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Oral Health Status and Associated Factors Among Young Children in Disadvantaged French Schools

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Short title: Oral Health Disparities in Disadvantaged Schools

Abbreviations:

dmft	*Decayed, Missing, Filled Teeth index (primary dentition)*
dmft + DMFT	*Combined caries index for mixed dentition (primary and permanent)*
DMFT	*Decayed, Missing, Filled Teeth index (permanent dentition)*
ICDAS	*International Caries Detection and Assessment System*
CP	*Primary school first grade*
GS	*Kindergarten final year*
QPV	*Priority Neighborhoods (quartiers prioritaires de la politique de la ville)*
PEN	*Priority Education Network*
PEN+	*Enhanced Priority Education Network*

Abstract [250 words max]

Background

To assess oral health status and socioeconomic disparities among kindergarten and first-grade children attending socially deprived schools in southern France.

Methods

A cross-sectional study was conducted in 46 schools located in Priority Education Networks (PEN/PEN+) and Priority Neighborhoods (QPV) during the 2024–2025 school year. Among 1,902 eligible children, 1,505 underwent a standardized clinical examination (79.1% participation). Caries experience (dmft/DMFT), oral hygiene, treatment needs, and preventive care were recorded.

Results

Overall, 61.9% of children required dental care and 56.7% had at least one active carious lesion. Only 44.1% had satisfactory dental status. The mean mixed caries index was 2.69 ± 3.45, mainly reflecting untreated decay in primary teeth (dmft 2.62 ± 3.36; DMFT 0.15 ± 0.58). A significant social gradient was observed, with higher median dmft in PEN+ than in non-priority schools (1 vs. 0; $p<0.001$). Poor oral hygiene affected 54.8% of children and was more frequent in PEN+ schools (61.4% vs. 34.9%; $p<0.001$). Although 19.9% required fissure sealants, fewer than 1% had received them.

Conclusion

Oral diseases remain highly prevalent among children in socially deprived settings, with clear socioeconomic inequalities from early childhood. The substantial gap between preventive needs and sealant coverage highlights shortcomings in current prevention policies and supports strengthening targeted, school-based oral health programs.

IRB approval number: IRB-MTP_2021_03_202100720

Introduction

Oral health is a major public health issue affecting general health, well-being, and quality of life.[1] Despite substantial progress in prevention, marked socioeconomic inequalities in oral health persist in France, particularly among young children. Early oral health education and preventive interventions are essential to establish lifelong healthy behaviours.[2] Although several school- and preschool-based prevention programmes have been implemented,[3-5] children living in disadvantaged areas, particularly those attending Priority Education Networks (PEN/PEN+), remain at increased risk of dental disease and limited access to preventive care.[6,7]

The French national **"M'T Dents"** programme provides free annual preventive dental examinations for individuals aged 3–24 years.[8] However, participation remains suboptimal, especially in deprived regions where organizational and social barriers limit programme uptake.[8-10] To improve coverage, the French National Health Insurance introduced school-based dental screening campaigns in priority education areas, initially for children aged 6–7 years and later extended to those aged 5–6 years.[11,12]

Dental caries, the most common chronic disease in childhood, may compromise mastication, speech, craniofacial development, and permanent tooth eruption following premature loss of primary teeth.[13,14] According to the World Health Organization, approximately 43% of children worldwide had caries in the primary dentition in 2019.[1] In France, 50–70% of 6-year-olds and 45–55% of 12-year-olds are caries-free,[15,16] and the mean DMFT index at age 12 has declined markedly over recent decades.[15,17] Nevertheless, important socioeconomic disparities persist, with higher caries prevalence among children living in deprived conditions, attending priority education schools, or born abroad.[15,18,19] International studies also report

marked variations in caries experience according to socioeconomic context and access to preventive care.[20,22,23]

Despite ongoing public health initiatives, recent epidemiological data on children attending French priority education schools remain limited, particularly since the implementation of annual school-based dental examinations.[21,24] This cross-sectional study evaluated oral health status, treatment needs, and oral hygiene among children attending the final year of kindergarten (GS) and the first year of primary school (CP) in Priority Education Networks and Priority Neighbourhoods of the Hérault department during the 2024–2025 school year. We also assessed whether oral health outcomes differed according to school deprivation level (PEN vs PEN+) to estimate the effectiveness of current national prevention strategies among vulnerable pediatric populations.[24,25]

Methods

Study design and participants

A cross-sectional study was conducted between October and December 2024, during the 2024-2025 school year. Prevention activities and data collection were carried out in public schools. A total of 46 schools participated in the study (Supplementary Table 1), including 41 priority education establishments (comprising 30 Enhanced Priority Education Networks [PEN+] and 11 Priority Education Networks [PEN]). Additionally, 5 schools located in officially designated Priority Neighborhoods located outside the PEN network were included to ensure a comprehensive assessment of high-risk pediatric populations in the department (Supplementary Table 1).

Inclusion criteria were: age between 5 and 7 years at the time of data collection, a signed informed consent from parents or legal guardians, after receiving complete information about the objectives, methods and implications of the study; presence at the school on the day of the clinical examinations.

Exclusion criteria were: refusal to participate in the oral examination, regardless of parental consent; children for whom parental consent had not been obtained, or whose legal guardians had explicitly refused to allow them to participate in the study.

Ethical Considerations

The study complied with the Declaration of Helsinki and received approval from the Institutional Review Board of Montpellier University Hospital (approval number IRB-MTP_2021_03_202100720, 18 March 2021). Administrative authorization was obtained from the Occitanie Regional Education Authority, and the study was conducted in partnership with the French National Health Insurance (Assurance Maladie). Written informed consent was

obtained from parents or legal guardians. Participation was voluntary, children could decline examination at any time, and all data were anonymized in accordance with the General Data Protection Regulation (GDPR).

Interventions

Two complementary public health interventions were delivered: a classroom-based oral health education workshop and an individual oral examination.

The educational workshop (Figure 1) included age-adapted information on oral hygiene, diet, dental diseases, and prevention using educational models, demonstration materials, and interactive games. Its objective was to promote healthy oral hygiene behaviours and improve children's understanding of dental diseases.



Figure 1. Prevention workshops in 2024-2025

Each child subsequently underwent a standardized clinical oral examination with completion of a structured assessment form. Parents received an individualized report indicating whether

dental consultation was recommended. Children were also provided with an age-appropriate toothbrush, toothpaste, and an M'T Dents information leaflet.

Before fieldwork, participating undergraduate dental students received standardized training from an experienced faculty member (C.I.) regarding study procedures, data collection, and examination protocol. Students worked in teams of three or four during school visits.

Examiner Reliability

To ensure diagnostic standardization and minimize inter-examiner variability, all undergraduate dental students underwent a rigorous theoretical and clinical calibration session led by an experienced faculty supervisor (C.I.) prior to the field campaigns. Standardized clinical criteria based on WHO guidelines were systematically reviewed, and consensus evaluations using clinical photographs were mandatory to achieve optimal alignment in diagnostic thresholds before data collection.

Data collection

Participant characteristics included sex, periodontal status (with/without periodontal disease), need for treatment, need for descaling, need for fissure sealing, overall oral health graded as 1 (satisfactory), 2 (needs monitoring), or 3 (needs treatment); oral hygiene graded as 1 (satisfactory), 2 (needs monitoring).

The Decayed, Missed and Filled Teeth index (DMFT) defined by the World Health Organisation (WHO) [26] was used to assess the oral health status of children according to their type of dentition (dmft for primary dentition, and DMFT for permanent dentition). For children with mixed dentition, the overall caries burden was estimated by combining the dmft

and DMFT components, providing a cumulative measure of caries experience across all teeth present in the oral cavity.

Data collected during the clinical examination were:

- Presence of caries, tooth by tooth, reported independently of the level of caries involvement, according to a binary variable (caries present/caries absent).
- Missing teeth, regardless of the cause.
- Filled teeth, indicating previous treatment by a dental surgeon.
- Presence of fissure sealants, observed clinically.
- Signs of periodontal disease, without distinction between gingivitis or periodontitis, nor specification of the degree of inflammation.
- Identified oral health needs, divided into three categories: scaling, treatment, fissure sealing.
- Qualitative assessment of oral hygiene, classified as satisfactory or needing improvement.
- Qualitative assessment of overall oral health, divided into three levels: satisfactory, needs monitoring, needs treatment.
- Degree of cooperation of the child during the examination.

Each tooth was clinically assessed and coded as follows:

- 0: Sound tooth;
- 1: Decayed (d/D);
- 2: Filled (f/F);
- 3: Missing due to caries (m/M);
- 4: Presence of fissure sealant;

- 5: Exfoliated or erupting (excluded from caries indices)

Caries Diagnostic Criteria and Thresholds

Clinical caries detection was performed exclusively through visual examination under standardized artificial lighting, in accordance with WHO epidemiological diagnostic criteria.[26] To ensure maximum reproducibility and diagnostic consistency among examiners, the diagnostic threshold was limited to cavitated lesions, capturing clinically distinct lesions equivalent to the International Caries Detection and Assessment System (ICDAS) codes 3 to 6.[27] Consequently, non-cavitated early enamel changes (ICDAS codes 1 and 2), such as initial white or brown spots, were classified as sound (score 0).[26,27] This conservative approach was systematically applied to mitigate the risk of false positives and to account for the logistical constraints of school-based dental examinations where dental radiographs and surface drying with compressed air were unavailable.

Statistical Analysis

Quantitative variables were expressed as mean ± standard deviation (SD) or median (interquartile range [IQR]), as appropriate, and qualitative variables as frequencies and percentages. Children were classified as having mixed dentition if at least one first permanent molar (teeth 16, 26, 36, or 46) was present.

Comparisons according to sex, school grade, and school category were performed using Student's *t* test or one-way ANOVA for normally distributed continuous variables, and Wilcoxon or Kruskal-Wallis tests otherwise. Categorical variables were compared using the chi-square test or Fisher's exact test when appropriate. All tests were two-sided, with statistical significance set at $p<0.05$. Analyses were performed using R software (version 4.4.0).

Results

Out of 49 targeted schools, 46 participated in the study (93.9% participation rate), representing a total of 1,902 eligible pupils. Of these, 1,506 children were examined, and data for 1,505 were included in the final analysis (79.1% effective participation rate) (Figure 2) The study population was predominantly composed of children from priority education zones, with 60.7% in Enhanced Priority Education Networks (PEN+) and 31.1% in Priority Education Networks (PEN), while only 8.2% attended schools outside these networks.

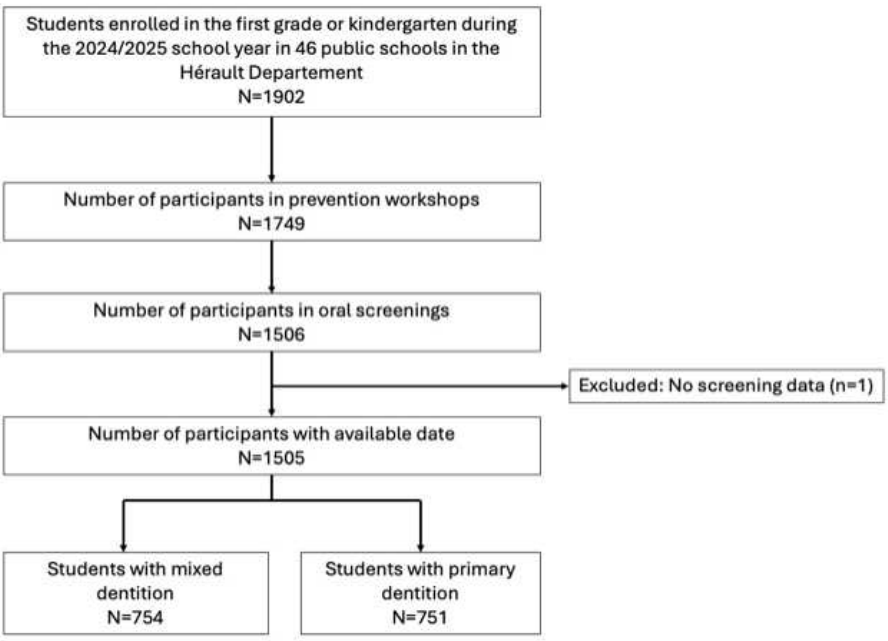


Figure 2. Study flowchart

Socio-demographic characteristics are shown in Table 1.

Table 1. Sociodemographic characteristics of the analyzed population.

Variable	n	Population
Sex, n (%)	1505	
Male		878 (58.34)
Female		627 (41.66)
School zone, n (%)	1505	
Normal		123 (8.17)
PEN		468 (31.10)
PEN+		914 (60.73)
Educational level, n (%)	1505	
Primary (CP)		889 (59.07)
Kindergarten (GS)		616 (40.93)
Mixed dentition (Y/N), n (%)	1505	754 (50.10)
Periodontal disease, n (%)	1503	34 (2.26)
Care needs, n (%)	1505	931 (61.86)
Need for scaling, n (%)	1505	357 (23.72)
Fissure sealing, n (%)	1504	299 (19.88)
Tooth requiring treatment, n (%)	1505	722 (47.97)
Yes		
Dental status, n (%)	1505	
Satisfactory		663 (44.05)
Needs monitoring		185 (12.29)
Needs treatment		657 (43.65)
Favourable oral hygiene, n (%)	1505	680 (45.18)
DmFT (mixed index), median (Q1 ; Q3)	1505	1 (0 ; 5)
dmft (temporary index), median (Q1 ; Q3)	1505	1 (0 ; 4)
DMFT (permanent index), median (Q1 ; Q3)	754	0 (0 ; 0)
Number of decayed permanent molars, mean (± SD)	754	0.13 (± 0.56)
Number of permanent molars filled, mean (± SD)	754	0.01 (± 0.13)

Nearly two thirds (61.9%, n=931) of the children required dental care. Unfavorable oral hygiene was observed in 54.8% of the participants.

The median cumulative caries experience, measured by the mixed index (dmft+DMFT), was 1.00 (0.00 ; 5.00). This was largely driven by the primary dentition (median dmft = 1 (0; 4)), while permanent teeth were only beginning to erupt and remained relatively unaffected (median DMFT = 0 (0; 0)).

Although 19.9% of children presented a clinical indication for fissure sealants, actual coverage was extremely low (<1%). Observed fissure-sealant coverage on first permanent molars ranged from only 0.3% to 0.7%, despite nearly one-fifth of children presenting an indication for sealant placement.

At the time of examination, 56.7% (n=853) presented with at least one active carious lesion (Figure 3). Caries lesions mainly affected the second primary molars, with 19.3% of teeth 55 and 22.3% of teeth 85 affected by caries. Conversely, the anterior sectors showed better results, with high rates of healthy teeth: 85.6% for tooth 62 and 97.5% for tooth 83. Furthermore, the presence of caries on some permanent first molars, with 2.3% of 36 affected.

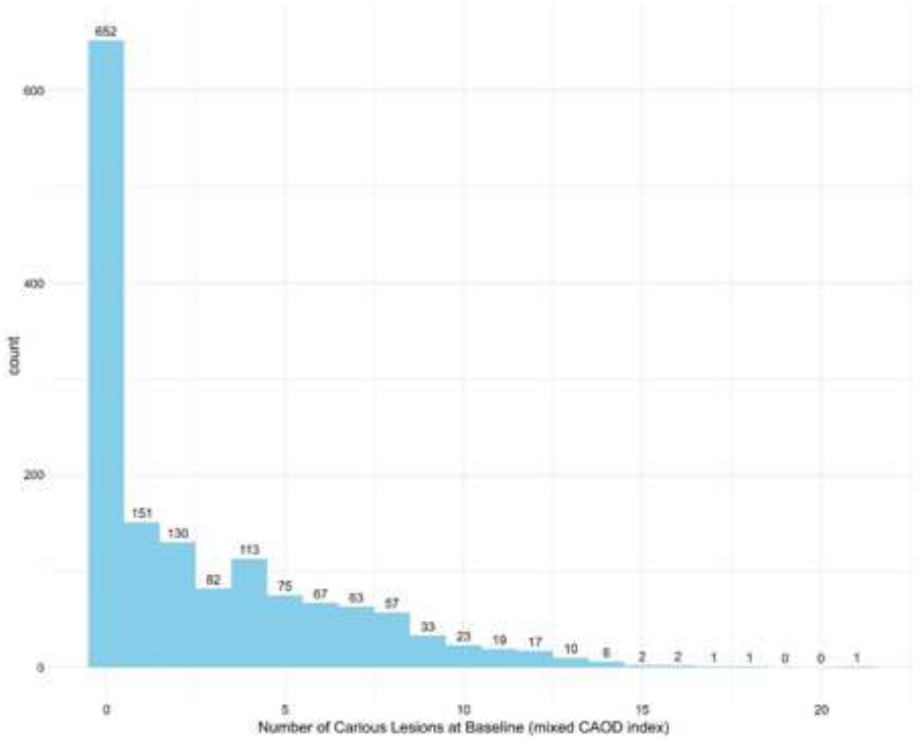


Figure 3. Number of children with carious Lesions at Baseline.

Boys with primary dentition had significantly more carious lesions than girls (median number 1 (0; 4) versus 0 (0; 3), p=0.034).

The distribution of caries index components and fissure sealants is presented in Figure 4.

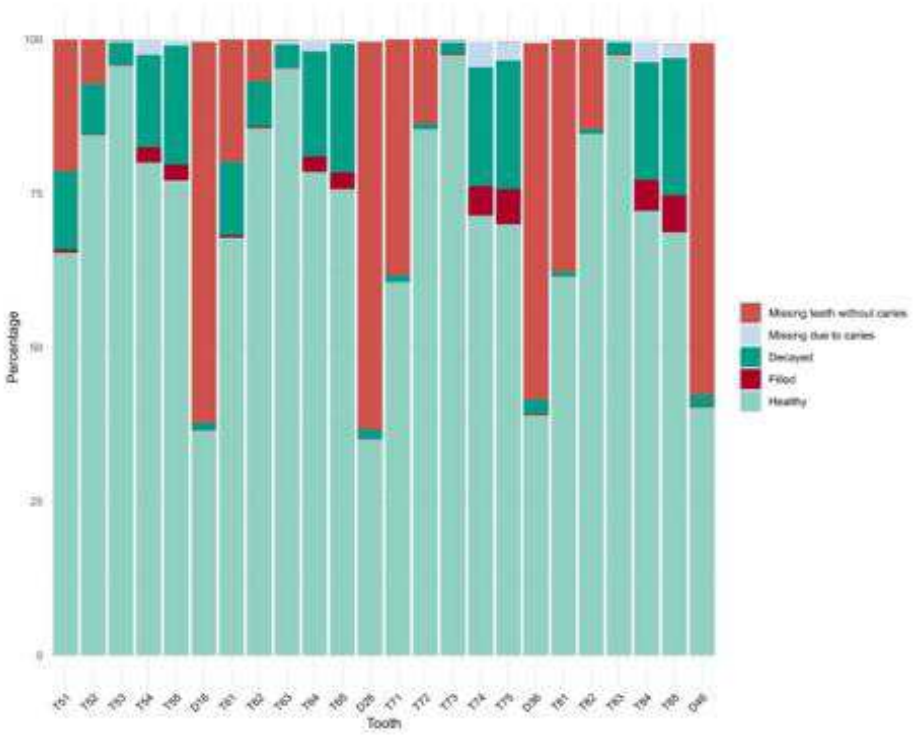


Figure 4. Distribution of components of the caries index and fissure sealant status (2024–2025).

Carious lesions predominantly affected the second primary molars, particularly teeth 85 (22%) and 65 (21%), whereas anterior teeth were largely preserved, with healthy tooth rates of 86% for tooth 62 and 98% for tooth 73. Early caries were also detected in first permanent molars, particularly tooth 36 (2%).

Restorations were uncommon in the incisor-canine region (<0.7%) but more frequent in mandibular primary molars (teeth 74, 75, 84, and 85), reaching 6% for tooth 85. Tooth loss due

241 to caries mainly involved the first primary molars (up to 4%), while anterior teeth were rarely
242 affected.
243 Tooth absence unrelated to caries was primarily observed in first permanent molars (teeth 16,
244 26, 36, and 46), with rates ranging from 57.1% to 62.9%, reflecting physiological eruption.
245 Moderate rates were also observed for primary central incisors (teeth 51, 61, 71, and 81),
246 consistent with normal exfoliation.
247 Oral health status varied significantly according to school setting (Figure 5A). The proportion
248 of children requiring dental care increased from 50% in urban schools to 67% in PEN+ schools
249 (p=0.001). Likewise, the percentage of children with at least one tooth requiring treatment rose
250 from 29% in urban schools to 41% in PEN schools and 54% in PEN+ schools (p<0.001).
251 Overall dental status and oral hygiene were also poorer in PEN+ schools, with 50% of children
252 requiring treatment and 61% presenting inadequate oral hygiene, compared with 27% and 35%,
253 respectively, in urban schools (both p<0.001). Caries indices were significantly higher in PEN
254 and PEN+ schools (Table 2).

255 **Table 2.** Caries indices according to school levels and zones. Data are median (Q1; Q3).

	First graders (CP)	**Kinder garteners (GS)**	**p**	**Non priority schools**	**PEN schools**	**PEN+ schools**	**p**
CHILDREN WITH ONLY PRIMARY TEETH (N=751)	N=326	N=425		N=71	N=244	N=436	
temporary caries index (dmft)	1 (0; 4)	0 (0; 4)	0.876	0 (0; 1)	0 (0; 3)	1 (0; 4)	<0.001
CHILDREN WITH PERMANENT AND PRIMARY TEETH (N=754)	N=563	N=191		N=52	N=224	N=478	
mixed caries index (dmft+DMFT)	2 (0; 5)	1 (0; 5)	0.305	0 (0; 3.25)	1 (0; 4)	2 (0; 6)	<0.001
temporary caries index (dmft)	2 (0; 5)	1 (0; 5)	0.254	0 (0; 3.25)	1 (0; 4)	2 (0; 6)	<0.001
permanent caries index (DMFT)	0 (0; 0)	0 (0; 0)	0.967	0 (0; 0)	0 (0; 0)	0 (0; 0)	0.412

Comparing school grades (Figure 5B), first graders more frequently required dental care than kindergarten children (65% vs. 57%, p<0.001) and were more likely to have at least one tooth requiring treatment (51% vs. 43%, p=0.003). Overall dental status tended to be poorer in first graders (p=0.095), whereas caries indices and oral hygiene did not differ significantly between the two grades (Table 2).

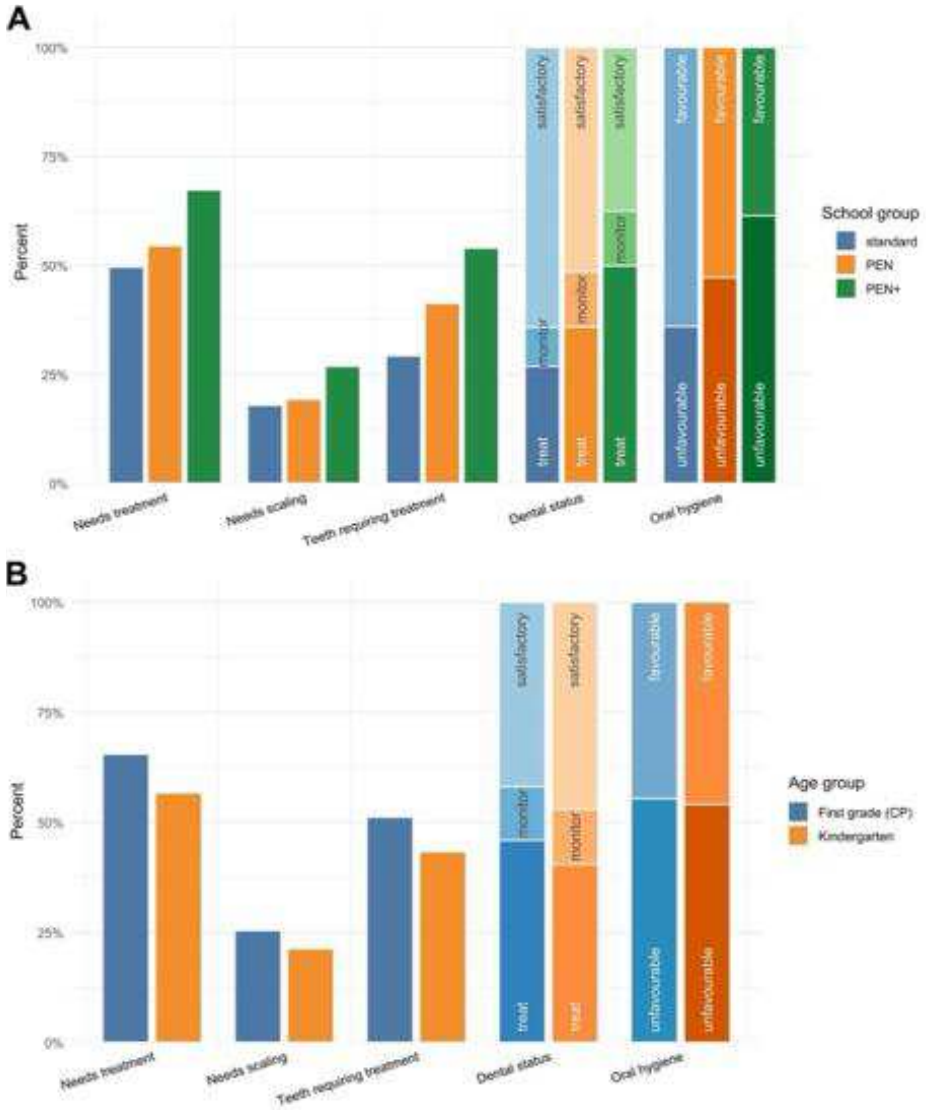


Figure 5. Comparison of oral health indicators. A) Across school zones (standard; PEN, Priority Education Network schools; PEN+, enhanced Priority Education Network schools). B) Across school grades (GS, kindergarten final year; CP, primary school first grade).

Discussion

This cross-sectional study provides an updated assessment of oral health among kindergarten and first-grade children attending disadvantaged schools in the Hérault department, France. With a large sample of 1,505 children and a participation rate of 79.1%, our findings demonstrate a persistent and marked socioeconomic gradient in pediatric oral health despite evolving national prevention policies.

More than half of the children presented at least one active carious lesion, and nearly two-thirds required dental treatment. These findings are consistent with previous reports from French priority education areas [7] and confirm that the burden of oral disease remains substantial despite improvements reported nationally.[15,17-19,21,24] Although international studies reported lower or comparable caries prevalence,[20,22,23,28] our results place this population among those at highest risk. The higher dmft observed in PEN+ schools further illustrates the impact of socioeconomic deprivation on oral health.[15,21,23,24,30] Moreover, the presence of caries in first permanent molars highlights the need for preventive interventions before and during the early mixed dentition period.[29]

The observed inequalities are likely multifactorial, reflecting differences in oral hygiene behaviours, parental support, healthcare access, and social determinants of health.[23,27,30] Primary molars were the teeth most frequently affected, probably because of their complex anatomy and cleaning difficulties in young children.[31-33] Additional factors such as early periodontal disease, non-nutritive sucking habits, or developmental defects including molar-incisor hypomineralisation may further increase oral disease susceptibility.[31-35] Boys also exhibited significantly higher caries levels in the primary dentition than girls, whereas no sex difference was observed in permanent teeth.

One of the most important findings was the marked discrepancy between preventive needs and preventive care. Although almost one-fifth of the children required fissure sealants, actual sealant coverage remained negligible. Because fissure sealants are fully reimbursed in France,[36] this gap is unlikely to be explained by financial barriers alone and probably reflects limited awareness, low perceived need for dental care, organizational barriers, and insufficient uptake of the national M'T Dents programme.[10,25,36-40] These observations suggest that universal preventive strategies alone are insufficient to reduce oral health inequalities and support the implementation of proportionate universalism and targeted school-based interventions.[2,3,6,25,38]

Children in first grade showed greater treatment needs than kindergarten children, whereas caries indices remained similar. This pattern may reflect progression of untreated lesions rather than a higher incidence of disease and reinforces the importance of early detection beginning in preschool.[28,41,42] The planned annual M'T Dents examinations represent an important opportunity to strengthen prevention; however, their effectiveness will depend on multidisciplinary collaboration involving schools, pediatricians, families, and dental professionals, together with supervised toothbrushing and sustained oral health education.[3,12,43]

School-based screening proved particularly effective in identifying children with unmet treatment needs who may otherwise have limited access to dental care.[2,6,7,24] Beyond epidemiological surveillance, these programmes represent an opportunity to reduce oral health inequalities through early referral and preventive interventions.

This study has several limitations. First, because it was conducted in a single French department, the findings should be generalized with caution.[24] Second, non-participation may

have introduced selection bias related to socioeconomic or cultural factors.[44] Third, visual examinations performed without bitewing radiographs probably underestimated the true prevalence of caries, particularly proximal lesions.[26,27,45] Future studies should combine digital data collection with non-ionizing diagnostic technologies, such as digital fiber-optic transillumination, to improve epidemiological accuracy.[46] Finally, because school screening is often a child's first contact with oral healthcare, ensuring a positive clinical experience and effective communication with families remains essential to promote long-term engagement with dental services and reduce dental anxiety.[3,25,38,47]

Overall, our findings demonstrate that oral health inequalities remain substantial among young children living in disadvantaged school settings. Strengthening school-based prevention, improving access to evidence-based preventive measures such as fissure sealants, and reinforcing early multidisciplinary interventions are essential to reduce the persistent burden of pediatric oral disease.

Despite national prevention initiatives, dental caries remains highly prevalent among children in Hérault’s Priority Education Networks. School-based screening and early preventive strategies—including fissure sealants, supervised toothbrushing, and oral health education—are essential to reduce unmet treatment needs and socioeconomic inequalities in pediatric oral health.

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of Montpellier University Hospital (approval number IRB-MTP_2021_03_202100720, 18 March 2021). Administrative authorization was obtained from the Occitanie Regional Education Authority. Written informed consent to participate was obtained from the parents or legal guardians of all children before inclusion. Children could decline the oral examination at any time.

Clinical trial number

Not applicable.

Consent for publication

Written informed consent for publication of the photographs shown in Figure 1 was obtained from the parents or legal guardians of the children depicted, as the children were minors at the time the photographs were taken. Written informed consent for publication was also obtained from the students appearing in the photographs. The manuscript contains no other individual personal data or identifying information.

Availability of data and materials

The datasets generated and analysed during the current study are not publicly available because they contain health data collected from minors under the ethics approval, but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

CD collected data, carried out the data collection process, drafted the initial manuscript, and revised the manuscript. LG and CDu contributed to the methodological design, performed the statistical analyses, and critically reviewed and revised the manuscript. JP contributed to data presentation, preparation of figures and tables, and critically reviewed and revised the manuscript. CI conceptualized and designed the study, contributed to the study methodology, manuscript writing, final formatting and editing, and critically reviewed and revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

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