Dental caries, one of the most common diseases of man, constitutes a major public health problem that begins in early childhood. Although less than one half of the population in the United States receives dental care in each 12-month period, the cost of treating dental caries exceeds $2 billion in a single year. Untreated, dental caries cause pain, lost teeth, malocclusion, and problems of mastication and nutrition.

For these reasons, data on dental caries—derived from the Ten-State Nutrition Survey (TSNS) of 1968-1970—are of particular relevance. These data are unique: (1) with regard to sample size, including more than 10,000 individuals between the ages of 5 and 20 years; (2) in the income range considered, primarily lower income which is a socioeconomic group believed to be encumbered with a greater load of health-related problems; (3) in the wealth of data on the two largest racial groupings, whites and blacks, who differ in many important health-related respects.

The voluminous data on dental caries contained in the TSNS have, so far, been only partially reported, and certainly incompletely analyzed.

This statement will summarize more extensive analyses of dental caries in the pediatric age group, and report some new and novel findings.

METHODOLOGY

Information on dental caries contained in data tapes supplied by the Center for Disease Control, Atlanta, Georgia, was carefully edited or "cleaned" to remove coding errors and obvious defects of transcription. In making the analysis, two departures from conventional procedures were employed. First, the data analysis was based on only 28 of the 32 permanent teeth. Second, information regarding caries experience was analyzed tooth by tooth for each of the maxillary and mandibular teeth involved. The third molars ("wisdom teeth") were excluded from analysis because they are the most frequently missing (i.e., dental agenesis) or unerupted teeth of the dentition. Moreover, the third molars, even when present, are rarely erupted in the pediatric age group.

Tooth-by-tooth analysis, rather than the conventional decayed-missing-filled (DMF) index was employed for several reasons. First, the DMF index is a difficult measure for nondental personnel to comprehend. Second, DMF indices do not show which teeth are carious and, therefore, are unable to discriminate as to whether there are socioeconomic, nutritional, or racial differences in the pattern of caries development.

To simplify graphic display in certain instances, teeth were grouped by morphological classes—incisors, bicuspids, and molars. This grouping made it possible to show the differing rates of caries experience without unduly complicated illustrations. As with individual teeth, these graphs show the percentage of teeth affected but
depict the changes in caries experience as a function of age.

**FINDINGS**

The TSNS data clearly show that dental caries experience is an age-site-dependent phenomenon. Different classes of teeth are affected at different ages and at different rates. In general, dental caries begins shortly after tooth eruption, increases until the late teens, and then tends to “plateau” during the third decade of life. As shown in Figure 1, dental caries is first expressed in the molar segment of both jaws, with onset shortly after the time of first molar eruption. The rate of increase slows in the late teens and tends to plateau at approximately 20 years of age, indicative of maximum caries development. The bicuspids are second in both age at time of disease onset and severity of expression. Dental caries develops shortly after bicuspid eruption (at about 10 years of age) and increases steadily during the next decade without evidence of a plateau by age 20. The severity of dental caries in bicuspids is approximately one half that found in the molars at age 20. The incisors are the least affected teeth. The maxillary incisors slowly begin to develop dental caries after a lag period of nearly two years after eruption. The mandibular incisors are highly caries-resistant, with less than 5% of the population experiencing dental caries by 20 years of age. The incidence of caries in the incisors at all ages is much lower than for the bicuspids or molars.

The data summarized in Figure 1 also show differences in caries rate between the jaws. The mandibular molars develop carious lesions slightly in advance of the maxillary molars. The man-
Fig. 2. Cumulative racial differences in caries experience of the permanent maxillary teeth. Similar differences were found in the mandible. As shown, black children have a lower incidence of caries than do white children at the same ages. Even with correction for per capita income, significant differences persist.

Racial differences in dental caries experience were clearly evident. It was readily apparent that, for every tooth at every age and for both sexes, black individuals experience less dental caries than white. The difference in caries experience between the two races is large and consistent. The difference appears shortly after tooth emergence and increases steadily thereafter (Fig. 2).

Effects of Sex

Although the female might be expected to show a higher caries rate consistent with earlier tooth eruption, a sex difference was not clearly demonstrated in the TSNS data, except possibly with white children. White girls exhibited slightly greater dental caries experience than white boys, a fact most evident in the anterior segment of the maxilla, as well as in the bicuspid segment of both jaws. Black girls also evidenced slightly greater caries experience than black boys, but the differences were small. To conserve space, these small, overall sex differences are not illustrated here.

Effects of Income

Dividing the TSNS dental data into two broad income groupings, one overall finding emerges—poverty protects against dental caries. The lower-income grouping exhibited less dental caries, for each tooth individually and overall, than did the higher-income grouping. This “protective” effect of lower income is especially apparent in blacks, but it is also present—although less clearcut—in whites (data on black boys are given in Figure 3). At age 14, but at earlier and later ages as well, children from families in the lower-income group ($1,000 per capita and below) consistently evidenced lower caries rates than children from families in the higher-income group ($2,000 per capita and up). Such income-related differences in dental caries rates are evidenced by black girls as well as black boys, but they are somewhat less dramatic in the
FIG. 3. The effect of income on dental caries experience as shown in 14-year-old black boys. Children from families in the higher-income (>$2,000 per capita) group have a greater incidence of dental caries than children from families in the lower-income (<$1,000 per capita) group. Considered on an individual tooth basis, the increased dental caries experience of the boys from the higher-income families is especially apparent in the first molars of both jaws and in the maxillary incisors.

Black children had less dental caries than white children soon after eruption of the permanent teeth; the difference between the two groups increased steadily each year thereafter.

Furthermore, the original comparison of lower and higher per capita income groups 6 to 17 years of age showed "... children in low-income-ratio states had DMF scores similar to those children in high-income-ratio states ..." Reexamination revealed an income-related effect. Clarification of this point is important because the program was directed to "identify ... malnutrition and health related problems ..." to "be of value not only to Congress in its deliberations, but also to health workers in developing programs designed to alleviate the problems and concerns which the survey demonstrated." The original report indicated that no difference in magnitude of dental caries
existed between the lower and higher income groups; therefore, no insight into protection from dental caries could be gained from detailed comparison of the dietary constituents. We were surprised that the income effect is opposite of what we might have expected. Children in the higher of the two income groups suffered the most from dental caries. A greater frequency of food intake or a higher sucrose consumption may be responsible for the difference observed, but data to support such a conclusion were not available. The mechanism whereby lesser affluence protected against dental caries needs precise identification. Adherence to the nutritional habits which characterized the less affluent group might maintain the low dental caries activity level of that group despite future upward economic mobility. It might permit extension of the dental caries protection to other segments of the population as well.

SUMMARY

The Ten-State Nutrition Survey data show a consistent, dramatic, and meaningful difference in dental caries experience between black and white children at all ages. This difference transcends socioeconomic grouping, nutritional level, and developmental status. This study also has shown an apparently protective effect of poverty insofar as dental caries is concerned. Children from lower-income families experienced less dental caries than children from higher-income families.

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REFERENCES


ACKNOWLEDGMENT

The assistance of Susan M. Nelson, Robert L. Wainright, and the University of Michigan in the computer analysis is gratefully acknowledged.
The Effect of Age, Sex, Race, and Economic Status on Dental Caries Experience of the Permanent Dentition


Pediatrics 1976;57:457

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