Dental caries experience in a Connecticut Head Start program in 1991 and 1999

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Abstract

Purpose: Reports from most industrialized countries suggest that dental caries in children has been declining over the last 50 years. However, this trend may be reversing, especially in younger children. The aim of the present study was to compare caries levels and patterns of 3- and 4-year-old Head Start children observed in 1999 with those observed in 1991.

Methods: Clinical dental caries data were collected from 517 children enrolled in the Hartford, Conn, Head Start program in 1999 and compared to similar data from 311 children attending the same Head Start program in 1991. No radiographs were used in either sample.

Results: In 1999, a mean dmft score of 1.49 and a caries prevalence of 38% was found compared to 1.68 and 49%, respectively, in 1991. When only those with caries were considered, both the mean dmft and mean dmfs were greater in 1999 than in 1991. In 1999, 57% of carious surfaces were treated compared to only 39% in 1991. Furthermore, this increased treatment was seen predominantly in those with greatest severity of disease. When the patterns of disease were analyzed, children in 1999 had greater levels and severity of maxillary anterior caries compared to 1991. No differences in pit and fissure caries and posterior proximal caries were observed.

Conclusions: The overall prevalence of dental caries in the study population was less in 1999 than 1991, however, those with disease experienced a greater severity.(*Pediatr Dent.* 2002;24:309-314)

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Reports from most industrialized countries suggest that dental caries in child populations has been declining over the last 50 years.[1,2] However, it has been suggested that this trend may be reversing, especially in younger children.[3] Such a finding, if true, has significant implications for preschool populations that continue to exhibit high levels of caries.

Data for American preschool populations are primarily derived from surveys of children attending Head Start programs, a federally funded preschool program for 3- to 4-year-old children from low-income families. Surveys report these children to be at high caries risk with at least a mean dft score of 2.0.[4] In comparison, the third National Health and Nutritional Examination and Survey (NHANES III), which used weighted estimates of US populations, reported a mean dft score of 0.6 for 2- to 4-year-old children.[5] Only one study, involving Apache children, has made direct comparisons between similar Head Start populations and this reported no decline in dental caries from 1979 to 1993.[6]

The aim of the present study was to compare caries levels and patterns from Head Start children located in a fluoridated community observed in 1999 with those observed in 1991 to determine if they changed significantly over the eight-year period.

Methods

In 1999, a total of 979 children were enrolled in the Hartford, Conn, Head Start program. Of these, 517 children (53%) spread across all 17 Head Start sites in Hartford were

Table 1. Definitions of Caries Pattern Combinations

Pattern present	Abbreviation
Maxillary anterior only	ma
Maxillary anterior and pit and fissure	ma:pf
Maxillary anterior, pit and fissure and posterior proximal	ma:pf:pp
Pit and fissure only	pf
Pit and fissure and posterior proximal	pf:pp

examined for dental caries as part of their annual oral health screening. All children present on the day of the screening with previously completed consent forms (obtained by the Head Start staff) were examined by one of two dentists (JD and GM). Parents did not know what day their children were being examined. Dental examinations were conducted using mirrors, #23 explorers and focusable flashlights. One child who refused the explorer received only a visual examination, and 14 children refused the examination totally. Caries diagnosis was based on Radike criteria.[7] The examiners reviewed the Radike criteria prior to the examinations and conducted practice sessions. Ten subjects (not included in the final data analysis) received examinations from both dentists and a kappa score of 0.82 for interdentist reliability was obtained. No radiographs were used.

The 1999 data were compared to data from children attending the same Head Start program in 1991. At that time a total of 580 children were enrolled. Of these, 311 (54%) were recruited from nine of the 10 Hartford Head start centers by research assistants for a 3-year study investigating caries risk factors. All children with completed consent forms were examined by one of two dentists (JC and ET). The same examination conditions and diagnostic criteria were used as in 1999. Eleven children who refused the explorer received only a visual examination. The number of children completely refusing examination was not recorded in this study. Similar to the 1999 study, the examiners reviewed the Radike criteria prior to the examinations and conducted practice sessions. A practice session involving some of the children included in the final data analysis produced a kappa score of 0.99 for interdentist reliability.[8]

In addition to calibration of the examiners in each study, ET and JD were calibrated on a separate project in 1994 using the same diagnostic criteria in 10 five-year-old patients. A kappa score of 0.84 was obtained.

Caries data were analyzed using caries prevalence and dmfs/t scores as well as pattern information. For the purposes of the present study, dental caries patterns were categorized as: "maxillary anterior caries" (ie, caries of the maxillary anterior incisors and the mesial surfaces of the canines); "pit and fissure caries" (ie, caries of occlusal fissures, buccal pits of mandibular second molars and lingual grooves of maxillary second molars); or "posterior proximal caries" (ie, caries of all contacting posterior smooth surfaces and the distal surfaces of the canines).[9] After determining prevalence and dmfs information for each pattern, each child was then assigned to one caries pattern or combination of patterns (Table 1).[10] Two children that did not fall into the listed caries pattern combinations were classified based on the pattern considered to present the highest caries risk. Statistical differences in caries prevalence were analyzed using the chi-square test, and differences in mean dmfs/t scores were analyzed using the Mann Whitney U test.

Table 2. Demographic and Caries Data from 1991 and 1999 Head Start Children

	1991 sample	1999 sample
Number	311	517
Mean age (yrs)	3.9	3.9
Racial profile	65% African-American 33% Hispanic 2% other	59% African-American 39% Hispanic 2% other
Caries prevalence	49%*	38%*
Mean dmft	1.68†	1.49†
Mean dmft among caries-positive children	3.42	3.88
Mean dmfs	2.75±6.5†	3.06±8.2†
Mean dmfs among caries-positive children	5.59±8.4	7.98±11.6
ds	1.67	1.33
ms	0.50	0.63
fs	0.59	1.10
d/dmf %	61%	43%

*P<.01 by chi-square test
†P<.05 by Mann-Whitney U test

Table 3. Percentage of Children with Given Level of Treatment by dmft Score and Year of Examination

	dmft score of 1-4		dmft score of 5+	
% of treatment completed	1991	1999	1991	1999
0	86%	87%	57%	44%
≤50%	7%	4%	16%	15%
>50%	7%	9%	27%	41%

Results

The 1999 and 1991 samples had similar demographic characteristics as described by age, race/ethnicity and income. The mean age was 3.9 years and a predominance of African-Americans was seen in both samples. Caries in the 1999 sample was significantly lower compared to the 1991 sample, as documented by both percent prevalence and mean dmft scores. In contrast, the mean dmfs was significantly greater in 1999 than 1991. When only those with caries were considered, both the mean dmft and mean dmfs were greater in 1999 compared to 1991, although these results did not achieve statistical significance (Table 2). Furthermore, in 1999, 28% of those with caries had dmft scores of 5 or greater compared to 20% in 1991.

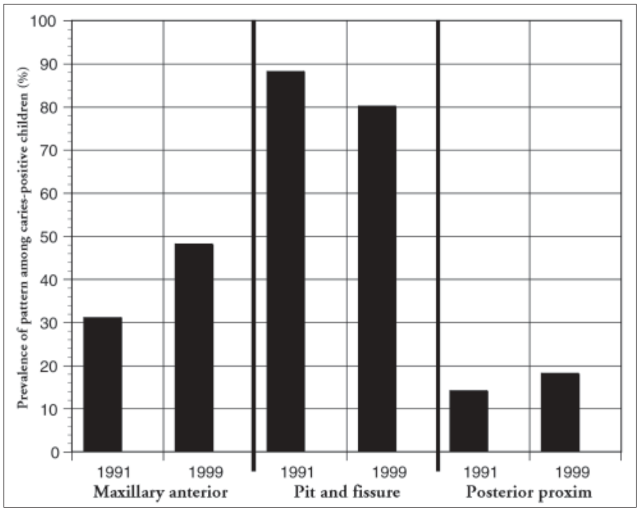

Fig 1. Prevalence of caries patterns among caries-positive children

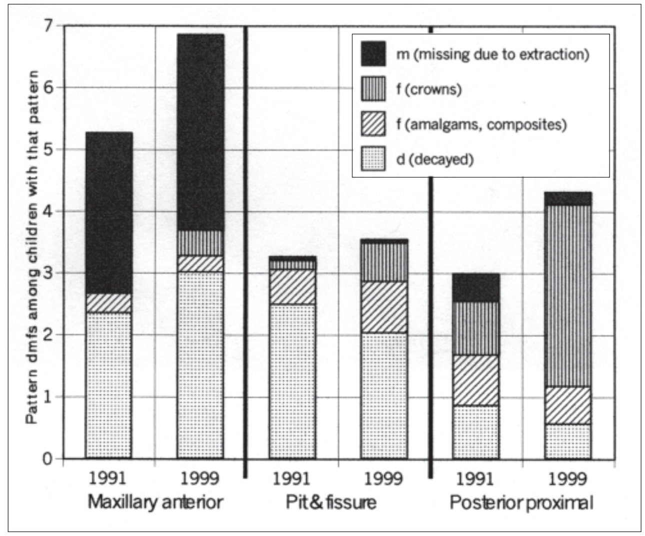

Fig 2. Mean pattern dmfs score among children positive for the pattern

Treatment in the 1999 sample was greater than in the 1991 sample, with 43% of the dmfs score in 1999 comprised of decayed surfaces compared to 61% in 1991. The increased treatment was seen predominantly in those with the greatest caries. Among those with dmft scores of 1-4 little change was seen in treatment, but among those with dmft scores of 5 or greater, 41% in 1999 had more than 50 percent of their treatment completed, compared to 27% in 1991 (Table 3).

Children with caries were then analyzed as a separate group to determine the pattern of disease. Among those with caries, in 1999, 48% experienced maxillary anterior caries compared to only 31% in 1991 ($P<.01$; Fig 1). Children with maxillary anterior caries in 1999 had a mean maxillary anterior dmfs score of more than 1.5 surfaces greater than that for children in 1991 ($P<.05$). Both treated components (restorations and extractions) and untreated components (decayed surfaces) were greater in 1999. The main treatment choice in both years was extraction (Fig 2).

In contrast, the pit and fissure pattern did not show significant changes between 1999 and 1991. The prevalence in 1999 was 80% compared to 88% in 1991 (Fig 1), while the dmfs score showed a small increase of 0.29 surfaces. Treatment among the 1999 children did increase by 0.74 surfaces. The main treatment choice in both years was amalgams or composites, although more stainless steel crowns were placed in 1999 than 1991 (Fig 2).

The posterior proximal pattern also did not show significant changes between 1999 and 1991. The prevalence in 1999 was 18% compared to 14% in 1991 (Fig 1), while the dmfs score showed an increase of 1.32 surfaces. Treatment in 1999 was predominantly stainless steel crowns, while in 1991, an equal use of stainless steel crowns and amalgams or composites was seen (Fig 2).

Differences were seen in the distribution of caries pattern combinations between the 1999 and 1991 samples. In 1999, a greater proportion of children had caries patterns involving maxillary anterior caries compared to 1991 children who predominantly experienced only the pit and fissure pattern as determined by clinical examination (Fig 3).

Discussion

Conclusions regarding changes in caries prevalence over time can only be achieved when study design for different samples reflects a high degree of similarity. The examinations of both samples used identical diagnostic criteria and equipment. Although different sets of examiners took part in the 1991 and 1999 projects, two of these examiners had worked and been calibrated together on other projects. Both samples of children in the present study were recruited from the same Head Start program, thereby keeping geographic and demographic characteristics of the two populations consistent. In both samples, the mean age was 3.9 years and a predominance of African-Americans was seen. Additionally, the income guidelines for Head Start eligibility did not change between 1990 and 2000 and census figures for Hartford County show only a modest increase from 6% to 7.5% of families below the federal poverty level.

The most substantial differences between the two samples were the method of recruitment and the number of subjects examined. In 1999, children were examined as part of the required annual oral health screening, whereas in 1991, children were examined if they had agreed to participate in a larger ongoing study examining caries risk. In spite of these differences, the percentage of available Head Start children examined in each year was almost identical at slightly over 50%. It is possible that the parents of both samples could have been self-selecting because of a greater interest in the oral health of their children since they were willing to provide permission for the examinations. The greater number of children examined in 1999 was due to expansion of the Head Start program to serve more eligible children.

The samples used in the present study, similar to most previous studies of caries in Head Start children, were convenience samples.[6,11,12] Furthermore, non-responder bias was not addressed because of the limitations of working with this population and the inability to examine non-responders without consent. Although care should be taken in extrapolating this data to all United States children, it still provides valuable

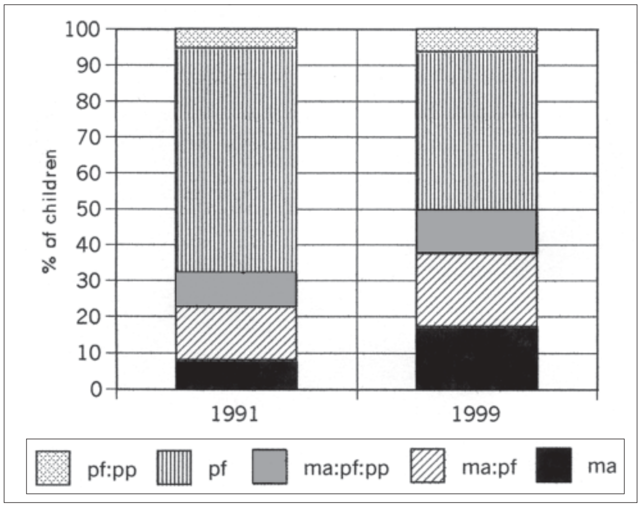

Fig 3. Distribution of caries patterns among caries-positive children

information on the levels of caries at two time periods in these Head Start children.

Radiographs were not used in 1999 or 1991. Although, this may have decreased the number of untreated posterior proximal lesions diagnosed, the number of children with caries was probably not affected. Children with proximal caries nearly always have fissure caries.[10] The underestimate of the number of lesions present may have been a greater issue in the 1999 sample. The results suggest a greater concentration of disease in fewer children and a greater proportion of children experiencing patterns involving maxillary anterior caries in 1999. Children with more severe decay and children with the maxillary anterior pattern are more likely to exhibit posterior proximal lesions. Therefore, because more children in the 1999 sample had these findings, they may have had more undetected posterior proximal caries.

Evidence from reviews of caries levels in Europe indicates that the decline of dental caries may have leveled out and in some cases caries may have increased during the late 1980s and early 1990s, particularly in populations with mean dmft scores below 2.0.[13] Data on caries levels in North America are sparse but suggest similar findings, especially in Canada.[14] In the present study, conducted in 1999 and 1991, a decrease in both the prevalence of caries and mean dmft score was found. This finding is in contrast to the previous reports, especially considering the mean dmft score in the present study was lower than 2.0 in both 1991 and 1999. However, the mean dmft in those with caries was greater in 1999 than 1991, suggesting that the total amount of disease may not be decreasing. Rather, the disease may be increasingly confined to a high-risk subsection of the population. These findings are corroborated by other reports. For example, Bohannan found that 20% of children have 60% of the dental caries,[15] and studies examining dental Medicaid costs have found that 2% to 3% of children account for 25% to 45% of expenditures.[16,17]

The true level of dental caries in populations is often hard to determine due to the confounding factor of treatment. High levels of treatment (restorations and extractions) inflate the surface-based dmfs index. Use of the dmft reduces this inflationary effect but may underrepresent the level of caries in high-risk groups as the presence of multiple independent lesions on the same tooth are not reflected by the dmft index. In the present study, the fact that the dmft score increased, even though this index may underestimate disease among high-risk children, clearly indicates the increased severity of caries among those affected.

In 1999, greater levels of treatment were observed compared to 1991. This increase in treatment may be due, in part, to the introduction of a new downtown university hospital clinic, and improvements in Medicaid reimbursement that facilitated the expansion of some existing clinics and increased the number of providers.[18] The increased treatment may also be due to the concentration of disease in fewer high-risk children. When multiple carious lesions are present in one quadrant, even one visit can result in a considerable treatment effect. Further, high levels of disease in individual subjects may increase treatment under general anesthesia, which results in high levels of complete restorative care. These latter factors may explain the increased treatment seen in the 1999 children, as those with high dmft scores were most likely to receive the greatest level of treatment (Table 3).

The prevalence of maxillary anterior caries and the mean dmfs score of this pattern were both greater in 1999 compared to 1991 (Figs 1 and 2). Multiple studies have shown that, compared to caries-positive children without maxillary anterior caries, children with maxillary anterior caries experience higher levels of posterior proximal caries and pit and fissure caries as well as higher levels of future disease.[6,19,20] Hence, the greater prevalence of maxillary anterior caries in 1999 may explain the greater mean dmfs and dmft scores among those with caries in 1999. This is further reinforced by the greater proportion of children with caries pattern combinations involving both maxillary anterior caries and posterior caries patterns in 1999 than 1991 (Fig 3). This trend towards a greater predominance of maxillary anterior caries has also been seen in the NIDR National Dental Surveys. Between 1979-1980 and 1986-1987, the prevalence of maxillary anterior caries did not change, while the prevalence of caries in posterior teeth decreased significantly.[21] The main treatment option for maxillary anterior caries in 1999 and 1991 was extraction, indicating an advanced stage of disease when most children were seen for care. This has been found by other investigators.[22]

Pit and fissure caries showed no clear changes between 1991 and 1999, except that there was a decrease in the proportion of children experiencing only this pattern (Fig 3). Children with only pit and fissure caries exhibit the lowest caries risk compared to other caries pattern combinations. Therefore, a decrease in the proportion of caries positive children with this pattern contributes to an increase in severity of the caries experienced. The treatment of this pattern consisted primarily of amalgams and composites, indicating that the majority of lesions were either isolated small occlusal lesions, or the surface was involved secondarily as part of a Class II preparation.

Similar to pit and fissure caries, posterior proximal caries showed no clear changes between 1991 and 1999 (Figs 1 and 2). However, an overall increase in treatment, especially with stainless steel crowns, was seen. The increased use of crowns, which have been shown to be the most cost-effective form of treatment for posterior proximal lesions[23,24] may be due to the increased severity of disease seen among those with caries.

Within the populations studied it is clear that the overall prevalence of dental caries is still decreasing with time, but that those developing disease are experiencing it more severely. Interestingly, even though this population of Head Start children from an inner city neighborhood is typically described as having high caries risk, many children remain caries free. These findings emphasize the need to develop risk-based prevention and treatment strategies that can direct available resources to those most in need.

Conclusions

1. The prevalence of caries appeared to be lower in 1999 than 1991.
2. Children with caries in 1999 had more severe disease than in 1991.
3. Children with caries in 1999 had greater levels and severity of maxillary anterior caries than in 1991.
4. Children in 1999 had more treatment than in 1991.

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Abstract of the Scientific Literature

A Double-Blind, Placebo-Controlled Study of Modified-Release Methylphenidate in Children with Attention Deficit/Hyperactivity Disorder

Attention deficit/hyperactivity disorder (ADHD) affects 3% to 6% of school-aged children in the United States. Stimulants have been used to reduce ADHD symptoms. These commonly used stimulants including methylphenidate (Ritalin), pemoline (Cylert), dextroamphetamine (Dexedrine or Dextrostat), and mixed salts of amphetamine (Adderall), are available in immediate-release (IR) formulations. After oral administration of IR formulations, optimum behavioral effects occur within 1 to 2 hours, with a duration of 3 to 5 hours. This raises a number of issues related to compliance, privacy, peer ridicule, controlled drug storage, accountability on the part of school faculty and staff, and potential abuse.

Wax-matrix, sustained-release MPH (Ritalin-SR) formulations, developed in the late 1970s to solve this problem, have not been adopted in clinical practice, because of their delayed onset of action, insufficient duration of effect, and comparatively lower effectiveness. Modified-release methylphenidate (MPH MR [Metadate CD]) was developed later and designed to produce a rapid onset of therapeutic effect but has a sufficient duration to eliminate the need for a midday dose at school. It utilizes a new dual-phase formulation that contains IR and extended-release (ER) forms of the drug in a 30:70 ratio by weight.

The study was a 3-week, double-blind, 32-site, clinical trial comparing MPH MR with placebo. A total of 321 children between the ages of 6 and 16 years who had a diagnosis of ADHD and who had not failed a previous trial of stimulant treatment for ADHD were selected, with 158 of them randomized to MPH MR and 163 to placebo. Children in the MPH MR group were started on a dose of 20 mg a day and reached a mean dose of 40.7 mg a day (1.28 mg/kg a day) at endpoint. Compared with placebo, MPH MR significantly reduced ADHD symptoms ratings on the teacher version of the 10-item Conners' Global Index, on the parent version of the Conners' Global Index, on the parent assessment of global efficacy, and on investigator assessment of global improvement. The most common adverse events in the MPH MR group were headache, anorexia, abdominal pain, and insomnia. Only anorexia occurred at a rate that was significantly greater than placebo.

Comments: MPH MR administered once daily in the morning is effective and safe for controlling ADHD symptoms throughout the school day. **LG**

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