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Dental Caries and Periodontal Disease Among Mexican-American Children from Five Southwestern States, 1982-1983*

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INTRODUCTION

The Hispanic population may be the largest minority group in the United States by the end of the 20th century. The 1980 census showed an estimated 14.6 million Hispanics in the United States (1), an increase of about 5.6 million (62%) since 1970, although even this figure may be an underestimate.

Despite the growing numbers of Hispanics, little information is available about their health status (2,3). Because of the paucity of data, Public Law 94-311, enacted in 1976, required designated federal agencies to collect, analyze, and publish health, social, and economic data on Hispanic Americans. In response to this mandate from Congress, and following the recommendations of the expert committee of the National Academy of Public Administration (4), the National Center for Health Statistics (NCHS) organized a health and nutrition survey of persons between the ages of 6 months and 74 years who were of Hispanic descent and who lived in selected geographic areas of the United States. This survey is known as the Hispanic Health and Nutrition Examination Survey (HHANES). Persons were considered eligible to participate in the survey on the basis of self-reported ethnicity or national origin. HHANES was conducted in the period 1982-1984 and included Hispanics residing in three geographic regions of the United States: selected counties in five southwestern states (Texas, New Mexico, Arizona, Colorado, and

California), the Miami area (Dade County), and selected counties or areas of New York City, New Jersey, and Connecticut. The three components of HHANES targeted Hispanics of Mexican, Cuban, and Puerto Rican origin, respectively. These subpopulations represent the majority of Hispanics in the United States (1). Data were collected in the Southwest from 1982 through 1983, and data collection was completed in Miami and New York City in 1984.

This paper describes the estimated prevalence of dental caries and periodontal disease among Mexican-American children 5-17 years of age living in the five selected southwestern states. The prevalence was based on data obtained from dental examinations of 2,550 children, including 22 children who lived in the selected households but who were not Mexican-Americans. **BACKGROUND**

Little information is available on the oral health of Hispanic Americans. Previous surveys conducted by NCHS and the National Institute of Dental Research (NIDR) have included few Americans of Hispanic descent (5-7). In the first National Health and Nutrition Examination Survey (NHANES I), for example, only about 700 persons reported that they were of Mexican ancestry.

The only extensive survey that included a large sample of Hispanics was the Ten-State Nutrition Survey of 1968-1970 (8), which showed that Hispanic children in Texas (6-17 years of age) had more missing teeth and higher scores based on decayed, missing, and filled teeth (DMFT) than non-Hispanic white and black children. By contrast, Hispanic children in the nine other states had lower mean DMFT scores than either non-Hispanic whites or blacks residing in these states. In Texas, fewer Hispanics had gingivitis than blacks or non-Hispanic whites, whereas in the other states the prevalence of periodontal disease among Hispanic children was similar to that of non-Hispanic white children but lower than that of black children.

In the 1978-1981 National Preventive Dentistry Demonstration Program (9,10), Hispanic children 6, 8, 10, and 12 years of age from three cities where water supplies are fluoridated--New York; El Paso, Texas; and Hayward, California--participated in the study. Mean scores based on decayed, missing, and filled permanent tooth surfaces (DMFS) of El Paso Hispanic children were less than half those of Hispanic children from the two other cities, although they were similar to the scores of El Paso's non-Hispanic children.

Several smaller surveys of Hispanic or Mexican migrant workers have also been reported (11-13). In Michigan, children of Hispanic migrant workers had a higher percentage of unmet dental needs than U.S. children overall in 1971-1974 (11). A similar conclusion was reached by other investigators (12,13). Many Hispanic Americans, however, live under different social and environmental conditions than do Hispanic migrant workers, thus the general applicability of these studies may be limited.

Health attitudes and behaviors of Hispanic Americans reportedly differ from those of non-Hispanic Americans (14,15). Hispanics have been found to use professional dental services infrequently, and many of them consult a dentist only when they are in pain (14). Differences also have been found between Hispanics and non-Hispanics in the reasons for and frequency of dental visits and in the use of cosmetic, orthodontic, surgical, and prosthetic services. These differences remain even after income and education have been considered.

Because of limited data on the dental health of Hispanic children, investigators have had difficulty in reaching firm conclusions. The data do suggest, however, that the prevalence of dental caries among Hispanics does not differ from that of the population at large in the same geographic region. METHODS HHANES Survey Design

The HHANES sample design was a four-stage cluster sample selected with probabilities proportional to size. The four stages were 1) primary sampling units (PSUs), made up of counties or small groups of contiguous counties, 2) segments (clusters of households), 3) households, and 4) eligible persons. A detailed description of the sample design is presented elsewhere (4); a summary description is presented here.

During the planning phase of HHANES, criteria were formulated that specified the eligibility requirements for inclusion in HHANES. A county was included in the HHANES sampling frame if it satisfied at least one of the following conditions: 1) the county's Hispanic-origin population numbered at least 30,000, 2) the county's Hispanic-origin population was at least 10,000 but less than 30,000, and it constituted at least 5% of the total county population, 3) the county's Hispanic-origin population was at least 5,000 but less than 10,000, and it constituted at least 10% of the total county population, or 4) the county's Hispanic-origin population was less than 5,000, and it constituted at least 15% of the total county population.

By design, therefore, HHANES is not a representative national survey of all Hispanics residing in the United States, but rather it is representative of Hispanics living in the areas sampled. These areas include approximately 76% of all Hispanics living in the United States (4). The southwestern portion of HHANES covered approximately 97% of all Mexican-Americans within its sampling frame (five selected states).

In the Southwest, 14 PSUs were randomly selected from the 193 located in the five southwestern states. The selection of these PSUs took into consideration the number of Mexican-Americans, the ratio of 1980 to 1970 Mexican-American population, the median income, and the percentage of urban residents. Households in the 14 selected counties were divided into segments; the minimum number of Mexican-Americans in each segment ranged from 50 to 100 persons. Segments that had fewer than 50 Mexican-Americans were excluded from the sample. The eligible segments were stratified by density of Mexican-American population and economic status, as determined by rent paid or value of

homes. Segments were selected with equal probabilities within each of the 14 selected PSUs. From each of these segments, six households were then selected.

Mexican-Americans residing in each selected household were sampled by using the following probabilities: three-fourths of eligible Mexican-Americans ages 6 months to 19 years, one-half of eligible Mexican-Americans ages 20 to 44 years, and all eligible Mexican-Americans ages 45 to 74 years. By design, not all persons included in the sample underwent the same interviews in their residences nor the same medical, dental, and biochemical assessments at the mobile examination center. After being informed of their inclusion in the survey, some persons could not or would not participate in the interviews, and some of the persons interviewed could not or would not be examined. A total of 7,240 persons received dental examinations (Table 1). Oral Conditions Measured in HHANES

In HHANES, plans were made for each participant to receive a medical and dental examination and to provide a 24-hour dietary-recall record during an interview conducted by a trained dietary interviewer. Other demographic and health-related behaviors were also to be recorded. Questions of relevance to dentistry included reasons for and frequency of dental visits, preventive health behaviors, coverage by dental insurance, and an evaluation of perceived oral health.

Dental examiners measured the prevalence of dental caries by using NIDR criteria (7), periodontal disease by using the Periodontal Index (PI) (16), oral hygiene status by using Debris (DI) and Calculus (CI) Indexes (17), and malocclusion status and history of orthodontic treatments as defined by NIDR (18). The examiners also evaluated the denture status of partially and completely toothless examinees, and they estimated the need for restorative care by using the NIDR Dental Restorative Treatment Need Index (18). The dental examiners were all trained by NIDR staff. Statistical Analysis

When dental data are abstracted from national surveys, analysts should take into consideration the complexity of the sample design (clustering) and the disproportionate probabilities of selection (sampling weights) of the persons in the sample. Failure to adjust for the clustering effects may lead to an underestimation of the standard errors of the computed statistics and may result in higher probabilities of detecting statistically significant differences when no such differences exist (type I error) (19,20). Sampling weights permit results to be generalized to the population from which the sample was drawn (Mexican-Americans in the five selected southwestern states).

In the analyses presented in this paper, sampling weights were used and clustering effects were accounted for. Programs of the Organized Sets of Integrated Routines in Statistics (21), supported by the Institute for Survey Research, University of Michigan, were used to compute weighted means, regression coefficients, and percentages. So that the clustering effects introduced by the sample design would be accounted for, standard errors--computed for a simple random sample--were multiplied by their design effects. The design effects represent the estimated increase in the variance of the variable under study (for example, DMFS scores) that has resulted from selecting participants in clusters rather

than individually, as when a simple random sample design is used. The design effects were computed for the purpose of this analysis for the DMFT, DMFS, PI, DI, and CI scores (Table 2). Each of these variables was stratified by age, income, and gender, and design effects were computed for each of the cells in the age-gender-income matrix. Design effects larger than one were added and their mean was computed for estimating an overall design effect that was used to adjust the standard errors of each variable. Testing for statistical significance between means or percentages was based on the comparison of 95.0%, 99.0%, or 99.9% confidence intervals. RESULTS Dental Caries by Age, Gender, Income, and Type of Tooth Surface

Of all the Mexican-American children between 5 and 17 years of age residing in the Southwest, 46.0% were free of caries (Table 3). Overall, 4.4% had DMFT scores higher than nine. The percentage of children with DMFT scores of nine or above ranged from 1.0% (for 10-year-olds) to 19.4% (for 17-year-olds).

The distribution of the mean DMFS by age is presented in Figure

1. The main contributor to the DMFS after age 8 was filled tooth surfaces; the percentage of filled to total DMFS surfaces was 66.0% for all Mexican-Americans in the Southwest. The rate of increase in number of filled surfaces with increasing age was three times larger than the rate of increase in number of decayed surfaces (regression slopes for the number of filled and decayed surfaces with increasing age were 0.54 and 0.18, respectively). The number of missing teeth was significantly lower than the number of decayed or filled teeth (pless than 0.001).

Mexican-American females had a significantly higher mean number of filled occlusal surfaces than males (pless than 0.01), although no significant difference was detected between males and females in decayed and missing occlusal and other tooth surfaces (Table 4). Occlusal tooth surfaces of molars were the most susceptible to decay, and anterior tooth surfaces were the least decayed. Dental Caries by Income Status

No significant association was shown between mean DMFS scores and income. However, the percentages of decayed or filled tooth surfaces, out of the total DMFS scores, were significantly different between low-income families (less than \$6,000 annual income) and high-income families (\$40,000 or more annual income) (Table 5). Children from low-income families had a higher percentage of tooth surfaces that were decayed and less that were filled than children from high-income families (pless than 0.05). Comparison of Results from HHANES, NIDR, and NHANES I Surveys

Figure 2 presents a comparison of the mean DMFS of Mexican-American children 5 through 17 years of age in Southwestern HHANES (1982-1984), children residing in the western states* during NHANES I (1971-1974), and those residing in Region V** of the NIDR survey (1979-1980). Except for children ages 13 and 17, the mean DMFS scores for Mexican-American children in 1982-1983 did not differ significantly from mean DMFS

scores of children from Region V in the NIDR survey, whereas the mean DMFS scores of children examined during NHANES I were significantly higher after age 9 (p less than 0.05). Periodontal Disease and Oral Hygiene

The prevalence of periodontal disease, plaque, and calculus in Mexican-American children 5-17 years of age is presented in Tables 6 and 7. A high proportion (76.9%) of Mexican-American children suffer from gingivitis. The Mexican-American children in 1982-1983 had significantly higher mean DI and PI scores than children from the western states examined during NHANES I even after adjustment was made for income in 1971-1974 and 1982-1983. Mexican-American children from high-income families had lower PI, CI, and DI scores (approximately 40%, 70%, and 15%, respectively) than Mexican-American children from low-income families.

A significantly higher percentage of Mexican-American children had gingivitis in 1982-1983 than children (all races) residing in the western states in 1971-1974 (Table 7). The mean number of teeth with mild gingivitis among Mexican-Americans ages 5-17 years was 6.14, whereas the mean number of teeth with more severe forms of gingivitis was 1.01. Four children between the ages of 5 and 17 years had periodontal pockets.

DISCUSSION Survey Design

Planning and conducting a survey like HHANES presents some difficult choices. The reference population mainly resides in a few states (3), with a relatively small portion of the population residing in the rest of the country. Because of this distribution of Mexican-Americans, the survey was limited to areas where the majority of Mexican-Americans reside. The costs of including every Mexican-American in the sampling frame would be prohibitive; therefore, the geographic area included in HHANES was restricted to U.S. counties having a large (as described in the section titled HHANES Survey Design) Mexican-American population. As a result, the southwestern portion of HHANES cannot be considered a national survey of all Mexican-American residents but rather of approximately 84% of them, and of 97% of the 1980 Mexican-origin population in the Southwest (4).

In the analysis of data from a complex survey like HHANES, a number of factors need to be considered. The available algorithms used for computing means and their standard errors assume that a proportionate simple random sample is selected. For complex survey designs, this assumption is invalid, and adjustment for the sampling weights and clustering of individuals introduced by the previously described sampling strategy should be made in order to reach more accurate and precise population estimates (20). (An accurate estimate is an estimate with minimum total error that includes bias as well as the variance, whereas a precise estimate is an estimate with minimum variance.) Further, the sample weights provided by NCHS also include adjustments for nonresponse and noncoverage that were made to compensate for nonrepresentation of some of the targeted population. Analyses presented in this paper have accounted for both clustering and sampling weights.

Comparison with Other Surveys

Analytical considerations create a problem when the results of one national survey are compared with those of another. The NHANES I, the NIDR Dental Caries Prevalence Survey, and the Southwestern HHANES were conducted at different times and in different locations, with the use of different sample designs, logistic arrangements, and examiners.

The first presentation of HHANES dental data showed a close similarity between the distribution of dental caries among Mexican-Americans residing in the Southwest and that of other groups in the region examined by NIDR in 1979-1980. The surface-specific distribution of dental caries in Mexican-American children also mirrored that of children who participated in the National Preventive Dentistry Demonstration Project (9,10) and children in the NIDR survey (22). In HHANES, the occlusal surfaces of molars were the most susceptible tooth surfaces to decay. The findings from HHANES support the observation of Graves and Stamm (23) that dental caries is now a disease predominantly of occlusal surfaces of molars. HHANES results showed that few anterior teeth of Mexican-Americans were affected by caries, and few children's teeth were extracted because of caries--findings similar to those from the NPDDP (10).

Because of differing patterns concerning the use of dental services and the observation that Mexican-Americans seek dental services less frequently than other groups surveyed (14,15), Mexican-American children in the Southwest were expected to have significantly more decayed teeth than other children residing in the same region. The data from HHANES, however, showed that for Mexican-American children, filled teeth were the main contributor to the total DMFS scores. The ratio of filled surfaces to the total DMFS scores was approximately 66%. In the NIDR survey, this ratio for Region V children was approximately 74%, whereas for Region VII (Washington, Oregon, and California) in the NIDR survey, the ratio was over 90%. These differences may be associated with the lower average income of Mexican-Americans when compared with regional average incomes.

Prevalence of Dental Caries

The predominant feature of dental caries in the Mexican-American children was the overall low level of disease and its clustering in occlusal surfaces of molars. Children (all races) from the southwestern states have long had a lower prevalence of dental caries than children from other parts of the country (6,7,9,10), and a comparison of the southwestern portion of HHANES and a statewide survey in South Carolina, also conducted during 1982-1983, shows that these differences still remain (24). Although numerous explanations have been promoted for the low prevalence of dental caries in certain geographic regions (25,26), none have been scientifically tested within the context of the multifactorial causes of caries. One likely explanation for the lower prevalence of dental caries in the Southwest is the wide availability of naturally fluoridated water supplies (27). Since the survey population's residential history was not collected in HHANES, the effect of exposure to fluoridated water cannot be explored further. In HHANES, the reported dietary and nutritional intake of Mexican-Americans has been assessed, but the data collected have not yet been comparatively analyzed.

Despite the overall low level of dental disease in Mexican-American children, only 14.6% of the 17-year-olds were caries-free, and over 50% of those children had five or more decayed or filled teeth. Also, of the estimated 5.6 million decayed, missing, or filled teeth of Mexican-American children, approximately 3.3 million (58.9%) were contributed by about 26.0% of the children. This finding concurs with the results of the NPDDP study (10): a relatively small percentage of the children are highly susceptible to dental caries, but the majority are not.

The distribution of dental caries in southwestern Mexican-Americans raises a number of issues on the effectiveness and economics of different preventive programs. Because of the Mexican-Americans' concentration of dental decay on occlusal fissures, the use of fissure sealants as a preventive procedure seems most appropriate. Based on HHANES data, approximately 77.0% of the decayed or filled occlusal surfaces in 17-year-olds had sound proximal surfaces and, therefore, could theoretically have been saved from fissure caries with the use of fissure sealants. These findings strongly support the recommendations of the Council on Dental Research of the American Dental Association concerning sealants (28).

Although income was not a significant predictor of total DMFS scores, analysis showed that Mexican-American children from families with low annual income had about two times more decayed teeth than children from high-income families. This high level of unmet dental need among children from low-income families was also observed in the National Preventive Dentistry Demonstration Program (29). HHANES data strongly support the need for dental public health programs that give special attention to these children.

Periodontal Disease

Overall, HHANES data showed very little periodontitis (pocketing) but a high percentage of mild gingivitis among Mexican-American children. These results suggest that Mexican-Americans need considerably more education concerning dental health.

SUMMARY

Analysis of Southwestern HHANES data showed that the prevalence of dental caries among Mexican-American children is similar to that of children of the same age examined during the NIDR survey (1979-1980), despite a lower level of restorative treatment. Approximately 50% of Mexican-American children 17 years of age, however, had five or more teeth that were either decayed or filled. Occlusal surfaces of molars were the most susceptible teeth to decay; few anterior teeth were affected. This distribution of dental caries strongly supports the use of fissure sealants on molar teeth. Children from low-income families had two times more decayed teeth than children from high-income families. Mild gingivitis and poor oral hygiene were more prevalent in the Mexican-American children than in the child population for the region examined during NHANES I in 1971-1974. Children from high-income families had better periodontal health than those from low-income families.

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