BRIEF COMMUNICATION

An Evaluation of NHANES III Estimates of Early Childhood Caries

Linda M. Kaste, DDS, MS, PhD; Thomas F. Drury, PhD; Alice M. Horowitz, PhD; Eugenio Beltran, DMD, MPH, MS, DrPH

Abstract

Objectives: *The purposes of this study were to estimate and evaluate the prevalence for the United States of early childhood caries (ECC) among children 12 to 23 months of age.* ***Methods:*** *The 1988–94 National Health and Nutrition Examination Survey (NHANES III) public-use data set was analyzed using SUDAAN. Two ECC case definitions were used. Definition #1 was restricted to the caries score called by the examiner. Definition #2 liberally included children identified by definition #1 and those possibly having questionable caries scores.* ***Results:*** *The NHANES III six-year prevalence estimates of caries in the maxillary anterior incisors of children 12 to 23 months of age were 1.0 percent for definition #1 and 1.7 percent for definition #2. Mexican-American and economically disadvantaged children were disproportionally represented with ECC.* ***Conclusions:*** *The prevalence of ECC among children 12 to 23 months of age is barely detectable at the national level. Alternative study designs and improved case definitions are needed for further advances in ECC. [J Public Health Dent 1999;59(3):198-200]*

Key Words: early childhood caries, dental caries, infant, prevalence, United States, Mexican-American, National Health and Nutrition Examination Survey III, NHANES III, estimates.

Early childhood caries (ECC) is a relatively new term that encompasses dental caries occurring in the primary dentition of young children. ECC subsumes other descriptive terms of dental caries in young children, i.e., "baby bottle tooth decay," "nursing caries," and "bottle mouth." Despite a general reduction in caries among US children, there is a high prevalence of caries, often of debilitating severity, among certain subpopulations (1).

The 1988–94 National Health and Nutrition Examination Survey Phases 1 and 2 (NHANES III) provide the opportunity for estimating national prevalences for children 12 to 23 months of age because of oversampling of children younger than 5 years of age (2). Ripa provided a national estimate of ECC prevalence of no higher than 5 percent, based on conclusions he drew from the available information (1). NHANES III–Phase 1 results were reported in an overview of childhood caries for 1988–91 (3). This paper presents a data evaluation of the ECC assessment for the full 1988–94 NHANES III database.

Methods

The data used are from the NHANES III Public Use tapes (2). Detailed descriptions are available elsewhere (2-4). Variance estimation and chi-square significance tests for the complex features of the NHANES III design were made using SUDAAN (5).

A visual, nontactile technique, referred to as a "lift the lip" caries assessment, was conducted for children 12 to 23 months of age. The children were classified into three categories: (1) no visible evidence of caries or restoration observed on the labial or approximal surfaces of any of the maxillary incisors, (2) at least one maxillary incisor showed visual evidence of caries or restoration on a labial or approximal surface, and (3) unable to be examined. No dental probing was done on these children; thus, code 3 also was used when the examiner could not distinguish between stained and carious teeth (3). Two case definitions of ECC are used in this paper: (1) restricted to the caries score as coded at examination; and (2) a liberal combination score consisting of the children with caries and those unable to be examined. We used the second definition because some children in the "unable to be examined" category, particularly those with questionable caries, probably had actual caries.

Preliminary analyses found that Mexican-American children had the highest relative frequency of ECC. Accordingly, racial-ethnic background was recoded as Mexican-American or not Mexican-American.

Economic disadvantage was measured by three indicators: being below the official poverty threshold, being below 125 percent of the official poverty threshold, and being below 200 percent of the official poverty threshold (6). The first measure—being below the official poverty threshold—classifies children as "needy" if the ratio of their family's annual income to the official poverty threshold is less than 1.0. On this official poverty index, children in families with a ratio of 1.0 or higher are classified as "not needy." Similar classifications were

Send correspondence to Dr. Kaste, Division of Dental Public Health and Oral Epidemiology, Department of Stomatology, College of Dental Medicine, Medical University of South Carolina, 173 Ashley Avenue, PO Box 250507, Charleston, SC 29425. E-mail: kastelm@musc.edu. Dr. Kaste is also affiliated with the Department of Biometry and Epidemiology, College of Medicine, and Center for Health Care Research at MUSC. Drs. Drury and Horowitz are with the Health Policy Analysis and Development Branch, National Institute of Dental and Craniofacial Research. Dr. Beltran is with the Surveillance, Investigation, Research Branch, Division of Oral Health, Centers for Disease Control and Prevention. Manuscript received: 3/2/98; returned to authors for revision: 3/26/98; accepted for publication: 2/22/99.

TABLE 1
Six-year Period Estimates of Prevalence of ECC Among Children 12–23 Months Old by Selected Characteristics According to Alternative Case Definitions of ECC: United States, 1988–94

Characteristic	All Children		Children with ECC					
			Case Definition #1*			Case Definition #2†		
	n	Estimated Population (1,000s)	% Children (SE)	% Distribution (SE)	Chi-square *P*-value	% Children (SE)	% Distribution (SE)	Chi-square *P*-value
All children	1,177	3,678	1.0 (0.3)	100.0	—	1.7 (0.4)	100.0	—
Sex					.22			.89
Male	581	1,870	0.7 (0.4)	34.4 (15.1)		1.7 (0.6)	52.6 (12.2)	
Female	596	1,808	1.3 (0.5)	65.6 (15.1)		1.6 (0.5)	47.4 (12.2)	
Mexican-American					.08			.03
Yes	387	353	3.2 (1.0)	31.4 (11.8)		4.6 (1.3)	26.9 (9.2)	
No	790	3,326	0.7 (0.3)	68.6 (11.8)		1.3 (0.4)	73.1 (9.2)	
Official poverty status					.10			.03
Below 100%	436	957	1.9 (0.8)	56.8 (17.5)		3.6 (1.2)	62.6 (13.3)	
At or above	614	2,419	0.6 (0.3)	43.2 (17.5)		0.8 (0.4)	37.3 (13.3)	
125% of official poverty					.07			.02
Below 125%	531	1,229	1.8 (0.7)	71.0 (16.4)		3.1 (0.9)	70.8 (12.7)	
At or above	519	2,148	0.4 (0.3)	29.0 (16.4)		0.7 (0.4)	29.2 (12.7)	
200% of official poverty					‡			.01
Below 200%	726	1,816	1.7 (0.6)	100 (0.0)		2.6 (0.8)	88.2 (9.9)	
At or above	324	1,561	—	—		0.4 (0.4)	11.8 (9.9)	

*Case definition #1 is caries score as called at examination.
†Case definition #2 is combination of caries and unable to examine scores. Source: NHANES III–Phases 1 and 2 (Ref. 2).
‡Chi-square not calculated due to a cell with no observations.

established for 125 percent and 200 percent of the official poverty threshold.

Results

Nearly all 12–23-month-old-children (98.3–99.0%) assessed in NHANES III had no caries experience as assessed by the "lift the lip" technique. The national prevalence estimate for caries (definition #1) in the maxillary anterior incisors of children 12 to 23 months of age from NHANES III 1988–94 was 1.0 percent (Table 1). The estimate increased to 1.7 percent when children with possible questionable calls were included in the count (definition #2). Therefore, between 36,000 and 62,000 children 12–23 months of age in the United States were estimated to have caries experience. These national estimates for ECC are derived from 19 sample children identified with ECC by case definition #1 and 30 sample children when ECC case definition #2 was applied (data not shown). Males and females were equally likely to present with caries using either definition.

Mexican-American children were 4.6 times more likely to have a caries call (definition #1) than were those from all other racial-ethnic backgrounds (3.2% vs 0.7%) and 3.5 times more likely to have a caries or unable to evaluate call (definition #2) than were their racial-ethnic counterparts (4.6% vs 1.3%) (Table 1). The caries ECC score (definition #1) was found in 0.7 percent of the white non-Hispanic and 1.2 percent of the black non-Hispanic, but was not found in children of "all other" racial-ethnic backgrounds.

Across each of the three indices of economic need, about one out of 55 (1.8%) "needy" children 12–23 months of age had ECC as indicated by case definition #1. Using definition #2, each indicator of economic neediness was related to the prevalence of ECC and was estimated to affect from about one out of 28 to 38 (2.6%–3.6%) of children across the different "needy" classifications. Only slight variations were observed in the percentage of "needy" children with any ECC across the three indices of economic neediness. The observed differences among the three definitions of economic disadvantage were accounted for by sampling variations even without taking into account two facts: (1) that these percentages of poor children with ECC were intercorrelated due to the fact that the officially "needy" were included in each index's count of the economically needy, and (2) that the second and third indices each included children with a ratio value between 1.0 and <1.25 in their respective counts of the "needy." All of the children classified as having caries (definition #1) were in families living below 200 percent of the official poverty level.

Discussion

To develop national estimates of ECC, two major issues must be addressed. First, ECC is uncommon in the general population of very young children and occurs in subpopulations (1) that come into national samples with low probabilities (7). Surveys of the general population may provide

an insufficient number of sample cases to carry out the detailed analyses that are required to advance current understanding of the nature, course, and etiology of this disease. Because NHANES III oversampled children younger than 5 years of age, as well as Mexican-Americans and blacks, it appeared that NHANES III provided a survey context in which information on ECC might be explored, especially for these oversampled subpopulations. As it turned out, among the 1,177 children 12–23 months of age, only between 19 children by the restricted definition and 30 children by the liberal definition were identified as having ECC. These children yielded population estimates of ECC of 1.0 and 1.7 percent. These NHANES III national estimates are consistent with projections made by Ripa (<5%) in 1988 (1). While the NHANES III percentages represent an estimated 36,000 to 62,000 US children 12–23 months of age afflicted with early childhood caries, the limited number of cases does not allow for multiple variable analysis, a particular concern for the study of contributions of ethnicity versus economic need.

The second issue that the production of national estimates of ECC has to confront is a valid case definition of ECC as recently reviewed by Horowitz (8). Tied to this issue are the correlative issues of reliable and valid case ascertainment procedures for such a case definition. These problems may be thought of conjointly as the ECC problem of meaning and measurement. Clearly, the NHANES III case definition #2 of ECC was less than adequate, particularly when almost half of the "possible" cases were defined by exclusion rather than by inclusion criteria. It also would appear that the visual, nontactile approach that focused on the maxillary incisors has left questions of uncertainty of the caries impact in these young children. Further impact was expressed by Horowitz (9) in her recent statement: "It is difficult to make appropriate public health policy without appropriate measurement, and data are needed to determine the extent of ECC."

Keeping in mind the challenges of examining such young children, no sharp or hard instruments are recommended for oral examinations. Wet gauze may be the best adjunctive tool in the assessment. A consideration in the caries detection is the use of snacks for comforting children during examinations by other disciplines in NHANES III. Graham crackers need particular attention, as they cloud the ability of the examiner to determine caries presence, and were widely used at the examination sites. The liberal definition provides the most extreme estimate with great potential for overestimating the prevalence of caries. Further studies will be enhanced by at least the inclusion of a fourth category for capturing "questionable caries" by separating this group from the "unable to be examined."

In conclusion, the NHANES III estimates of ECC are consistent with previous projections of the magnitude of ECC in very young children (1). From the national perspective, ECC appears rarely among 12–23-month-old children. Further surveillance is desirable to verify that it remains a rare disease. However, future advances in ECC will require studies of special, high-prevalence populations. Such studies should focus on the development of conceptually more adequate and valid case definitions, as well as more reliable and valid ECC case ascertainment procedures. Inevitably, such a research program will be required to use study methodologies and designs that are more appropriate for the study of uncommon phenomena in elusive populations (7).

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