

# Scientific Article

## Dental Caries Trends in Primary Teeth among Third-grade Children in Harris County, Texas

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**Abstract: Purpose:** The purpose of this study was to assess trends in dental caries in the primary dentition of third-grade children in suburban Harris County, Texas. **Methods:** The study populations for the 2 cross-sectional surveys consisted of 1,584 third-grade children in 1991 and 1,039 in 1998. Trained dentists collected data on decayed and filled tooth surfaces (dfs). Chi-square tests analyzed the differences in proportions of children with and without dental caries experience in 1991 and 1998 by demographic subgroups: (1) gender; (2) ethnicity; and (3) socioeconomic status (SES). Student's t test investigated the differences in mean dfs scores in subgroups. **Results:** The prevalence of caries decreased significantly from 59% to 54% between 1991 and 1998 ( $P=.01$ ). The caries prevalence was lower in 1998 than 1991 in certain subgroups: 1) females; 2) Caucasians; and 3) low SES. The mean dfs score decreased significantly from 4.81 to 3.16, and lower dfs scores were seen in certain demographic subgroups between the 2 studies ( $P<.05$ ). Children from a low SES had high levels of untreated caries in both studies. **Conclusions:** Despite a decline in primary teeth caries of study participants, intergroup disparities exist, emphasizing the need for preventive strategies, especially for the low SES children. (*Pediatr Dent* 2008;30:129-33) Received March 4, 2007 / Last Revision July 20, 2007 / Revision Accepted July 24, 2007.

KEYWORDS: PRIMARY TEETH, DENTAL CARIES, ETHNICITY, GENDER, SES

Over the past few decades, a national trend of declining dental caries among children has been documented.<sup>1-5</sup> Based on the secondary analysis of data from the National Health and Nutrition Examination Survey (NHANES) I (1971-1974) and NHANES III (1988-1994), Brown et al reported a remarkable decline in both the prevalence and severity of dental caries in primary dentition of US children.<sup>3</sup> In comparing NHANES I and NHANES III, the mean number of decayed primary tooth surfaces among 6- to 10-year old children decreased from 3.97 to 1.23. Between NHANES III (1988-1994) and NHANES IV (1999-2002), caries prevalence in the primary dentition of 2- to 11-year-old children remained relatively stable at about 40%. The mean decayed and filled surfaces (dfs) score in 2- to 11-year-old children, however, showed a slight increase from 2.94 to 3.21 over the same time interval, due to an increase in the filled (f) component.<sup>6</sup>

Examining differences by demographic subgroups, a gender difference was observed in the caries experience in children

between NHANES III (1988-1994) and NHANES IV (1999-2002).<sup>5</sup> Two- to 11-year-old boys showed an increase in caries prevalence (from 39% to 43%) and an increase in caries severity (from 2.94 to 3.51 dfs), while girls showed a decrease in both prevalence (from 40 to 38%) and severity (from 2.94 to 2.90 dfs).<sup>5</sup> Considering changes by ethnicity between NHANES III and NHANES IV, the prevalence of dental caries increased only slightly among Caucasians (from 36% to 38%), African Americans (41% to 43%), and Mexican Americans (54% to 55%).<sup>6</sup> The severity of dental caries increased among all 3 ethnic groups, again due to an increase in the filled component.<sup>6</sup> The decayed component (ds) declined among African Americans (1.37 to 1.19) and Mexican Americans (2.33 to 1.55), but increased among Caucasians (0.85 to 0.90). The filled component (fs) showed an increase among all 3 ethnic groups. Looking at changes by socioeconomic status between NHANES III and NHANES IV, the prevalence of dental caries increased in the lowest socioeconomic status (SES) group (<100% of the Federal Poverty Level [FPL]) from 51% to 55%, and in the middle SES group (between 100-199% of the FPL) from 44% to 45%. The caries prevalence in the high-SES group ( $\geq 200\%$  of the FPL) remained about the same at approximately 31%.

At the Texas state level, the Texas Department of Health assessed the dental caries experience of 6<sup>th</sup> and 12<sup>th</sup>-grade children during 1984-87. A decade later in 1994, similar assessments were made, but findings have not yet been documented

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in the scientific literature. In the 1984-87 state survey, an ethnic variation was observed in the prevalence of dental caries and caries treatment rates.<sup>7</sup> Caries prevalence was lowest and treatment rates were highest among Caucasians, compared to Hispanics and African Americans. The mean numbers of decayed, missing due to caries, and filled permanent teeth (DMFT) for 6<sup>th</sup> and 12<sup>th</sup>-graders were 1.61 and 4.0, respectively. At the state level, girls had a slightly higher caries prevalence than boys. The study confirmed the need to target prevention for certain socioeconomic and ethnic groups with a particular emphasis on pit-and-fissure sealants.<sup>7</sup> Subsequently, another state-wide survey of Texas preschool, 2<sup>nd</sup>-grade, and 8<sup>th</sup>-grade children was conducted in 1998, which found a caries prevalence of 66% and 53% among second and eighth graders, respectively.<sup>8</sup> Dental caries data specific to primary dentitions at the state level in Texas are not yet available.

In 1991, the Harris County Health Department (HCHD) conducted a dental survey of third-grade children in suburban Harris County, Texas.<sup>9</sup> The study focused on children residing outside the city of Houston but within Harris County, and within the service responsibility of the county health department. Dental caries experience, expressed as the mean dfs score for the sample of 1,584 children, was 4.81. Among the 3 principal ethnic groups represented in the sample, African Americans had the highest caries severity scores (5.46) followed by Hispanics and Caucasians; the latter 2 groups had identical dfs scores of 4.69. The dfs score among children from the low-SES group was significantly higher than that of their counterparts from the high-SES group (5.42 vs 4.19).

The primary purpose of this study was to assess the trends in dental caries experience in the primary dentition of third-grade children in Harris County, Texas. The study compared data collected for primary teeth of third-grade students in 1998 with data from the same schools in 1991, using the same sampling format. The present study also investigated the prevalence and severity of dental caries in each survey sample (1991 vs 1998) and in different demographic subgroups.

## Methods

Harris County Public Health and Environmental Services Department (formerly known as the HCHD) periodically assesses dental caries parameters among third-grade children in the department's jurisdiction to monitor disease trends at the county level and to assess service and prevention programs. For the 2 cross-sectional studies (1991 and 1998), a population-proportional, multi-staged, stratified cluster sampling technique was used to select an appropriate representative sample of suburban Harris County third graders. School districts were stratified by size of enrollment and percentages of children from families of low SES. As a proxy for SES, districts with less than 20% of their enrollment qualified for the subsidized lunch program were classified as high-SES districts and districts with 20% or more of their students enrolled in the subsidized lunch program were classified as low-SES districts. Within

each selected district, ethnic stratification was applied to choose the participant schools with the intent of maintaining the ethnic mix representing the population of third graders in suburban Harris County. Data were collected during 20 site visits at 16 selected schools from 7 school districts in both 1991 and 1998.

After survey approvals from the school districts, each school sent letters to parents. These letters described possible minimal discomforts or risks of their child's participation in the surveys, naming the benefits of having an oral health assessment, and requested permission to include their child in the particular survey. Both the 1991 and 1998 consent procedures were approved by the school districts' administrations at the time of the respective studies. A priority for dental care notice was completed for each participant in the surveys, informing parents of the oral examination's findings and recommending referral of children to an appropriate source of care, if needed. Each of these studies was also reviewed and approved by the Harris County Public Health and Environmental Services-Projects Review Committee, which protects the rights of human subjects in research.

National Institute of Dental and Craniofacial Research protocols were used to assess the dfs score for the primary dentition to measure the dental caries experience.<sup>10</sup> Calibrated dentist examiners used portable dental chairs, portable high-intensity examination lights, no. 5 front surface mouth mirrors, and no. 23 sickle dental explorers for the clinical examinations. No radiographs were taken, and no special magnification or caries detection adjuncts were employed. Prior to the beginning of both the surveys (both 1991 and 1998), pilot surveys were conducted at certain schools not included in the study in order to train and calibrate the dentist examiners and data entry personnel.

During the 1991 study, 4 dentist examiners collected data, and repeat examinations were performed on every eighth student to assess intra- and interexaminer reliability, as measured by the kappa statistic. In the 1991 study, the kappa statistic showed that agreement between examiners ranged from 0.92 to 0.98 and the intraexaminer reliability ranged from 0.96 to 0.99. In the 1998 study, 1 of the original 4 dentist examiners and 3 new dentist examiners were used to collect data. Calibration exercises similar to the 1991 study were conducted. In the 1998 study, interexaminer kappa scores ranged from 0.66 to 1.00, and intraexaminer scores ranged from 0.68 to 1.00. Upon review of repeat examination discrepancies in the 1998 survey, the reliability differences were largely due to the methodology of one new examiner in classifying teeth as sealed or not sealed. After review, the determination was made that this error should have no negative impact on the reliability of the dental caries severity scores for children assessed by that examiner.

Data analysis was performed using the Statistical Package for Social Sciences (SPSS, Inc., Chicago, Ill) Chi-squared tests analyzed the differences in proportions of caries-free (dfs=0)

children in Harris County between 1991 and 1998, for the total samples as well as different demographic subgroups (age, gender, ethnicity, and SES). Additionally, odds ratios and 95% confidence intervals were computed to assess the probability of children being caries-free in 1998 compared to 1991 for the aforementioned demographic groups. The Student's *t* test was used to investigate any significant differences in mean decayed and filled tooth surfaces (dfs scores) among the respective demographic subgroups between the 2 studies. The significance level for the analytical tests, alpha, was set at less than or equal to .05.

**Results**

The prevalence of primary dentition caries (dfs≥1) in Harris County third graders decreased from 59% to 54% between 1991 and 1998. Table 1 shows the changes in prevalence of caries-free children in different demographic subgroups between 1991 and 1998. Overall, the probability of third-grade children being caries free in 1998 compared to 1991 was 1.23, with a 95% confidence interval of 1.04 to 1.44. Thus, children exhibited an improved probability of having better oral health in 1998. Changes in caries severity scores in the primary dentition of third grade children between 1991 and 1998, denoted by dfs scores, are shown in Table 2. The mean dfs score for third-grade children in Harris County decreased from 4.81 to 3.16 (*P*<.001). Table 2 shows the decline in caries severity (dfs) scores among different demographic subgroups. The decline in the 1998 mean dfs scores was similar among males and females (32% and 36%, respectively).

Decreases in the mean dfs scores were statistically significant for males and females (*P*<.001). Lower dfs scores were also

seen among the major ethnic groups in the samples: Caucasians, African Americans, and Hispanics (Table 2). The decline in mean dfs scores ranged from 0.50 decayed and filled primary tooth surfaces (dfs) among Hispanics to 2.29 dfs among African American children. Comparing SES differences in caries severity between the 1991 and 1998 surveys, the relative decrease in the dfs score was greater among children from the low-SES group compared to those from the high-SES group. The mean dfs score decreased from 5.42 to 3.31 among low-SES children (a 39% decrease), and from 4.19 to 3.01 among the high-SES group (a 28% decrease). The dfs differences between the 2 studies in the respective SES subgroups were also statistically significant (*P*<.001).

**Discussion**

A contrasting phenomenon was observed in dental caries trends in primary teeth between the Harris County study and the 2 most recent NHANES surveys. While a significant decline in dental caries prevalence and severity was observed between our studies, the prevalence of caries in the primary dentition remained almost the same between NHANES III (1988-94) and NHANES IV (2002-05). In the national studies, the prevalence of dental caries in the overall 2- to 11-year-old group, as well as the 2- to 5-year-old and 6- to 11-year-old subgroups did not show any significant change between NHANES III and NHANES IV. In the Harris County study, however, the prevalence of dental caries declined significantly from 59% to 54% over the 7-year period from 1991 to 1998.

The dental caries severity score (dfs) among the 2- to 11-year-olds did not show any significant change at the national level between NHANES III and NHANES IV. The same phenomenon was true for the demographic subgroups of gender and SES, but not for ethnicity. While the average ds score did not differ significantly between the 2 surveys among African Americans and non-Hispanic Caucasians, the ds score decreased significantly among Mexican Americans. The fs of the dfs score increased significantly among the 2- to 11-year-old age group as well as among a majority of the demographic subgroups (gender, ethnicity, and SES). The mean fs score, however, did not show a significant increase among African Americans and children above the 200% of the FPL. The Harris County study, by contrast, showed a significant decrease in the overall dfs score, and the decline was true across both genders and all

Table 1. TRENDS IN CARIES-FREE STATUS BETWEEN 1991 AND 1998 IN THIRD-GRADE CHILDREN IN HARRIS COUNTY, TEXAS, BY DEMOGRAPHIC GROUP

	1991 Sample Size (n)	1991 % Caries Free	1998 Sample Size (n)	1998 % Caries Free	Odds Ratio (95% CI)	P-value
<b>All Children</b>						
Participants	1584	40.8	1039	45.9	1.23 (1.04, 1.44)	.01
<b>Gender</b>						
Male	799	42.5	488	45.5	1.13 (0.89, 1.43)	.29
Female	785	39.1	551	46.2	1.34 (1.07, 1.68)	.01
<b>SES</b>						
Low	797	34.9	500	41.5	1.31 (1.04, 1.67)	.02
High	787	46.9	539	50.1	1.13 (0.90, 1.42)	.26
<b>Race</b>						
Caucasian	958	44.1	538	49.6	1.25 (1.01, 1.55)	.04
African American	255	36.5	185	41.6	1.24 (0.83, 1.87)	.27
Hispanic	307	36.4	263	40.3	1.18 (0.83, 1.67)	.32
Asian	18	42.9	20	45.0	1.57 (0.36, 7.01)	.49
Other/ Unknown	46	38.2	33	43.5	1.24 (0.37, 4.18)	.69

**Table 2.** TRENDS IN CARIES SEVERITY (DFS) AMONG THIRD-GRADE CHILDREN IN HARRIS COUNTY, TEXAS

	1991 Study	1998 Study	P-value
	Mean dfs (S.E.)	Mean dfs (S.E.)	
<b>All Children</b>			
All Participants	4.81 (0.17)	3.16 (0.15)	<.001
<b>Gender</b>			
Male	4.96 (0.26)	3.37 (0.23)	<.001
Female	4.65 (0.23)	2.97 (0.18)	<.001
<b>Ethnicity</b>			
	1991 Mean (S.E.)	1998 Mean(S.E.)	
Caucasian	4.69 (0.23)	2.67 (0.20)	<.001
African American	5.46 (0.46)	3.17 (0.32)	<.001
Hispanic	4.69 (0.34)	4.19 (0.32)	<.036
Asian	5.61 (1.50)	5.67 (0.42)	.94
Other	4.16 (0.80)	1.77 (0.42)	<.001
<b>SES</b>			
	1991 Mean (S.E.)	1998 Mean(S.E.)	
Low	5.42 (0.25)	3.31(0.20)	<.001
High	4.19 (0.24)	3.01 (0.21)	<.001

ethnicities. Similarly, both high and low-SES groups in Harris County showed a decline in caries severity, with the low-SES students showing a greater decline of 39% compared to a 28% decline among the high-SES group. This finding gives encouragement to the idea that past efforts targeted toward improvement of the oral health status of the low-SES children in Harris County have had a successful impact.

The differences between the Harris County and national surveys could be attributed to sampling variation as well as aggressive preventive service programs administered at the local level by the county health department. National surveys such as NHANES III and IV attempt to choose samples to represent the US population.<sup>6</sup> Certain demographic subgroups, such as African Americans and Mexican Americans, were oversampled in the national surveys. The study samples in Harris County were chosen to represent third-grade children in suburban Harris County whose ethnic mix differs from that of the national population. The Harris County samples did not oversample any of the demographic subgroups as did the national surveys. Furthermore, the age groups of samples in the Harris County study differ from those of the national surveys, which could explain the differences in magnitude of changes in caries severity scores at the national and local levels. While the Harris County study included third-grade 8- to 10-year-old children, the results comparing NHANES III and IV relate to 2- to 11-year-olds and included subgroups of 2- to 5-year-olds and 6- to 11-year-olds.

During the interim between the 1991 and 1998 studies, the HCHD promoted the fluoridation of the independent

water supplies in its area of responsibility. HCHD also provided pit-and-fissure sealants for children attending the county dental clinics and encouraged the use of sealants in private dental offices. Finally, through school-based educational programs, the HCHD taught the values of regular use of fluoridated toothpaste, daily oral hygiene, and early prevention, screening, diagnosis, and treatment of tooth decay through appropriate utilization of professional dental care for children, in both private office and public clinic settings. In contrast, some of the participants in the national surveys may not have received the benefits of dental caries prevention programs. Limitations of the Harris County study included examiner variability, the fact that the sampling technique was not a purely random selection of participants, and the lack of comprehensive data collected regarding the determinants of dental caries. The examiners who performed the dental examinations in the 1991 and 1998 studies were not the same, except for one. Examiners for the 2 studies could not be duplicated because of changes in personnel at the agencies/institutions involved the studies. Despite having different examiners in the 2 studies, the inter- and intraexaminer reliability in each of the studies was acceptable, as illustrated by respectable kappa scores. The kappa scores were higher for the 1991 study than the national studies. The kappa scores for the 1998 study, although lower, were similar to those of NHANES IV, which had scores of 0.64 to 1.0.<sup>6</sup> The higher level of discrepancies between examiners in the 1998 Harris County study were carefully reviewed, and most errors were related to sealant identification, which did not affect the carious or filled surface diagnosis. Thus, the dental caries trends reported here were not significantly affected by the relatively lower kappa scores in the 1998 study.

Although not a purely random sample, the sampling for the Harris County studies was designed to provide approximate representation of the child population in suburban Harris County. This limitation was accepted to keep the costs of the study in line with available funds. Although some population changes occurred between 1991 and 1998, the proportions of ethnic and SES groups remained essentially the same.

Finally, a limitation in the present study was the lack of data on determinants of dental caries, including fluoride exposure, microbial assessments (particularly mutans streptococci counts), dietary habits, salivary flow rates, etc. Data on determinants of dental caries, both in 1991 and 1998, would have shed more light on the overall trends in dental caries as well as the trends among the demographic subgroups.

### Conclusions

Based on this study's results, the following conclusions can be made:

1. Despite a generalized decline in dental caries levels among children in Harris County, Texas, disparities in dental caries experience exist between certain subgroups.

2. Although children from both low- and high- SES groups showed improvement in dental caries prevalence and mean dfs scores, the low-SES children showed a greater rate of improvement than the high-SES group.
3. Nevertheless, low-SES group children continued to have higher levels of untreated dental decay, and the lowest contribution of filled tooth surfaces to the decayed and filled surfaces (dfs) caries severity index.
4. Although the national studies may indicate a plateau in the reduction of dental caries, the Harris County studies indicate that local prevention efforts should be maintained to sustain improvements in dental caries and to eliminate disparities in oral health between high- and low-SES groups.
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## Abstract of the Scientific Literature

### Comparison of buccal midazolam with rectal diazepam in the treatment of prolonged seizures in ugandan children: A randomized clinical trial

*The aim of this study was compare the efficacy and safety buccal midazolam versus rectal diazepam in the management of prolonged (>5minutes) seizures. The study was designed as single-blinded, randomized clinical trial of children ages 3months -12years presenting to an acute care clinic. Patients had to have been seizing for more than 5 minutes while in the unit. Primary outcome measure was cessation of visible seizure activity within 10 minutes and no recurrence within the hour. Secondary outcomes assessed included; risk for respiratory depression, and time to seizure cessation. Results revealed that 43% of patients with diazepam and 30% in the midazolam group experienced treatment failure, which was not a statistically significant difference. Concurrent presence of malaria increased adverse outcomes. There was also no significant difference in seizure cessation or respiratory depression with either regimen. Midazolam was more effective at preventing recurrent seizures in the initial 24 post-ictal period (p=.001). When parents were asked, 56% favored the oral route (midazolam) versus 34% the rectal.*

**Comments:** Buccal midazolam presented an alternative to rectal diazepam which offered easier administration and a more effective means of preventing recurrent seizures within the 24 hour post-ictal period. One of the concerns with repeated rectal diazepam is the potential for absorption into adipose tissue and eventual respiratory depression. This is not a concern with midazolam. *ST*

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