



Survey of Oral Health Status of Maryland Schoolchildren, 2000-2001

Mark D. Macek, DDS, DrPH Mark L. Wagner, DMD Harry S. Goodman, DDS, MPH
Michael C. Manz, DDS, MPH Ilise D. Marrazzo, MPH

*Dr. Macek is assistant professor, Department of Oral Health Care Delivery, Dr. Goodman is associate professor, Department of Pediatric Dentistry, Dr. Wagner is Director of Health and Research, Special Olympics, Inc, and professor emeritus, Baltimore College of Dental Surgery Dental School, University of Maryland, Baltimore, Md; Dr. Manz is senior research associate in health sciences, Department of Cariology, Restorative Sciences and Endodontics, School of Dentistry, University of Michigan, Ann Arbor, Mich; Dr. Marrazzo is acting director, Office of Oral Health, Maryland Department of Health and Mental Hygiene, Baltimore, Md.
Correspond with Dr. Macek at mdm002@dental.umaryland.edu*

Abstract

Purpose: The purpose of this study was to describe dental caries experience in the primary and permanent dentitions of Maryland schoolchildren in kindergarten and third grade, with an emphasis on untreated disease.

Methods: Data came from the *Survey of the Oral Health Status of Maryland Schoolchildren, 2000-2001*. Outcome variables were measures of dental caries experience for primary and permanent teeth. Dental caries was scored only for lesions that were >0.5 mm, measured with a periodontal probe. Radiographs were not used. Descriptor variables included grade level, gender, race/ethnicity, eligibility for free or reduced meals at school, parent/guardian education, dental insurance status, and region. The statistical software program SUDAAN was used to produce weighted estimates and account for the complex sampling design.

Results: More than 2 in 10 schoolchildren had a history of dental caries. In children with a history of disease, approximately half of the experience was due to untreated decay. Controlling for confounders, disparities in untreated dental caries were significantly associated with region, race/ethnicity, and parent/guardian education.

Conclusions: Success in meeting the dental caries treatment needs in children will require attention to multiple family-level, community-level, and system-level barriers, especially among low socioeconomic status populations. Unless barriers are overcome, dental caries disparities will continue in Maryland. (*Pediatr Dent.* 2004;26:329-336)

KEYWORDS: CHILDREN, DENTAL CARIES, EPIDEMIOLOGY, HEALTH SURVEY, MARYLAND

Received July 14, 2003 Revision Accepted January 2, 2004

The prevalence of dental caries among children in the United States has declined dramatically during the last few decades.¹⁻³ Although some researchers^{4,5} suggest that the decline has leveled off in recent years, particularly for the primary dentition, all agree that the prevalence of disease in the United States is much lower today than it was 30 years ago. Despite the dramatic decline in prevalence across the general population, some groups remain more likely to experience dental caries than other groups. For example, children with low socioeconomic status (SES) and children from certain race/ethnicity groups have higher mean dental caries experience scores than do their counterparts.⁶

Researchers use the decayed and filled index (df), and decayed, missing, and filled index (DMF) to measure dental caries experience in primary and permanent teeth, respectively. These indices provide information regarding level of active disease, history of prior treatment, and utilization of oral health care services. While the “decayed” component of these indices may be only somewhat useful for estimating treatment need,⁷ it does represent a measure of access to care, as well as the level of health knowledge and attitudes toward health in a population.

Untreated dental caries in children may lead to infection, pain, and lost school productivity—both in terms of lost school days and reduced concentration in school.

It might also be a nidus for pathogenic bacteria that could infect other teeth in the mouth and lead to spread of disease. Bluntly stated, untreated dental caries is dental caries neglected. The existence of untreated dental caries in a child indicates that he or she either did not seek treatment or did not receive treatment. Likewise, disparities in the amount of untreated dental caries in a population indicate that specific groups either did not seek treatment or did not receive treatment. Identifying the disparate children and/or population groups would help policymakers and public health professionals allocate limited resources to those most in need. In these times of limited public health budgets, lower dental insurance benefits, and uncertain economic outlooks, being able to allocate resources according to need is essential.

The purpose of this investigation is to describe dental caries experience in the primary and permanent dentitions for Maryland public schoolchildren in kindergarten and third grade, with emphasis on untreated dental caries. Although findings are specific to Maryland, results will be useful to practitioners and policy makers throughout the United States who must allocate limited health promotion resources across child populations.

Methods

The data for this investigation came from the *Survey of the Oral Health Status of Maryland School Children, 2000-2001* (Maryland Survey 2000-2001), a representative, cross-sectional survey with oral screening and health questionnaire components. The oral screening component consisted of tooth-specific and tooth surface-specific dental caries assessments, as well as an overall treatment need appraisal, and evaluations of dental sealants and fluorosis. The health questionnaire component consisted of a 15-question instrument completed by parents/guardians, documenting dental visit and tooth cleaning histories, existence of a usual source of medical and dental care, history of tooth pain, dental insurance, and a variety of demographic and SES items. The Maryland Survey 2000-2001 was administered to a representative sample of Maryland public schoolchildren from kindergarten, third grade, ninth grade, and 10th grade during the 2000-2001 academic year.

Sample design

Maryland Survey 2000-2001 used a 2-stage sampling design to select the study sample. At the first stage, for the kindergarten and third grade, 50 elementary schools were selected from 5 geographic regions in the state, according to a probability-proportional-to-size (PPS) sampling design. Implicit stratification was employed to ensure a good geographic distribution of sample schools through systematic PPS selection from a list of schools ordered geographically by county within geographic region, and by city (and zip code within larger cities). The PPS design allowed schools with larger enrollments to have a greater chance of being selected into the study. These differing probabilities in the first selection stage

were offset by selecting a set number of classrooms during the second selection stage.

At the second stage, 2 kindergarten and 2 third-grade classrooms were randomly selected from all such classrooms at the selected schools. All students present in the selected classrooms were recruited for the survey. Two refusing schools were replaced using a PPS method of selecting a replacement school from the same sampling interval in the sampling frame as the refusing school.

In Maryland, schools are administered at the county level, making the collection of schools within a county equivalent to a school district. Two of the 24 counties in Maryland chose not to participate in the Maryland Survey 2000-2001, because they did not want to take time away from the curriculum. As such, the study sample was representative of kindergarten and third-grade public schoolchildren in 22 of the 24 Maryland counties across the 5 geographic regions of the state.

Data collection and management

Seven carefully trained, calibrated, and licensed dentists conducted the oral screening component of the Maryland Survey 2000-2001. An assistant/data recorder accompanied each dentist. Oral screenings took place at the sampled schools in a designated area. Each dentist used a portable dental chair and light source. Screenings were completed with disposable, nonmagnifying dental mirrors, Community Periodontal Index of Treatment Needs (CPITN) or Periodontal Screening and Recording (PSR) type periodontal probes with a 0.5 mm ball at the tip, mouth masks, and vinyl gloves. Each dentist used a modification of established criteria⁸ for dental caries detection; the tip of the periodontal probe was used to determine whether carious lesions were of sufficient size to warrant scoring as "caries." Screeners did not use radiographs to identify dental caries.

The assistant/data recorders entered the dental caries data directly into a Microsoft Access data entry software program for portable computers designed specifically for this investigation. Data recorders transferred the health questionnaire data into an Epi-Info software program.⁹ The health questionnaire and oral screening data were merged via a unique personal identifier assigned to each sample child. Personal identifiers were removed from the combined data once the datasets were merged.

Sample schoolchildren received a toothbrush for their participation along with a screening report card that described the oral findings in terms of treatment need (immediate treatment necessary, treatment necessary in due course, no treatment necessary). Sample schools received an incentive of \$100 for their participation.

Study variables

The main outcome variables were prevalence of caries-free children and prevalence of unrestored dental caries in the primary and permanent dentitions (dt+DT). Additional outcome variables included mean number of decayed primary

and permanent teeth (dt+DT), filled primary and permanent teeth (ft+FT), and the sum of decayed and filled primary teeth plus the sum of decayed, missing, and filled permanent teeth (dft+DMFT).

Descriptor variables included grade level (kindergarten, third grade), gender, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, other/unknown), eligibility for free or reduced-cost meals at school (eligible, ineligible), parent/guardian level of education (less than 12th grade, 12th grade, some college or college graduate), dental insurance status (private, Medicaid or SCHIP, no insurance), and geographic region (western, central DC, southern, central Baltimore, eastern shore). The western region included 4 counties, Central DC region included 3, southern region included 3, eastern shore region included 8, and central Baltimore region included 3 counties and the city of Baltimore. Of the 2 counties that chose not to participate in the Maryland Survey 2000-2001, 1 came from the southern region and 1 from the eastern shore region.

Analysis

The SAS statistical software program for Windows¹⁰ was used to combine the oral screening and health questionnaire data, to clean the combined data, and recode outcome and descriptor variables. The SAS-callable SUDAAN statistical software program for Windows¹¹ was used to produce univariate, bivariate, and multivariate estimates, because this software program accounted for the complex, multistage sample design when deriving population estimates, standard errors, and confidence intervals. Probability values (*P* values) <.05 were considered to be statistically significant in all analyses.

Analysis was restricted to children in kindergarten and third grade. Children with “unknown” parent/guardian level of education (N=121), “unknown” dental insurance status (N=168), “unknown” presence of a usual source of dental care (N=125), and “unknown” dental visit history (N=83) were not included in the analysis due to small sample sizes across these subcategories. The final sample for this investigation included 2,309 children, representing 105,168 kindergarten and third-grade public schoolchildren in Maryland. The overall response rate for the study sample was 52%.

Consent and confidentiality

The procedures, possible discomforts or risks, and possible benefits were explained fully to the human subjects involved, and their informed consent (and assent for children 13 years of age or older) was obtained prior to the investigation. The Institutional Review Boards for the University of Maryland Dental School and Maryland Department of Health and Mental Hygiene reviewed and approved all aspects of this investigation, as did the Maryland Department of Education and individual school districts.

Results

Table 1 describes the final sample for this investigation. More than 78% of sample children came from the central Baltimore or central DC regions—the most populous regions in Maryland. There were approximately equal distributions of kindergarten and third-grade sample children, as well as equal distributions of boys and girls. The vast majority of the sample was non-Hispanic white, and about 7% of the sample was Hispanic. Approximately 66% of the sample was eligible for free or reduced meals at school, and slightly more than 71% of the sample children came from households having a parent or guardian with greater than 12 years of education. About 63% of the sample had private dental insurance, and approximately 16% had no dental insurance. Nearly 21% of sample schoolchildren had dental benefits via Medicaid or Maryland’s version of the State Children’s Health Insurance Program (MCHP).

Table 2 describes the prevalence of caries-free kindergarten and third-grade schoolchildren across selected characteristics. Overall, 78% of schoolchildren were caries free. The population subgroups with the lowest percentages of caries-free children were those who resided in the eastern shore region, in third grade, boys, Hispanic children, eligible for free or reduced meals at school, whose parent or guardian had 12 years of education or less, and those with Medicaid or MCHP dental insurance coverage.

Table 3 lists the mean number of dt+DT, ft+FT, and dft+DMFT for all schoolchildren, as well as for those with a positive history of dental caries (dft+DMFT>0). Overall, kindergarten and third-grade public schoolchildren in Maryland had 0.6 dt+DT, 0.6 ft+FT, and 1.2 dft+DMFT, per child. Sample children who lived in the western region and those ineligible for free or reduced meals at school had the lowest dft+DMFT (0.9), and those who lived in the eastern shore region and Hispanic children had the highest dft+DMFT (2). On average, approximately 50% of the dft+DMFT among all kindergarten and third graders was due to untreated disease (dt+DT).

Table 3 also shows that, overall, the kindergarten and third-grade schoolchildren with a positive history of dental caries had 1.7 dt+DT, 1.6 ft+FT, and 3.4 dft+DMFT, per child. Children with a dft+DMFT>0 who lived in the western region had the lowest dft+DMFT (2.8), and Hispanic children had the highest dft+DMFT (4.3). For children with dft+DMFT>0, approximately 50% of the dft+DMFT was due to untreated disease (dt+DT).

Table 4 shows the unadjusted and adjusted odds ratios for unrestored dental caries in the primary and permanent dentitions (dt+DT) among kindergarten and third-grade public schoolchildren in Maryland. Controlling for other variables in the model, region, grade level, race/ethnicity, and parent/guardian level of education were significantly associated with dt+DT. Specifically, compared with schoolchildren who lived in the southern region, all other children were significantly

Table 1. Sample Distribution, Including Sample Size, Percentage, Weighted Population Size, and Weighted Percentage, Maryland 2000-2001 (N=2,309)*

Characteristic	Sample size	Weighted Percentage	Weighted population	Percentage (%)
Overall	2,309	100	105,168	100
Region				
I–Western	171	7	10,868	10
II–Central DC	886	38	37,909	36
III–Southern	174	8	6,885	7
IV–Central Baltimore	934	41	42,498	40
V–Eastern shore	144	6	7,008	7
Grade level				
Kindergarten	1,191	52	47,360	44
Third grade	1,118	48	57,808	56
Gender				
Boys	1,179	51	53,102	51
Girls	1,130	49	52,066	49
Race/ethnicity				
Non-Hispanic white	1,331	58	54,170	52
Non-Hispanic black	659	29	37,525	36
Hispanic	152	7	6,140	6
Other/unknown	167	7	7,333	7
Free or reduced meals				
Eligible	639	28	35,222	34
Ineligible	1,532	66	63,437	60
Unknown	138	6	6,509	6
Parent/guardian education				
Less than 12 years	134	6	6,808	7
12 years	526	23	25,921	25
Greater than 12 years	1,649	71	72,439	69
Dental insurance status				
Private	1,460	63	63,661	61
Medicaid/MCHP	482	21	25,433	24
No insurance	367	16	16,074	15

*Source: Survey of the Oral Health Status of Maryland Schoolchildren, 2000-2001. Note: Children with unknown parent/guardian education, dental visit history, usual source of dental care, and dental insurance status are excluded from the analysis.

more likely to have unrestored dental caries. Compared with kindergarten children, third graders were significantly more likely to have untreated disease. Compared with non-Hispanic white children, non-Hispanic black students were significantly more likely to have untreated dental caries. Compared with schoolchildren whose parent or guardian had greater than 12 years of education, children whose parent or guardian had less education were significantly more likely to have untreated dental caries. Note that the eligibility for free or reduced meals at school variable was removed from the multivariate model,

sample schoolchildren were more likely to be ineligible for free or reduced meals at school, come from a home with greater than 12 years of education, and to have private dental insurance than was the state's actual population.¹⁶

National data have shown that Hispanics have a higher prevalence of disease than do non-Hispanic white children.⁶ In this investigation, the effect of having a higher-than-expected proportion of Hispanics probably caused the ratio of untreated dental caries to overall dental caries experience to be higher, as Maryland Survey 2000-2001 findings were

because it was highly correlated with the parent/guardian level of education and dental insurance status variables.

Discussion

Regarding children, some have argued that dental caries may no longer be pandemic in the United States,^{12,13} as disease prevalence has declined and dental caries has become increasingly concentrated in a small subgroup of the total population.¹⁴ Results from the Maryland Survey 2000-2001 gave additional evidence of this trend. Overall, the findings showed that dental caries in the primary and permanent dentitions was relatively uncommon, as almost 78% of Maryland's kindergarten and third-grade public schoolchildren were caries free. In addition, only 1.2 primary and permanent teeth were decayed or filled, on average, per child.

These findings might have been influenced by a few study limitations. The first limitation was that the response rate for the study sample was relatively low, and this low rate was not distributed evenly across population subgroups. For example, census statistics¹⁵ for Maryland suggested that the Maryland 2000-2001 sample had a higher proportion of Hispanic (7% vs 4%) participants, and a lower proportion of non-Hispanic white (58% vs 64%) participants than existed in the state's actual population. In addition,

Table 2. Weighted Prevalence of Caries-free Public Kindergarten and Third-grade Schoolchildren, Maryland 2000-2001 (N=2,309)*

Characteristic	Percentage (%)	95% CI
Overall	78	74-82
Region		
I-Western	80	70-90
II-Central DC	78	73-82
III-Southern	92	91-94
IV-Central Baltimore	78	71-84
V-Eastern shore	63	46-81
Grade level		
Kindergarten	81	76-85
Third grade	76	71-80
Gender		
Boys	77	72-81
Girls	79	75-83
Race/ethnicity		
Non-Hispanic white	82	78-87
Non-Hispanic black	73	67-79
Hispanic	70	61-79
Other/unknown	76	69-82
Free or reduced meals		
Eligible	68	62-74
Ineligible	84	81-88
Unknown	70	60-80
Parent/guardian education		
Less than 12 years	64	56-73
12 years	68	62-74
Greater than 12 years	83	80-85
Dental insurance status		
Private	82	79-86
Medicaid/MCHP	71	64-77
No insurance	72	66-79

*Source: Survey of the Oral Health Status of Maryland School Children, 2000-2001. Note: Children with unknown parent/guardian education, dental visit history, usual source of dental care, and dental insurance status are excluded from the analysis. 95% CI=95% confidence interval.

higher than national estimates for children ages 6 to 12 years⁶ (% d/dft Maryland Survey=50% vs % d/dft-national estimates=37%).

Numerous studies¹⁷ also have shown that there is an inverse relation between poverty status and dental caries experience and an inverse relation between the presence of private dental insurance and dental caries experience. In this investigation, the effect of having a higher-than-expected proportion of high SES participants probably caused the

overall dental caries experience estimates to be lower, as Maryland Survey 2000-2001 dft findings were lower than national estimates for children ages 6 to 12 years⁶ (dft Maryland Survey=1 vs dft national estimates=1.6). Although the survey data were weighted to account for sample design factors and response rates, the sample weights used in the analysis may not have accounted completely for differences between the sample and target population, in terms of race/ethnicity and SES.

The second limitation was that conservative criteria were used to identify dental caries, in that visual identification of dental caries was employed, only lesions greater than 0.5 mm (as measured by a periodontal probe) were considered carious, and the study did not use radiographs. Consequently, it is likely that the Maryland Survey 2000-2001 underestimated the true amount of dental caries in the sample schoolchildren; however, since this investigation used scoring criteria that were similar to those employed in national surveys, this limitation probably did not cause the Maryland Survey 2000-2001 results to differ from national findings.

These limitations notwithstanding, this investigation had a number of important strengths. For example, the survey employed standard examination protocol and established scoring criteria in the oral screening component, which allowed for meaningful comparisons with other standard surveys of dental caries experience. In addition, the investigation used multivariate analysis, which provided estimates that controlled for potential confounding and the inter-relation of descriptor variables.

Although the Maryland Survey 2000-2001 gave additional evidence that overall dental caries experience may no longer be pandemic among US children, the Maryland Survey 2000-2001 also showed that untreated dental caries made up a substantial proportion of disease experience among those with a positive history of dental caries. For example, about 50% of dft+DMFT was due to untreated dental caries, on average, per child. This statistic represented an average of approximately 0.6 untreated primary and permanent teeth per child for the whole population, and 1.7 untreated primary and permanent teeth per child for those with a positive history of dental caries.

Extrapolating these findings to the state, the Maryland Survey 2000-2001 showed that, among kindergarten and third-grade public schoolchildren, there were approximately 63,100 primary and permanent teeth with active disease. If one were to consider these statistics in terms of the percentage of primary and permanent teeth that were untreated per child, and given that kindergarten and third-grade children have between 20 and 24 primary and permanent teeth in their mouths, the Maryland Survey 2000-2001 showed that approximately 3% of erupted teeth exhibited active disease per child, for the whole population, and 7% to 9% of erupted teeth exhibited active disease per child for those with a positive history of dental caries. Clearly, these statistics would have been considerably higher 30 years ago and Maryland has made great strides toward

reducing the burden of dental caries in recent decades. However, these statistics are far from inconsequential today and still represent a serious public health problem.

This investigation also showed that active disease was not evenly distributed across the population of kindergarten and third-grade public schoolchildren. Underprivileged children and those from certain geographic regions were 1.3 to 6 times as likely to have unrestored dental caries as were schoolchildren with higher SES or those from the southern region of the state. The association between SES and unrestored dental caries was not surprising. In their review of the literature, Reisine and Psoter¹⁸ concluded that there was strong evidence for an inverse association between SES and dental caries experience, especially for children younger than 12 years.

The explanation for this inverse relationship is complex and likely a combination of many factors. For example, studies have shown that low-SES children make fewer visits to a dentist than their high-SES counterparts.^{19,20} In addition, parents/guardians with a low SES might not fully appreciate and/or comprehend the importance of good oral health^{21,22} or health in general,^{23,24} which could translate into less attention paid to preventive behaviors.

The association between region and unrestored dental caries did not meet expectations. The southern region exhibited the lowest levels of untreated dental caries; however 2 of the 3 counties in this region had low-SES profiles. By contrast, the central Baltimore region exhibited the greatest levels of untreated dental caries. However, this region had substantial pockets of high-SES populations. These variations should be examined further. In addition, several counties and subregions had only a limited number of dentists who were accepting Medicaid and/or MCHP patients into their practices. Future investigations should look at county-level comparisons and should de-

Table 3. Weighted Mean Number of Decayed Primary and Permanent Teeth, Filled Primary and Permanent Teeth, and Decayed and Filled Primary Teeth Plus Decayed, Missing, and Filled Permanent Teeth Among Public Kindergarten and Third-grade Schoolchildren, Maryland, 2000-2001*

Characteristic	All children (N=2,309)			Children with dft+DMFT>0 (N=782)		
	dt+DT	ft+FT	dft+DMFT	dt+DT	ft+FT	dft+DMFT
Overall	0.6	0.6	1.2	1.7	1.6	3.4
Region						
I—Western	0.5	0.4	0.9	1.6	1.3	2.9
II—Central DC	0.6	0.5	1.1	1.7	1.4	3.3
III—Southern	0.2	0.9	1.1	0.4	2.3	2.8
IV—Central Baltimore	0.6	0.6	1.3	1.7	1.8	3.6
V—Eastern shore	1.3	0.6	2	2.5	1.1	3.9
Grade level						
Kindergarten	0.6	0.4	1	2.3	1.3	3.6
Third grade	0.6	0.8	1.4	1.3	1.8	3.3
Gender						
Boys	0.6	0.6	1.2	1.7	1.5	3.4
Girls	0.5	0.6	1.2	1.6	1.7	3.4
Race/ethnicity						
Non-Hispanic white	0.4	0.5	1	1.3	1.7	3.2
Non-Hispanic black	0.7	0.5	1.3	1.9	1.4	3.3
Hispanic	1.2	0.8	2	2.5	1.6	4.3
Other/unknown	0.8	0.9	1.7	1.9	2	4
Free or reduced meals						
Eligible	0.9	0.6	1.6	2.1	1.4	3.6
Ineligible	0.4	0.5	0.9	1.2	1.8	3.2
Unknown	0.9	0.7	1.6	2.2	1.6	3.8
Parent/guardian education						
Less than 12 years	1.1	0.7	1.8	2.3	1.4	3.8
12 years	1	0.6	1.7	2.3	1.3	3.8
Greater than 12 years	0.4	0.6	1.0	1.3	1.8	3.1
Dental insurance status						
Private	0.4	0.5	1	1.4	1.8	3.3
Medicaid/MCHP	0.8	0.7	1.5	1.9	1.5	3.5
No insurance	0.9	0.5	1.5	2.2	1.3	3.7

*Source: Survey of the Oral Health Status of Maryland Schoolchildren, 2000-2001. Note: Children with unknown parent/guardian education, dental visit history, usual source of dental care, and dental insurance status are excluded from the analysis.

scribe the relation between untreated dental caries and a dentist-to-population ratio that takes into consideration willingness to see low-SES, Medicaid, and MCHP patients.

While the bivariate association between dental insurance status and unrestored dental caries was statistically significant, it was somewhat surprising to find that dental insurance was not significantly associated with unrestored dental caries, controlling for other variables in the model. Multivariate analysis showed that education, regional variations, and race/ethnicity overshadowed the relation

between dental insurance and active disease. Some support for these findings exists in the literature. Manski and colleagues²⁵ showed private dental insurance had a statistically significant relation with dental visits at the bivariate level. However, Ismail and Sohn²⁶ showed having access to a universal, publicly funded dental insurance program had less influence on the dental caries experience of Canadian children than did education level, dental visit practices, and other oral health behaviors in a multivariate model.

The implication of these findings is that merely providing dental insurance coverage may not be sufficient to reduce disparities in oral health status. Rather, success in meeting the unrestored dental caries treatment needs in children likely would require attention to multiple family-level, community-level, and system-level barriers,²⁰ especially among low-SES populations. While a thorough discussion of these issues is not the focus of this manuscript, qualitative and formative research is clearly needed to understand them. Unless these barriers are overcome, disparities in unrestored dental caries and other unmet need will continue in Maryland and throughout the United States.

Conclusions

1. More than 2 of 10 Maryland kindergarten and third grade public schoolchildren had a history of dental caries. Boys, those eligible for free or reduced meals at school, non-Hispanic blacks and Hispanics, children of parents or guardians with 12 years of education or less, and those without private dental insurance were most likely to have experienced dental caries in their lifetime.
2. Approximately half of the dental caries experience in Maryland kindergarten and third grade public schoolchildren was due to untreated disease.
3. Controlling for other sociodemographic factors, untreated dental caries in Maryland was significantly

Table 4. Unadjusted and Adjusted Odds Ratios for Unrestored Dental Caries in Primary and Permanent Teeth Among Public Kindergarten and Third Grade Schoolchildren, Maryland 2000-2001 (N=2,309)*

Characteristic	Unadjusted		Adjusted	
	Odds ratio	95% CI	Odds ratio	95% CI
Region				
I–Western	3	1.5–5.7	3	1.7–5.1
II–Central DC	3.4	2.4–4.7	2.7	1.9–3.8
V–Eastern shore	3.4	2.2–5.1	2.6	1.9–3.5
IV–Central Baltimore	6.8	3.1–14.9	6	3.2–11.4
III–Southern	Reference	—	Reference	—
Grade level				
Third grade	1.3	1–1.8	1.3	1–1.8
Kindergarten	Reference	—	Reference	—
Gender				
Boys	1.1	0.9–1.5	1.2	0.9–1.5
Girls	Reference	—	Reference	—
Race/ethnicity				
Other/unknown	1.5	1–2.3	1.6	1–2.4
Hispanic	2	1.1–3.5	1.6	0.9–2.7
Non-Hispanic black	1.7	1.2–2.6	1.6	1–2.3
Non-Hispanic white	Reference	—	Reference	—
Free/reduced meals				
Unknown	2.3	1.4–3.7	Removed due to correlations with	
Eligible	2.5	1.7–3.5	parent/guardian education and	
Ineligible	Reference	—	dental insurance status	
Parent/guardian education				
Less than 12 years	2.7	1.8–4	2	1.2–3.4
12 years	2.3	1.8–2.9	1.9	1.5–2.5
Greater than 12 years	Reference	—	Reference	—
Dental insurance status				
No insurance	1.8	1.2–2.5	1.4	1–1.9
Medicaid/MCHP	1.9	1.3–2.7	1.2	0.9–1.8
Private	Reference	—	Reference	—

*Source: Survey of the Oral Health Status of Maryland Schoolchildren, 2000-2001. Note: Children with unknown parent/guardian education, dental visit history, usual source of dental care, and dental insurance status are excluded from the analysis.

Statistically significant odds ratios at $P < .05$ level are listed in **bold**. 95% CI=95% confidence interval.

4. Results likely underestimated the true dental caries experience and true prevalence of unrestored dental caries, because radiographs were not used during the scoring of disease, only lesions >0.5 mm (measured via periodontal probe) were scored as dental caries, and the study sample had a higher SES and was more likely to have dental insurance than the target population of Maryland schoolchildren.

- Given the existence of some study limitations, the results of this investigation likely represent the most conservative estimate of the true problems faced by elementary schoolchildren in Maryland.

Acknowledgements

The Maryland Survey 2000-2001 was funded by the Maryland Department of Health and Mental Hygiene. The opinions contained in this investigation are those of the authors and do not necessarily represent the opinions of the funding agency.

References

- US Department of Health and Human Services. National Institutes of Health. National Institute of Dental Research. *The prevalence of dental caries in United States children, 1979-80*. NIH Publ No. 82-2245. Washington, DC: Government Printing Office; 1981.
- US Department of Health and Human Services. National Center for Health Statistics. *Decayed, missing, and filled teeth among persons 1-74 years, United States 1971-1974*. DHHS Publ No. (PHS) 81-1678, Series 11 No 223. Washington, DC: Government Printing Office; 1981.
- US Department of Health and Human Services. National Institutes of Health. National Institute of Dental Research. *Oral health of United States children*. NIH Publ No. 89-2247. Washington, DC: Government Printing Office; 1989.
- Burt BA. Trends in caries prevalence in North American children. *Int Dent J*. 1994;44(suppl 1):403-413.
- Kaste LM, Selwitz RH, Oldakowski RJ, Brunelle JA, Win DM, Brown LJ. Coronal caries in the primary and permanent dentition of children and adolescents 1-17 years of age: United States, 1988-1991. *J Dent Res*. 1996;75(special issue):631-641.
- Vargas CM, Crall JJ, Schneider DA. Socio-demographic distribution of pediatric dental caries: NHANES III, 1988-1994. *J Am Dent Assoc*. 1998;129:1229-1238,1526.
- Burt BA, Eklund SE. Measuring dental caries. In: *Dentistry, Dental Practice, and the Community*. 5th ed. Philadelphia: WB Saunders; 1999:178-184.
- US Department of Health and Human Services. National Institutes of Health. National Institute of Dental Research. *Oral health surveys of the National Institute of Dental Research. Diagnostic criteria and procedures*. NIH Publ No. 91-2870. Washington, DC: Government Printing Office; 1991.
- Dean AG, Dean JA, Coulombier D, Burton AH, Brendel KA, Smith DC, Dicker RC, Sullivan KM, Fagan RF. *Epi Info, version 6. A word processing, database, and statistics program for public health on IBM-compatible microcomputers*. Atlanta: Centers for Disease Control and Prevention; 1995.
- SAS Institute, Inc. The SAS system for Windows. Release 8.0. Cary, NC: SAS Institute, Inc; 1999.
- Research Triangle Institute. SUDAAN. Release 8.0. Software for the statistical analysis of correlated data. Research Triangle Park, NC: Research Triangle Institute; 1998.
- Brown LJ, Wall TP, Lazar V. Trends in total caries experience: Permanent and primary teeth. *J Am Dent Assoc*. 2000;131:223-231.
- Brown LJ, Wall TP, Lazar V. Trends in untreated dental caries in primary teeth of children 2 to 10 years old. *J Am Dent Assoc*. 2000;131:93-100.
- Anderson M. Risk assessment and epidemiology of dental caries: Review of the literature. *Pediatr Dent*. 2002;24:377-385.
- US Census Bureau. United States Census 2000. Census 2000 data for the state of Maryland. Available at: <http://www.census.gov/census2000/states/md.html>. Accessed April 21, 2003.
- Manski RJ, Macek MD, Moeller JF. Private dental coverage: Who has it and how does it influence dental visits and expenditures? *J Am Dent Assoc*. 2002;133:1551-1559.
- Edelstein BL. Disparities in oral health and access to care: Findings of national surveys. *Ambul Pediatr*. 2002;2(suppl 2):141-147.
- Reisine ST, Psoter W. Socioeconomic status and selected behavioral determinants as risk factors for dental caries. *J Dent Educ*. 2001;65:1009-1016.
- Edelstein BL, Manski RJ, Moeller JF. Pediatric dental visits during 1996: An analysis of the federal Medical Expenditure Panel Survey. *Pediatr Dent*. 2000;22:17-20.
- Edelstein BL. Access to dental care for Head Start enrollees. *J Pub Health Dent*. 2000;60:221-229,230-232.
- Chavers LS, Gilbert GH, Shelton BJ. Racial and socioeconomic disparities in oral disadvantage, a measure of oral health-related quality of life: 24-month incidence. *J Pub Health Dent*. 2002;62:140-7.
- Skaret E, Milgrom P, Raadal M, Grembowski D. Factors influencing whether low-income mothers have a usual source of dental care. *J Dent Child*. 2001;68:136-139.
- Esser-Stuart JE, Lyons MA. Barriers and influences in seeking health care among lower income minority women. *Soc Work Health Care*. 2002;35:85-99.
- Behera SK, Winkleby MA, Collins R. Low awareness of cardiovascular disease risk among low-income African-American women. *Am J Health Promot*. 2000;14:301-305,iii.
- Manski RJ, Edelstein BL, Moeller JF. The impact of insurance coverage on children's dental visits and expenditures, 1996. *J Am Dent Assoc*. 2001;132:1137-1145.
- Ismail AI, Sohn W. The impact of universal access to dental care on disparities in caries experience in children. *J Am Dent Assoc*. 2001;132:295-303.