

**ABSTRACT** This article examines the extent to which caries prevalence and untreated caries vary in children by ethnicity and household income level. Data from the Third National Health and Nutrition Examination Survey, 1988-1994, for 10,332 children 2 to 18 years of age indicate that lower-income children and Mexican-American and African-American children are more likely to have a higher prevalence of caries and more unmet treatment needs than their higher-income and non-Hispanic white counterparts.

# Sociodemographic Distribution of Pediatric Dental Caries: NHANES III, 1988-1994

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National surveys conducted during the past three decades have demonstrated a decline in the overall mean levels of clinically detectable dental caries in U.S. children and adolescents.<sup>1</sup> Nevertheless, dental caries remains the single most common disease of childhood that is neither self-limiting nor amenable to short-term pharmacological management. More than 80 percent of the pediatric population is affected by dental caries by age 17.<sup>1</sup>

Although most U.S. children remain at some level of risk of developing tooth caries, 80 percent of permanent teeth affected by caries are found in roughly 25 percent of 5- to 17-year-old children.<sup>2</sup> Recent reports further show that dental caries is a significant health problem for U.S. preschool-age children<sup>3,4</sup> and is disproportionately concentrated in children from low-income households<sup>4</sup> and ethnic minority groups.<sup>1,5</sup> In spite of having higher documented levels of dental disease and treatment needs, members of low-income households and minority populations historically have used fewer dental services than their more affluent and nonminority counterparts.<sup>6</sup>

Public policy-makers have long recognized the need for programs to facilitate access to dental services for children from low-income households. Comprehensive coverage for pediatric dental services has been required under Medicaid for more than two decades. More recently, dental care has been included as an eligible category of covered services under Title XXI amendments to the Social Security Act (Pub L No. 105-33), which seeks to expand coverage and access to health care for uninsured, low-income children through the Children's Health Insurance Program, or CHIP.

Federal legislation alone, however, does not ensure access. A recent investigation by the Office of the Inspector General of the U.S. Depart-

## SELECTED ELIGIBILITY CRITERIA FOR TITLE XIX (MEDICAID) AND TITLE XXI (CHILDREN'S HEALTH INSURANCE PROGRAM).

### 100 PERCENT OF FEDERAL POVERTY LINE

The Omnibus Budget Reconciliation Act, or OBRA, amendment of 1990 expanded Medicaid (Title XIX) eligibility for all children up to age 19 years. The amendment provided for a year-by-year phase-in of Medicaid eligibility for children born after September 30, 1983, whose family incomes are below 100 percent of the federal poverty line. (§1902[a][10][A][I][VII] of the Social Security Act)

### 133 PERCENT OF FEDERAL POVERTY LINE

The OBRA amendment of 1989 required that all states provide Medicaid eligibility to pregnant women, infants and children less than 6 years of age, with family incomes at or below 133 percent of the federal poverty line (§1902[a][10][A][I][IV] and [VI] and §1902 [1] of the Social Security Act)

### 200 PERCENT (AND ABOVE) OF FEDERAL POVERTY LINE

The Balanced Budget Act of 1997 (Pub L No. 105-33) amended the Social Security Act to add Title XXI, the Children's Health Insurance Program, which provides states with the option to expand child health assistance to uninsured, targeted low-income children. A targeted low-income child is defined as a child less than 19 years of age, who resides in a family with an income at or below 200 percent of the federal poverty line or 50 percent above the Medicaid applicable income level (that is, the current Medicaid eligibility level), whichever is greater, and who is not eligible for Medicaid or other health insurance coverage. (§2110 [b][1][B] and §2110[c][4] of the Social Security Act)

ment of Health and Human Services, or DHHS,<sup>7</sup> found that only one in five Medicaid-eligible children received routine preventive dental services. Although all states participate in Medicaid, it remains to be seen whether all states implement CHIP. States that decide to implement CHIP as a separate program, rather than as an expansion of Medicaid, may elect to omit dental benefits entirely.

**U**nderstanding the extent and sociodemographic distribution of dental caries and treatment needs in the pediatric population is an important prerequisite for designing effective programs to fa-

cilitate access to dental services for low-income children. We address this issue by analyzing data from the Third National Health and Nutrition Examination Survey, or NHANES III, 1988–1994, which is the most recent national survey with measures of both childhood caries and sociodemographic characteristics.<sup>8,9</sup> Findings on the prevalence of clinically detectable caries and unrestored teeth by age, dentition (primary and permanent teeth), ethnicity and household income are provided for a nationally representative sample of U.S. children 2 to 18 years of age.

### METHODS

**Data source.** We analyzed

data from NHANES III to assess the sociodemographic distribution of untreated dental caries and dental restorations. NHANES III was conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics and uses a national multistage probability sample of the U.S. civilian noninstitutionalized population to collect information on the national prevalence of, trends in and risk factors for selected diseases.

The initial NHANES III sample consisted of 33,994 people, who ranged in age from 2 months to 99 years. The survey design included an oversampling of African-Americans, Mexican-Americans, and people 2 months to 5 years of age and 60 years of age and older to obtain statistically reliable estimates for these populations. Data were collected from participants through face-to-face interviews, physical and dental examinations, and laboratory tests. Details of the plan, sample design and protocol used to obtain participants' informed consent have been published previously.<sup>8</sup>

**Population.** Complete data on coronal caries in NHANES III were collected from 10,332 children from 2 to 18 years of age. Data on 944 participants were excluded because of missing information on one or more variables of interest to this study. The final sample used in our analyses included 9,388 children, of whom 3,889 were 2 to 5 years of age; 4,116 were 6 to 14 years of age; and 1,383 were 15 to 18 years of age. We assessed the study population for a possible bias associated with missing data on poverty status by comparing the caries

indexes of children included in the analyses with those of children who were excluded because of missing poverty information. We noted no significant differences.

**Dental examinations.** The oral health component of NHANES III included questions asked in face-to-face home interviews and data from extensive oral examinations conducted in the NHANES mobile examination center. Licensed dentists trained to conduct surveys according to National Institute of Dental Research guidelines performed the oral examinations.<sup>10</sup>

Dental examiners were calibrated periodically during the survey by an expert in oral examination for epidemiologic surveys as a gold standard. Analyses of data from repeated examinations indicate that the intra- and interexaminer reliability was excellent; the kappa statistic for intraexaminer reliability was 0.98 and for the interexaminer reliability it was 0.96 to 1.0.<sup>2</sup>

Participants who were 12 to 23 months of age received a brief visual inspection of maxillary incisors to identify early childhood caries. Participants who were 2 years of age and older received a complete visual-tactile dental caries examination, using a front-surface mirror and a No. 23 metal explorer, as part of the oral health examination. Additional details describing the caries examination procedure have been published elsewhere.<sup>2</sup>

In NHANES III, dental caries levels in permanent teeth were recorded using the DMFT/S index,<sup>11</sup> which, in aggregate, represents the sum of decayed teeth or untreated

TABLE 1

DEMOGRAPHIC CHARACTERISTICS OF THE POPULATION.*			
VARIABLE	% 2 TO 5 YEARS n = 3,889	% 6 TO 14 YEARS n = 4,116	% 15 TO 18 YEARS n = 1,383
<b>Sex</b>			
Male	51.4	51.5	49.9
Female	48.6	48.5	50.1
<b>Ethnicity</b>			
Non-Hispanic white	64.1	68.0	66.3
African-American	16.0	15.2	15.1
Mexican-American	9.5	8.3	7.6
Other	10.4	8.5	10.9
<b>Income Level (% of FPL†)</b>			
0 to 100	27.9	24.6	21.7
101 to 200	25.5	24.5	23.2
201 to 300	21.6	23.7	23.2
301 and up	24.9	27.2	32.0

\* Source: Third National Health and Nutrition Examination Survey, 1988–1994.  
† FPL: Federal poverty line.

caries (D), missing (M) and filled (F) permanent teeth (T) or surfaces (S). For primary teeth, the index is presented as dft/s (in lowercase letters), which, in aggregate, represents the sum of decayed (d) and filled (f) primary teeth (t) or surfaces (s). Missing teeth are not included in the primary tooth index because of the difficulty in distinguishing between whether teeth are missing as a result of extraction or natural exfoliation.<sup>11</sup>

For the purposes of our study, we used tooth-level data to create DMFT and dft indexes. The percentages of DMFT and dft scores represented by untreated caries (D or d) and filled teeth (F or f) also were calculated for each participant by dividing the number of decayed or filled teeth by the dft

or DMFT score and multiplying the result by 100— $d/dft \times 100$  and  $D/DMFT \times 100$ .

**Sociodemographic characteristics.** Sociodemographic variables of interest in our analyses included age (reported in years at the time of the home interview), ethnicity and household income level. Ethnicity was defined by the participant's self-report of being non-Hispanic white, African-American, Mexican-American or other. NHANES III was designed to be representative of Mexican-Americans rather than of all Hispanics; Hispanics of non-Mexican-American origin are included in the "others" category. Household income level was calculated using the ratio of family income to the federal poverty line, or FPL, threshold,

TABLE 2

## PERCENTAGE OF CHILDREN WITH DECAYED AND FILLED TEETH BY INCOME LEVEL, DENTITION AND AGE.\*

INCOME LEVEL (% OF FPL†)	PRIMARY TEETH				PERMANENT TEETH			
	% Decayed (SE‡)		% Filled (SE)		% Decayed (SE)		% Filled (SE)	
	2 to 5 Years	6 to 12 Years	2 to 5 Years	6 to 12 Years	6 to 14 Years	15 to 18 Years	6 to 14 Years	15 to 18 Years
<b>0 to 100</b>	29.7 (2.7)	41.6 (2.6)	9.3 (1.6)	36.8 (3.3)	19.5 (2.1)	34.4 (3.5)	25.3 (2.6)	65.1 (3.7)
<b>101 to 200</b>	24.4 (2.3)	27.7 (2.5)	9.3 (1.3)	40.6 (2.8)	14.3 (2.1)	29.2 (4.3)	28.6 (2.7)	61.6 (3.6)
<b>201 to 300</b>	12.2 (1.6)	17.1 (2.2)	7.8 (1.5)	36.6 (4.2)	8.7 (1.4)	22.6 (3.9)	29.9 (3.0)	63.9 (5.3)
<b>301 and up</b>	6.0 (1.2)	14.7 (2.3)	6.5 (1.3)	31.7 (3.0)	3.4 (0.9)	13.2 (1.9)	30.2 (3.2)	67.2 (3.4)
<b>All</b>	18.7 (1.2)	24.9 (1.5)	8.7 (0.9)	36.1 (1.6)	11.3 (0.9)	23.5 (1.7)	28.7 (1.7)	66.3 (1.7)

\* Source: Third National Health and Nutrition Examination Survey, 1988–1994.

† FPL: Federal poverty line.

‡ SE: Standard error of the percentage.

which is established annually by the U.S. Bureau of the Census, and adjusted by family composition and the age of the family reference person. Poverty line was recorded in the NHANES III survey as a continuous variable, which let us create income categories that correspond to policy-relevant intervals and cutoff points used by the states to establish Medicaid and CHIP program eligibility—for example, 100, 133 and 200 percent of the FPL threshold (see Box).

**Statistical methods.** We analyzed data according to age groups that correspond to the eligibility criteria defined by Congress for the provision of Medicaid and CHIP benefits (see Box). We made minor modifications so as to be consistent with the NHANES III design—the lower age limit was defined as 2 years—and to reflect developmental status considerations—primary and permanent dentition. We divided data for the primary dentition into two groups: 2- to 5-year-old children and 6- to 12-year-old children.

We created the latter group to avoid artificially inflating the denominator by inappropriately including older children whose primary teeth had exfoliated. In addition, we divided data for the permanent dentition into two groups: 6- to 14-year-old

In each age/dentition group the proportion of children with untreated caries was highest for those in the lowest income group and then declined as income increased.

children and 15- to 18-year-old children. However, data for the overall population, independent of dentition status, are presented in three age groups: 2 to 5 years of age, 6 to 14 years of age and 15 to 18 years of age.

We calculated mean levels of dft and DMFT and the percentage of children with decayed and filled teeth for different age/dentition groups, ethnic groups and income levels. We assessed the differences between groups, using 95 percent confidence intervals, or CIs, based on this formula: 95 percent CI = estimate  $\pm$  (1.96  $\times$  standard error, or SE). We found that age-adjusted DMFT and dft did not differ significantly from crude estimates; therefore, we present only crude estimates. All analyses included sample weights to provide estimates representative of the 2- to 18-year-old U.S. noninstitutionalized population. We conducted analyses using the SUDAAN statistical program (Research Triangle Institute, release 6.04) to obtain standard errors that accounted for design effects associated with the survey's complex sample design.<sup>12</sup>

### RESULTS

Table 1 presents data on the sociodemographic characteristics

TABLE 3

## MEAN NUMBER OF dft,\* DMFT† AND PERCENTAGE OF DECAYED AND FILLED TEETH FOR CHILDREN WITH AT LEAST ONE DECAYED OR FILLED TOOTH.‡

INCOME LEVEL (% OF FPL§)	PRIMARY TEETH					
	2 to 5 Years			6 to 12 Years		
	dft (CI**)	% d/dft†† (CI)	% f/dft‡‡ (CI)	dft (CI)	% d/dft (CI)	% f/dft (CI)
<b>0 to 100</b>	1.49 (1.10-1.88)	78.8 (71.7-85.9)	21.2 (14.1-28.3)	2.30 (2.10-2.50)	51.3 (43.5-59.1)	48.7 (40.9-56.5)
<b>101 to 200</b>	1.37 (0.98-1.76)	75.0 (69.1-80.9)	25.0 (19.1-30.9)	1.78 (1.58-1.98)	36.3 (30.4-42.2)	63.7 (58.0-69.4)
<b>201 to 300</b>	0.57 (0.37-0.77)	61.6 (47.7-75.5)	38.4 (24.5-52.3)	1.37 (0.98-1.76)	26.9 (18.9-34.9)	73.1 (65.1-81.1)
<b>301 and up</b>	0.31 (0.11-0.51)	45.0 (32.9-57.1)	55.0 (42.3-67.7)	1.06 (0.86-1.26)	26.4 (18.9-33.9)	73.6 (66.1-81.0)
<b>All</b>	0.97 (0.77-1.17)	71.1 (65.6-76.6)	28.9 (23.6-34.2)	1.61 (1.4-1.8)	36.7 (32.8-40.6)	63.3 (59.2-67.4)
	PERMANENT TEETH					
	6 to 14 Years			15 to 18 Years		
	DMFT (CI)	% D/DMFT†† (CI)	% F/DMFT‡‡ (CI)	DMFT (CI)	% D/DMFT (CI)	% F/DMFT (CI)
<b>0 to 100</b>	1.08 (0.88-1.28)	40.5 (34.2-46.6)	59.3 (53.2-65.4)	3.69 (3.10-4.28)	26.0 (20.7-31.3)	72.3 (66.6-78.0)
<b>101 to 200</b>	1.13 (0.93-1.33)	29.7 (21.7-37.7)	70.0 (62.0-78.0)	4.09 (3.31-4.87)	22.3 (14.9-29.7)	75.5 (67.5-83.5)
<b>201 to 300</b>	1.02 (0.82-1.22)	19.7 (12.3-27.1)	80.0 (72.4-87.6)	3.56 (2.58-4.54)	16.6 (10.1-23.1)	83.1 (76.4-89.8)
<b>301 and up</b>	0.89 (0.69-1.09)	8.6 (3.5-13.7)	91.4 (86.3-96.5)	3.12 (2.73-3.51)	6.5 (3.6-9.4)	93.2 (90.3-96.1)
<b>All</b>	1.03 (0.83-1.23)	24.9 (21.2-28.6)	74.0 (70.3-77.7)	3.57 (3.18-3.96)	17.1 (13.8-20.4)	81.8 (78.3-85.3)

\* dft: Decayed and filled primary teeth.  
† DMFT: Decayed, missing and filled permanent teeth.  
‡ Source: Third National Health and Nutrition Examination Survey, 1988-1994.  
§ FPL: Federal poverty line.  
\*\* CI: 95 percent confidence interval.  
†† Percentage of dft or DMFT represented by decayed teeth.  
‡‡ Percentage of dft or DMFT represented by filled teeth.

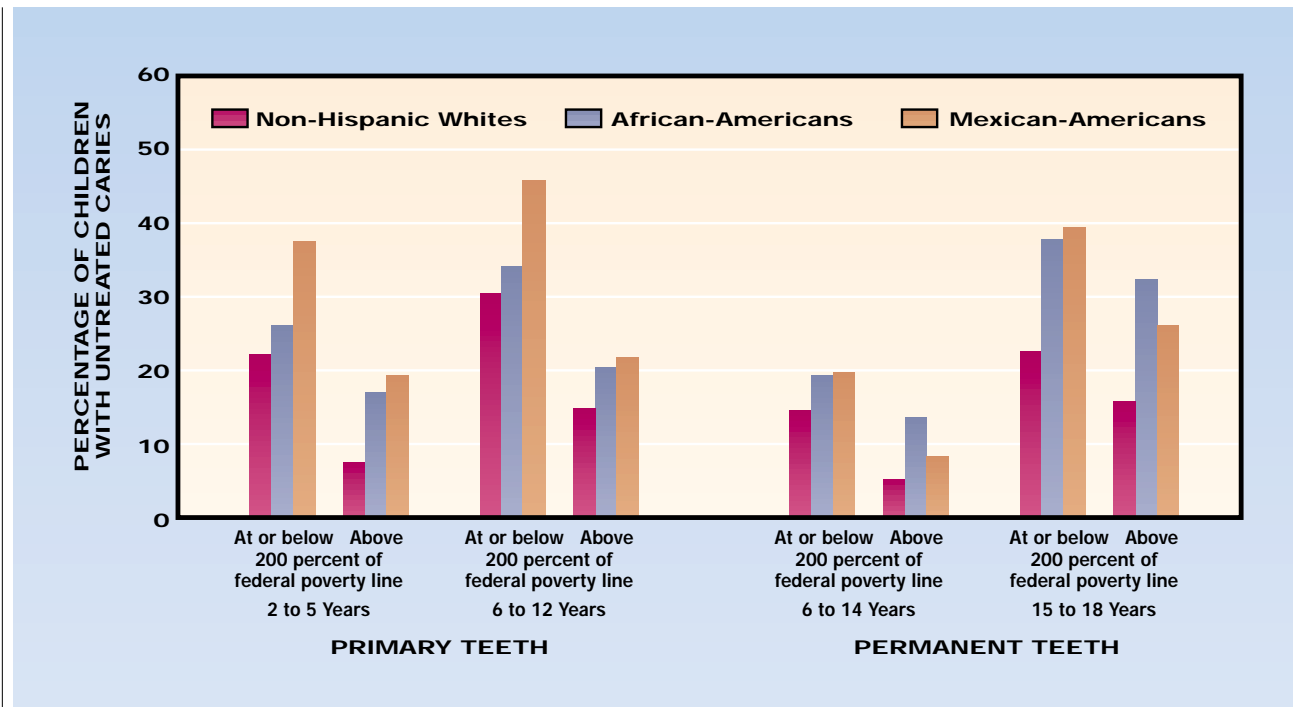
of the population included in the analyses. The income-level data show a relatively uniform distribution across the four income categories, with a slightly higher percentage of 2- to 5-year-olds in the lowest income category (0 to 100 percent of the FPL) and a slightly higher percentage of 15- to 18-year-olds in the highest income category (301 percent and up of the FPL).

The number of teeth at risk of developing caries varies by age for each dentition. Normal exfoliation of primary teeth begins around 5 years of age and

continues until age 12. Eruption of the permanent dentition, on the other hand, generally starts at 5 years of age and ends around 14 years of age (except for third molars). We found no differences in mean number of teeth by income level.

Table 2 shows the percentages of children with at least one decayed or filled tooth in each of the four age/dentition groups. Overall, 18.7 percent (SE 1.2) of 2- to 5-year-old children and 24.9 percent (SE 1.5) of 6- to 12-

year-old children in the sample had at least one primary tooth with untreated caries. Similarly, 11.3 percent (SE 0.9) of 6- to 14-year-old children and 23.5 percent (SE 1.7) of the 15- to 18-year-old children had at least one permanent tooth with untreated caries. In each age/dentition group, the proportion of children with untreated caries was highest for those in the lowest income group and then declined as income increased. For both types of dentition—primary and permanent teeth—the percentages of chil-



**Figure** Percentage of children with untreated caries by ethnicity, poverty status (200 percent of the federal poverty line), age group and dentition, Third National Health and Nutrition Examination Survey, 1988–1994.

dren with untreated caries in the lowest income group were at least five times greater than the respective figures for the highest income group. We also found that data for filled teeth showed comparatively little variation across income levels within each group.

These findings suggest that while lower-income children were as likely to receive some restorative care as were their more affluent counterparts, they also were much more likely to have unmet dental treatment needs. The data also demonstrate, in general, the progressive nature of dental caries in both the primary and permanent dentition, in that a higher proportion of children in the older age groups exhibited decayed teeth compared with their younger counterparts.

Table 3 shows that the mean dft and DMFT levels for children with at least one decayed

or filled tooth generally were related inversely to income level. The only exception was for permanent teeth in children who lived in households with incomes at 101 to 200 percent of

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the FPL. The differences among the income groups were statistically significant for dft, but not

for DMFT. However, among children with at least one decayed tooth, the percentage of dft and DMFT accounted for by untreated caries decreased consistently as income level increased. Conversely, the percentage of dft and DMFT attributed to filled teeth consistently increased as income increased. Thus, children from households whose income levels were below or near the FPL not only were more likely to exhibit clinically detectable caries, they also had a greater percentage of unmet dental treatment needs.

We found that Mexican-American children 2 to 5 years of age—especially those from lower-income households—were more likely than were their African-American and non-Hispanic white counterparts to have one or more decayed primary teeth. The percentages of 6- to 14-year-old children and 15- to 18-year-old children who

TABLE 4

MEAN NUMBER OF dft* AND DMFT† BY DENTITION, AGE AND ETHNICITY FOR CHILDREN FROM HOUSEHOLDS WITH INCOMES AT OR BELOW AND ABOVE 200 PERCENT OF THE FPL. ‡§								
INCOME LEVEL (% FPL) BY ETHNICITY	PRIMARY TEETH				PERMANENT TEETH			
	2 to 5 Years		6 to 12 Years		6 to 14 Years		15 to 18 Years	
	dft (SE**)	% d/dft†† (SE)	dft (SE)	% d/dft (SE)	DMFT (SE)	% D/DMFT†† (SE)	DMFT (SE)	% D/DMFT (SE)
<b>Non-Hispanic White</b>								
At or below 200	1.15 (0.2)	76.2 (5.2)	1.90 (0.2)	38.6 (4.7)	1.08 (0.1)	29.5 (3.0)	3.61 (0.3)	13.3 (2.8)
Above 200	0.33 (0.1)	51.7 (6.0)	1.08 (0.1)	26.1 (3.6)	0.95 (0.1)	11.6 (2.5)	3.35 (0.3)	9.3 (1.8)
All	0.67 (0.1)	66.7 (4.7)	1.40 (0.1)	32.1 (2.9)	1.00 (0.1)	19.0 (2.2)	3.43 (0.2)	10.6 (1.7)
<b>African-American</b>								
At or below 200	1.15 (0.1)	80.1 (2.8)	1.66 (0.1)	52.4 (3.0)	0.95 (0.1)	50.5 (3.0)	3.29 (0.2)	37.4 (2.9)
Above 200	0.67 (0.1)	78.7 (5.3)	1.42 (0.2)	37.6 (4.3)	0.75 (0.1)	37.3 (5.7)	2.62 (0.2)	32.2 (5.5)
All	1.04 (0.1)	79.9 (2.8)	1.60 (0.1)	48.9 (2.5)	0.89 (0.1)	47.2 (2.5)	3.11 (0.2)	36.0 (2.9)
<b>Mexican-American</b>								
At or below 200	1.91 (0.2)	79.9 (1.8)	2.37 (0.2)	57.9 (3.5)	1.11 (0.1)	42.2 (2.7)	3.54 (0.2)	39.5 (4.6)
Above 200	0.83 (0.2)	71.0 (7.3)	1.66 (0.3)	28.1 (6.2)	1.15 (0.1)	17.7 (4.1)	3.57 (0.5)	18.1 (5.9)
All	1.71 (0.1)	78.8 (1.9)	2.19 (0.2)	51.2 (3.4)	1.12 (0.1)	36.1 (2.5)	3.55 (0.3)	34.1 (3.1)

\* dft: Decayed and filled primary teeth.

† DMFT: Decayed, missing and filled permanent teeth.

‡ FPL: Federal poverty line.

§ Source: Third National Health and Nutrition Examination Survey, 1988–1994.

\*\* SE: Standard error.

†† Percentage of dft or DMFT represented by decayed teeth.

had one or more decayed permanent teeth were similar for African-American children (18.0 and 36.1 percent, respectively) and Mexican-American children (16.9 and 35.8, respectively), but were almost twice as high as those for their non-Hispanic white counterparts (8.5 and 17.8 percent, respectively). The figure shows disparities in untreated caries by ethnicity in the four age/dentition groups for children from households with incomes at or below and above 200 percent of the FPL. The 200 percent cutoff is particularly relevant because it is the threshold that states have gen-

erally identified for a child's being defined as a low-income child within the context of the recently enacted CHIP legislation.

Table 4 shows that, for the most part, mean levels of dft and DMFT were higher among children at or below 200 percent of the FPL. The percentages of teeth with untreated caries in children with detectable caries (percentage of d/dft and percentage of D/DMFT) also were consistently higher among children at or below 200 percent of the FPL. When we analyzed the data by ethnic groups and dentition, we found that a higher

percentage of children with household incomes at or below 200 percent of the FPL had untreated caries compared with their counterparts who had household incomes above 200 percent of the FPL. Interestingly, we found that the differences were not statistically significant for African-American children, who overall had a higher percentage of untreated caries when their household incomes were above 200 percent of the FPL compared with their non-Hispanic white and Mexican-American counterparts. In other words, higher income was not associated with

TABLE 5

## PERCENTAGE OF CHILDREN WITH DECAYED TEETH BY DENTITION, AGE AND POVERTY DEFINED BY SELECTED INCOME LEVEL CUTOFF POINTS.\*

INCOME LEVEL CUTOFF POINTS (% OF FPL†)	PRIMARY TEETH		PERMANENT TEETH	
	% 2 to 5 Years (SE‡)	% 6 to 12 Years (SE)	% 6 to 14 Years (SE)	% 15 to 18 Years (SE)
<b>At or below 100</b>	29.7 (1.2)	41.6 (2.6)	19.5 (2.1)	34.4 (3.5)
<b>Above 100</b>	14.4 (1.0)	19.6 (1.5)	8.6 (0.9)	20.7 (2.1)
<b>At or below 133</b>	30.0 (2.4)	39.4 (2.4)	18.2 (1.6)	35.4 (3.2)
<b>Above 133</b>	12.2 (0.9)	18.0 (1.6)	8.0 (1.0)	18.9 (1.9)
<b>At or below 150</b>	29.1 (2.3)	37.1 (2.5)	17.7 (1.5)	35.0 (3.0)
<b>Above 150</b>	11.5 (0.9)	17.8 (1.5)	7.5 (1.1)	17.9 (2.0)
<b>At or below 200</b>	27.2 (1.9)	34.7 (2.0)	16.9 (1.5)	31.7 (2.8)
<b>Above 200</b>	8.9 (0.8)	15.8 (1.6)	5.9 (0.9)	17.1 (2.0)
<b>At or below 250</b>	25.0 (1.8)	31.2 (1.8)	15.1 (1.3)	30.4 (2.5)
<b>Above 250</b>	7.9 (1.0)	15.6 (1.9)	5.5 (1.1)	14.9 (2.0)
<b>At or below 300</b>	22.9 (1.5)	28.7 (1.8)	14.2 (1.2)	28.6 (2.3)
<b>Above 300</b>	6.0 (1.2)	14.7 (2.4)	3.4 (0.9)	13.2 (1.9)

\* Source: Third National Health and Nutrition Examination Survey, 1988-1994.  
† FPL: Federal poverty line.  
‡ SE: Standard error.

significant reductions in untreated caries in African-American children.

Table 5 shows the percentage of children with untreated decayed teeth at or below and above the different income level cutoff points—100, 133, 150, 200, 250 and 300 percent of the FPL. Consistent with data in tables 2 and 4, the percentages of children with untreated caries are higher among children from households with income levels at or below the respective income level cutoff point than they are among their counterparts from higher-income households. Overall, higher percentages of children with untreated decayed teeth are evident in households with lower

income levels. The percentage of children with decayed teeth was higher in the older age groups across all income level cutoff points for both primary and permanent teeth; roughly twice as many 15- to 18-year-olds as 6- to 14-year-olds demonstrated decayed permanent teeth.

Table 6 shows that, with few exceptions, mean levels of dft decreased as the income level cutoff point decreased; we did not find a corresponding trend for mean levels of DMFT. The percentage of dft or DMFT represented by untreated caries (percentage of d/dft or percentage of D/DMFT) was higher in the lower-income group at each income level cutoff point and, in general, was greater among

lower-income children. Income appeared to have the least influence on untreated caries in the 2- to 5-year-old and 15- to 18-year-old groups and the greatest effect in the 6- to 12-year-old group.

### DISCUSSION

The recent enactment of CHIP as part of the Balanced Budget Act of 1997 and the 1996 report titled "Children's Dental Services Under Medicaid: Access and Utilization" by the DHHS Office of the Inspector General<sup>7</sup> have created new impetus for states to address pediatric oral health needs and revisit how dental benefits are provided to children from low-income households. CHIP provides opportunities for states to extend dental coverage to uninsured children from low-income households. Even if a state chooses not to include dental benefits in CHIP, outreach efforts may identify 3 million or more U.S. children who are Medicaid-eligible but not currently enrolled. Planning and implementing CHIP also will allow states to assess and revamp their current Medicaid programs to facilitate better integration with CHIP strategies. Understanding the distribution and magnitude of children's dental needs targeted by CHIP and Medicaid is a critical antecedent to successful program design and implementation.

Despite significant improvements in prevalence of dental caries over the past three decades, the data presented in this report indicate that dental caries remains a common childhood condition in the United States; the vast majority of children are af-



TABLE 6

## MEAN NUMBER OF dft,\* AND DMFT† AND PERCENTAGE OF DECAYED TEETH BY DENTITION, AGE AND POVERTY DEFINED BY SELECTED INCOME LEVEL CUTOFF POINTS.‡

INCOME LEVEL CUTOFF POINTS (% OF FPL§)	PRIMARY TEETH				PERMANENT TEETH			
	2 to 5 Years		6 to 12 Years		6 to 14 Years		15 to 18 Years	
	dft (SE**)	% d/dft†† (SE)	dft (SE)	% d/dft (SE)	DMFT (SE)	% D/DMFT†† (SE)	DMFT (SE)	% D/DMFT (SE)
<b>At or below 100</b>	1.49 (0.2)	78.8 (3.6)	2.30 (0.1)	51.3 (4.1)	1.08 (0.1)	40.5 (3.1)	3.69 (0.3)	26.0 (2.7)
<b>Above 100</b>	0.76 (0.1)	65.7 (3.3)	1.39 (0.1)	30.3 (2.1)	1.01 (0.1)	19.5 (2.2)	3.54 (0.2)	14.3 (1.8)
<b>At or below 133</b>	1.56 (0.2)	77.5 (3.3)	2.15 (0.1)	48.7 (3.7)	1.02 (0.1)	39.6 (2.5)	4.03 (0.3)	28.2 (3.4)
<b>Above 133</b>	0.63 (0.1)	63.4 (3.6)	1.34 (0.1)	28.7 (2.4)	1.03 (0.1)	17.8 (2.1)	3.38 (0.2)	12.0 (1.5)
<b>At or below 150</b>	1.51 (0.2)	77.6 (3.2)	2.15 (0.1)	46.5 (3.7)	1.07 (0.1)	37.9 (2.5)	3.97 (0.2)	26.9 (3.1)
<b>Above 150</b>	0.60 (0.1)	61.7 (3.9)	1.29 (0.1)	28.7 (2.7)	1.00 (0.1)	16.8 (2.5)	3.37 (0.2)	11.6 (1.6)
<b>At or below 200</b>	1.44 (0.1)	77.2 (2.8)	2.04 (0.1)	44.3 (2.9)	1.11 (0.1)	35.1 (2.2)	3.90 (0.2)	24.1 (2.5)
<b>Above 200</b>	0.43 (0.1)	54.7 (4.6)	1.21 (0.1)	26.7 (3.0)	0.95 (0.1)	14.0 (2.4)	3.31 (0.2)	10.8 (1.6)
<b>At or below 250</b>	1.30 (0.1)	77.3 (2.7)	1.92 (0.1)	41.3 (2.6)	1.08 (0.1)	32.9 (2.0)	3.68 (0.2)	23.2 (2.3)
<b>Above 250</b>	0.39 (0.1)	47.5 (5.3)	1.14 (0.1)	26.8 (3.4)	0.95 (0.1)	12.2 (2.6)	3.43 (0.2)	8.5 (1.7)
<b>At or below 300</b>	1.19 (0.1)	74.4 (3.0)	1.81 (0.1)	39.4 (2.3)	1.08 (0.1)	30.3 (1.9)	3.78 (0.3)	21.7 (2.1)
<b>Above 300</b>	0.31 (0.1)	45.0 (6.2)	1.06 (0.1)	26.4 (3.8)	0.89 (0.1)	8.6 (2.6)	3.12 (0.2)	6.5 (1.5)

\* dft: Decayed and filled primary teeth.  
† DMFT: Decayed, missing and filled permanent teeth.  
‡ Source: Third National Health and Nutrition Examination Survey, 1988–1994.  
§ FPL: Federal poverty line.  
\*\* SE: Standard error.  
†† Percentage of dft or DMFT represented by decayed teeth.

ected to some degree by the time they reach adulthood. Perhaps, more importantly, these data indicate that children from lower-income households are more likely to experience caries and have higher levels of untreated caries compared with their more economically advantaged counterparts.

Our findings concerning the high levels of untreated caries in children indicate that children entering new CHIP programs or enrolling in Medicaid will bring a burden of untreated illness that will need to be addressed in terms of access to dental providers. Fiscal re-

sources for comprehensive dental treatment (as opposed to just screening and preventive services) also will need to be addressed. Collectively, children from low-income households who might become enrolled in Medicaid and CHIP programs are at a higher risk of developing dental caries and may require a more intensive mix of services to meet their dental needs compared with their more economically advantaged counterparts.

Of considerable concern is the observation that among children at or below 100 percent of the FPL, nearly 80 percent of

decayed primary teeth have not been restored in 2- to 5-year-old children, and 40 to 50 percent of decayed primary and permanent teeth have not been restored in 6- to 12-year-old children and 6- to 14-year-old children, respectively. This observation emphasizes the need to provide children living in poverty with basic dental restorative services—such as amalgam and resin restorations and prefabricated stainless steel crowns—and to halt the caries process in already affected teeth and, thereby, prevent more serious adverse sequelae such as severe pain and infec-



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tion. These findings also serve to alert CHIP and Medicaid planners to the substantial unmet treatment needs among the youngest low-income children who may require special treatment considerations—such as sedation or general anesthesia—as an adjunct to accomplish dental treatment.

While this is not an unexpected finding given other research,<sup>1,5</sup> our analyses confirmed that African-American and Mexican-American children were about twice as likely to experience caries and had higher levels of untreated caries than their non-Hispanic white counterparts. We hope that these differences will stimulate research aimed at identifying the determinants of oral health status in different segments of the pediatric population and developing innovative interventions to prevent or reduce caries in high-risk groups.

The findings of this study are

subject to several limitations associated with the nature of survey examinations. First, the oral examination did not include radiographs to detect interproximal caries; thus, the reported caries levels are almost certainly underestimates of the true prevalence. Second, the criteria used for survey examination were more conservative than were the criteria used for diagnosis in clinical practice.<sup>10</sup> These limitations related to the examination protocol did not bias our results, as they apply to all children examined in the survey.

#### CONCLUSION

For state planning and budgeting purposes, state-specific data describing unmet dental care needs, utilization and associated costs provide critical planning tools. Although national data may not mirror conditions in specific states, results from NHANES III indicate that there is a higher percentage of children with unmet treatment needs when poverty is defined using lower income level cutoff points. Similar assessments using state data may help identify the definition of poverty at which available resources and cost of programs are in balance. ■

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