3). These results are close to the prevalences recorded in epidemiological surveys carried out in Black Africa. In Rwanda prevalence was 53% among children aged 12 years in 1985, in Burkina Faso prevalence rates ranged from 30% to 45% in 1998 among 12-year-olds [23,24].

From 2002 to 2003, studies in Thies and Diourbel in Senegal showed prevalences of 68.30% and 66% respectively [4,14]. In Côte d'Ivoire, Yao et al., [25] in 2001 reported a higher prevalence in elementary school students of 87.2%. Studies in more developed countries during this period showed lower prevalence. This is the case in, France (Gironde) in 2002 (16.8%), India (Kerala) in 2003 (26%), Germany in 2004 (39.3%, 8%) and France (Corsica) in 2006 (27.4%) [26]. Thus the prevalence results recorded from 1974 to 2003 showed a progressive extent of caries in 12-year-old children (Figure 2). The peak in 2009, which was 83.50% (Figure 2), was obtained in a study in children who lived in Koranic boarding schools and who are generally not followed by parents [27]. This result could be explained by the poor oral hygiene of these students, who are often forgotten during activities for the promotion of oral health.

Thus, Diouf et al. [28] in Senegal found that 81% of children (mean age 9.3 ± 0.4 years) attending Koranic schools did not use either a toothbrush or a tooth-rubbing stick. During the 1980s and 1990s, prevalences found in some European countries such as Belgium, Poland, Finland and Norway were comparable to those of 2009 in Diourbel [27]. Over the years, the oral health of the populations living in these developed countries had improved markedly because of the political will of the states and the efforts made by their health systems. In these countries, the health systems developed prevention programs based on oral hygiene improvement, optimal use of fluorides and reasonable sugar intake, supplemented by curative and promotional dental care (effective treatment, restoration and rehabilitation) [26].

The decline in prevalence (28.1%) (Figure 2) was noted among the 12-year-old children studied in the city of Kaolack (endemic fluorosis zone) attending public, confessional and Franco-Arab schools, where 91% of the schoolchildren were affected by fluorosis. The presence of fluoride in drinking water has certainly contributed to the decline in prevalence [29]. The prevalence of 28.1% is certainly lower than that observed among Brazzaville school children in Congo in 2013 (53%) and among children in Ouagadougou (Burkina Faso) in 2011, 48.2% [30-49]. In between 2010 to 2014 the prevalence increased from 41.80% in 2011 to 42.7% in 2014 (Figure 2). Although successful results can be achieved, it is difficult to sustain them due to a lack of human and material resources and a lack of monitoring activities associated with lifestyles and socio-economic levels.

Conclusion

Caries prevalence and experience among 12-year-old Senegalese school children remain respectively low according to the WHO, despite an irregular evolution. This instability may reflect a deficient and incoherent caries preventive policy and poor implementation of effective strategies in schools. Therefore, policy of promoting oral health in schools must be put in place. It should include capacity-building for oral health teachers; information, education and communication strategies for healthy behaviours, healthy lifestyles and access to fluoride for prevention when needed.

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