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Social Factors and Diet Diaries of Caries-Free and High-Caries 2- to 7-Year-Olds Presenting For Dental Care in West Virginia

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Abstract

Social factors are thought to have an association with dental caries. An extensive list as well as the cumulative effects of these factors has not been established for children seeking dental care. The purpose of this study was to compare selected social factors and diet diary recordings for children ages 2.8 years to 7.2 years who were caries-free (n = 36) with those having extensive interproximal lesions of the primary molars (n = 40).

Caries-free children were significantly more likely to have parents with college experience, be from smaller families, have an earlier birth order, have parents with an optimistic outlook for their own dentition, be present at scheduled appointments and be restricted in getting snacks unassisted. From cumulative effects of these social factors alone, 90% of the children could be correctly identified as belonging to the high-caries or caries-free group.

From diet diaries, no significant differences were found between groups for total number, timing, concentration or consistency of daily sucrose exposures. Perceived cariogenicity of snack foods was the same for the two groups.

Introduction

A number of socioeconomic factors have been associated with dental caries. However, the relative importance of individual factors has not been established for specific patterns of dental caries in children seeking dental care.

For a number of factors, a consensus exists with divergent views in a minority of studies. Reports are, for the most part, field studies with mirror and explorer examinations along with structural interviews but without radiographs. Parent education level has been reported as significantly higher in children with low caries experience and lower in children with high caries levels.[1,2,3,4] Economic status has also been reported as having an inverse association with dental caries levels.[1,3,5] However, one study has shown that the caries index is higher in children of high socioeconomic status.[6]

Sex of the child has not been found to have an association with caries experience for children of similar socioeconomic levels and educational environments.[7,8,9] In another study, significantly more girls were found in groups with high caries levels.[1]

Large family size was found in one instance to have a positive correlation with dental caries[1] and a negative correlation in another instance.[10] Urban children have been shown to have higher caries levels than rural children.[7,9,11] Missed appointment patterns and socioeconomic status have been correlated.[12] Children of self-paying people had significantly fewer missed appointments than Medicaid or insurance covered Union members. Missed appointments of Medicaid patients were predominately broken appointments and those of Union patients were predominantly cancelled appointments.

Social factors are associated with dietary habits. Two principal methods have been used to study die-

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tary habits. One method involves a recall or diary with recording of each food item consumed from one day up to seven days depending on the method. Significant correlations have been reported for between-meal sucrose exposures and caries level using this method.[7,9,13] However, in one instance no correlation was found between sucrose exposure and caries level from diet diaries.[14] A second method involves questions of specific food types (e.g. candy, gum, bread) and the approximate frequency of consumption. Using this method, significant correlations in between-meal sucrose exposures and dental caries have also been reported.[4,8,15]

A number of different caries patterns have been observed. Some are suspected to have predominant contributing factors. The pattern of "nursing bottle caries" involves the maxillary incisors, maxillary and mandibular first molars.[16,17] It has been attributed to nursing with milk or juice for naps and overnight. A second pattern is occlusal lesions initiated in anatomic defects of the molar teeth.[18] However, the reason for destruction of selected smooth surfaces of molar teeth (frequently involving antimeres) in an individual is not clear.

The purpose of this study was primarily to evaluate social factors for two groups of preschoolers presenting for dental care: caries-free and those with extensive interproximal caries of primary molars. The secondary purpose was to evaluate dietary habits of the same subjects as recorded by parents on diet diaries.

Methods and Materials

The study was conducted in a predominantly rural setting of Appalachia, West Virginia, with no towns exceeding 50,000 population. There are no private practice pedodontists in the area. Children who presented for routine dental care at West Virginia Dental School formed the patient pool for this study.

Criteria for Selection of Subjects

Dental criteria for inclusion in the study were as follows. Each caries-free child was examined and confirmed by two dentists using mirror, explorer, bitewing radiographs, and supplemental radiographs. Each high-caries child had carious lesions on at least five of the eight surfaces where primary molars approximate. A second criterion was that at least two of these lesions were large enough to include part of the occlusal surface (Figures 1 and 2). Large occlusal lesions by themselves did not qualify the patient for inclusion in the study. Lesions were included if the tooth was destroyed to the point that the site of the initial lesion could not be determined. Children with "nursing bottle caries" were excluded. Children with carious incisors were included only if they had rampant decay including lower incisors as well as satisfying the criteria for lesions in the molars. Subjects possessed the primary dentition or had permanent teeth penetrating the mucosa but not erupted to the occlusal plane.

Children with enamel hypoplasia, cleft lip or palate, identifiable genetic syndrome, mental or physical handicap were excluded from the study.

Two precluding social criteria were used. Only one child per family was included. Children were excluded if either parent had an occupation related to dentistry.

Sequence of Patient Selection

The sequence of circumstances for subject selection was as follows: Each child received a screening appointment without radiographs, an initial diagnostic appointment with radiographs, and a consultation appointment. Screening was a centralized system from which patients were routed to the faculty practice or to the student clinic. Consecutive children screened with the potential for inclusion in the study were recorded.

This was the first dental experience for the subjects with one type of exception. Children receiving emer-

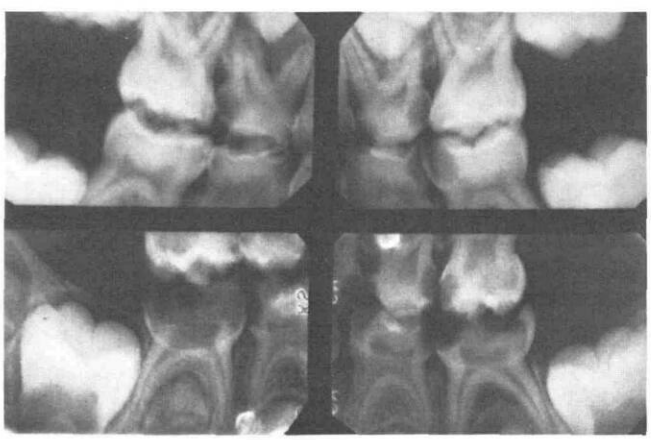

Figure 1. Radiographs from two typical children in the high-caries group having extensive interproximal lesions of the primary molars.

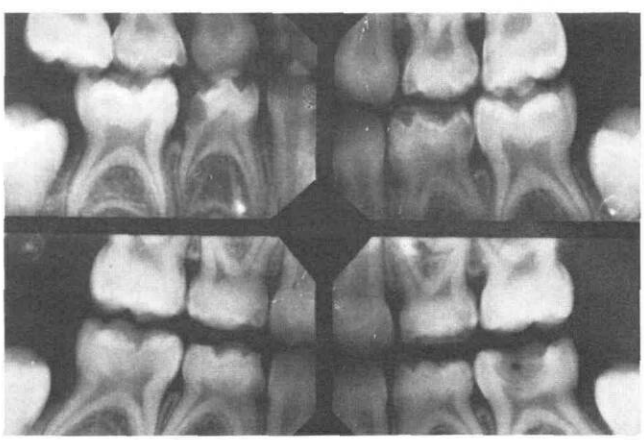

Figure 2. Radiographs from two children excluded from the study because they did not fit the criteria.

ency care in the school were included if pre-operative adiographs were available and if the children were referred for routine care at the time of emergency care. No mention was made to the parents at this point that they might be involved in a research project.

At the diagnostic appointment, after review of radiographs, subjects fitting the criteria were further noted. At this point a diet diary was issued. At the consultation appointment, and prior to the interview, written consent was secured. This was the first point of subject awareness of the study. Patients were not preselected for their potential willingness to cooperate in the study. All patients who reached this point in the selection process were asked, and all agreed, to participate in the study. It was assumed that these children as a group were representative of patients presenting for routine private dental care in the area.

All but one of the 36 caries-free children were Caucasian (the one exception had a Hispanic surname). All 40 of the high-caries children were Caucasian. None of the children in the study was adopted. The average age for the caries-free group was 4.6 years (range, 2.8 to 6.8); 18 were males and 18 were females. The average age for the high-caries group was 4.7 years (range, 3.3 to 7.2); 22 were males and 18 were females. Children were not pair-matched.

The Interview

The interview at the consultation appointment consisted of objective questions on social factors, general dietary habits, and a snack test. The child was not present for the interview. The following social factors were studied in the Results section.

A snack tray was displayed with eight snacks, each in a clear plastic bag. The parent was asked to choose the snack which "contributed most to dental decay, or was most likely to cause cavities." The parent made a choice and the bag was removed. The process was repeated until all eight snacks were selected. The choices were recorded as a ranking.

The Diet Diary

Study of the dietary habits was attempted using a five-day diet diary.[19] At the diagnostic appointment, the diet diary was begun by recalling the previous day's dietary intake for the child. Recordings for the first day were made by one investigator. After reviewing the instructions, the diary was given to the parent to complete the remaining four days. At the consultation appointment, the diet diary was collected.

Diet diaries were scored for sucrose exposure. Only foods with a sucrose concentration of 5% or greater were included. The average number of sucrose exposures per day was determined from the perspective of *timing, concentration,* and consistency based on the following criteria: (1) Timing of sucrose exposure was categorized as with a meal or as a snack. More than one exposure at a single snack or meal was counted as one exposure, (2) Number of exposures according to concentration were categorized by those having 5-20% sucrose and those having more than 20% sucrose,[20] (3) Number of exposures by consistency was defined as follows; a sucrose exposure which at body temperature is a fluid was classified as a liquid (soda pop, ice cream), solid-sticky was defined as a solid which at body temperature adheres to the teeth (cake, cereal), solid-crunchy was defined as a solid that at body temperature breaks apart without adhering upon contact with the teeth (apple).

Fluoride History

For determination of fluoride ingestion status, parents were asked to name their water supply. Town and city water supplies were checked in a listing provided by the West Virginia State Health Department. Well water supplies in this area of Appalachia were presumed to be deficient in fluoride.[21] Well water analyses performed in the area prior to the study by the Department of Pediatric Dentistry revealed low fluoride content. The last 26 subjects to be entered in the study (12 caries-free and 14 high-caries) were asked about changes in water supplies. This was the only question added after the start of the study.

Statistical treatment of data

The Chi Square test was used to compare the frequency of findings for two groups. Levels of significance of $p < 0.05$ and $p < 0.01$ were used.[22]

Cumulative effects were quantified by scoring a possible ten points for each category with a statistically significant difference between the two groups. Ten points were given for the extreme of a category favoring the caries-free group. No points were given for the other extreme of a category favoring the high-caries group. Where applicable, intermediate scores were assigned.

Results

Statistically significant differences were found between the two groups for a number of social factors and for one general dietary habit. The average number of children in the family was less for caries-free children (2.2 versus 3.0); 84% of the caries-free children came from families with one or two children compared with 50% for the high-caries children ($X^2 = 8.8$, $p < 0.01$). Birth order differed significantly between the two groups. For caries-free children, 50% were in the half of the family born earlier compared to 18% for high-caries children ($X^2 = 6.17$, $p < 0.05$). Children were excluded from this consideration in instances of an only child. Of the caries-free children, 100% appeared as scheduled for both the diagnostic and consultation appointments compared to only 50% for the high-caries children ($X^2 = 21.9$, $p < 0.01$). The remaining 50% had at least one broken or cancelled appointment. Parents' educational level was signifi-

cantly higher for the caries-free group; 73% of the fathers and 67% of mothers of caries-free children had some college experience as compared with 10% for fathers and 2% for mothers of high-caries children ($X^2 = 33.5$, $p < 0.01$) for fathers and $X^2 = 28.4$, $p < 0.01$ for mothers.

Predicted longevity for the parents' own teeth was significantly greater for the caries-free group; 78% of the parents of caries-free children thought they would have "most of their own teeth" beyond age 65 compared with 24% for parents of high-caries children ($X^2 = 20.3$, $p < 0.01$). Fifty-two percent of parents of high-caries children predicted that "most of their teeth would be lost before age 40".

The primary suspect for the cause of caries differed for the two groups; 8% of parents of caries-free children considered "soft teeth" as the primary reason for cavities compared with 25% for parents of high-caries children ($X^2 = 4.4$ $p < 0.05$). No significant differences in the primary suspect for caries were found between the groups for sweets or difficulties in brushing. The one general dietary habit to differ significantly between the two groups was accessibility to snacks. Of the caries-free children, 41% were permitted to get food without assistance compared to 82% for high-caries children ($X^2 = 15.1$, $p < 0.01$).

Statistical tests were not done on the "reason for presenting at the dentist". The expected result was that 86% of caries-free children presented for a routine exam and 71% of high-caries children presented for suspected cavities or dental pain.

A number of social factors did not differ significantly between the two groups. The mean age for mothers was almost identical for the two groups (29.8 and 29.7 years respectively). For both groups, almost all parents were married and living together (94% and 93%). Employment status of parents showed trends but the differences were not statistically significant. Fewer mothers of caries-free children were homemakers (65%) than was true of high-caries children (75%). More fathers of caries-free children were employed (100%) than was the case for high-caries children (85%). The number of children that "frequently spent time away from parents" was similar for the two groups (47% for the caries-free group and 52% for the high-caries group). Time spent at grandparents was similar for the two groups (30% and 38% respectively) and at the babysitters (17% and 8% respectively).

The mean reported daily frequency of toothbrushing was similar for the groups (1.4 times per day for caries-free children and 1.7 times per day for the high-caries children) as was reported use of floss (41% and 28% respectively). All parents reported using toothpaste containing fluoride.

The cumulative effects of six factors found to be significantly different between the two groups are presented in Figures 3 and 4. While there was frequent overlap for any one factor, few persons could be confused as to caries status based on the cumulative effect. A number of subjects deviated from their group in any single category. Not one caries-free child had a combination where the child had parents with less than a college education, had two or more siblings, had parents pessimistic about keeping their own teeth, failed to present as scheduled for the first two dental visits and was unrestricted in getting snacks. Not one high-caries child had the reverse of all these characteristics. Results of the cumulative scoring appear in Figure 5. For the category of "gets food without assistance", five points instead of ten was the maximum since this was the only category without some measureable basis for the response. By selecting a score of 35 as the division, over 90% of the subjects could be correctly distinguished as to caries status.

Comparison of diet diaries

For diet diary entries no significant differences in number of sucrose exposures were found between the two groups for any of the three basic categories or by any of the seven sub-categories. In each instance mean recorded daily sucrose exposure for the caries-free group was higher than, or equal to, that recorded for the high-caries group. The mean number of daily sucrose exposures was 4.8 for the caries-free group and 3.7 for the high-caries group. Mean number of exposures by timing was similar for the two groups. The caries-free group averaged 2.7 exposures with meals and 2.1 exposures with snacks (high-caries group 2.2 and 1.5 exposures respectively). Mean number of exposures by timing was similar for the two groups. The caries-free group averaged 2.7 exposures with meals and 2.1 exposures with snacks (high-caries group 2.2 and 1.5).

Mean number of exposures by concentration for the caries-free group was 2.3 for food with 5-20% sucrose and for foods with more than 20% sucrose; mean number of exposures for the high-caries group was 1.7 and 2.0 respectively. Mean number of exposures was equal for two of three consistencies of sucrose containing foods; both groups averaged 1.6 exposures of liquid foods containing sucrose and 2.0 exposures of crunchy foods with sucrose; the caries-free group averaged 3.0 sticky food exposures and the high-caries group averaged 1.9 exposures.

In the high-caries group, 58 percent responded that a change in the child's diet had occured since noticing the cavities. All of these mentioned reduction of sweets in some form. Comparisons of sucrose intake were made from diary entries of high-caries children indicating a reduction in sweets and those indicating no change. No significant difference was found between these sub-groups.

Perceived cariogenicity of foods was similar for the two groups as indicated by ranking of the snacks from the snack tray test. Mean rank for the chocolate candy was 1.1 for both groups; mean ranking for the cookies was 2.3 for the caries-free group and 2.0 for the high-caries group; mean ranking for the graham crackers was 3.7 for both groups; corn chips were ranked 4.0 and 5.8 respectively; mean popcorn rankings were 5.1 and 4.9; wheat wafers were 6.5 and 5.5; apple was 6.4 and 7.0; and raw carrots were ranked 7.7 for both groups.

No significant differences were found regarding exposure to fluoridated water; 68% of the caries-free

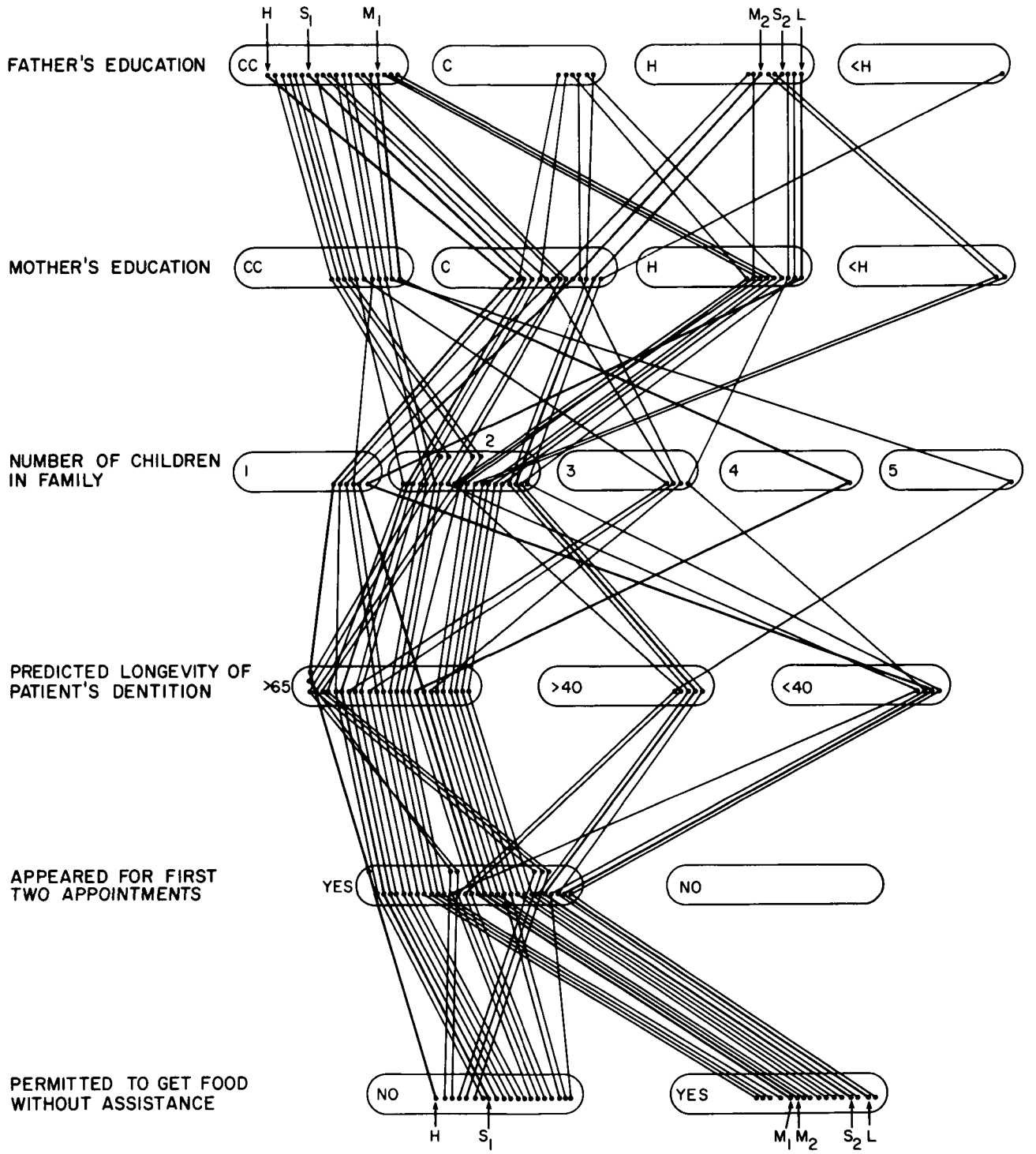

Figure 3. Graph from the caries-free group. Each continuous line represents one child. In the ovals, CC: completed college; C: some college; H: completed high school; < H: did not complete high school. As line indicators, N: the highest score; L: the lowest score; M_1 and M_2: scores closest to the mean; S_1 and S_2: one standard deviation above and below the mean.

group, and 49% of the high-caries group reported water presently fluoridated ($X^2 = 2.1$, N.S.). No conclusive pattern was evident from more extensive histories of fluoridation. Of the 26 subjects asked about history of water supplies, twenty had no change in water supply. One of the high-caries group and five of the caries-free group had changed supplies. The trend for a higher percent of the caries-free children taking supplemental fluorides (31% versus 13%) was not significant ($X^2 = 2.3$).

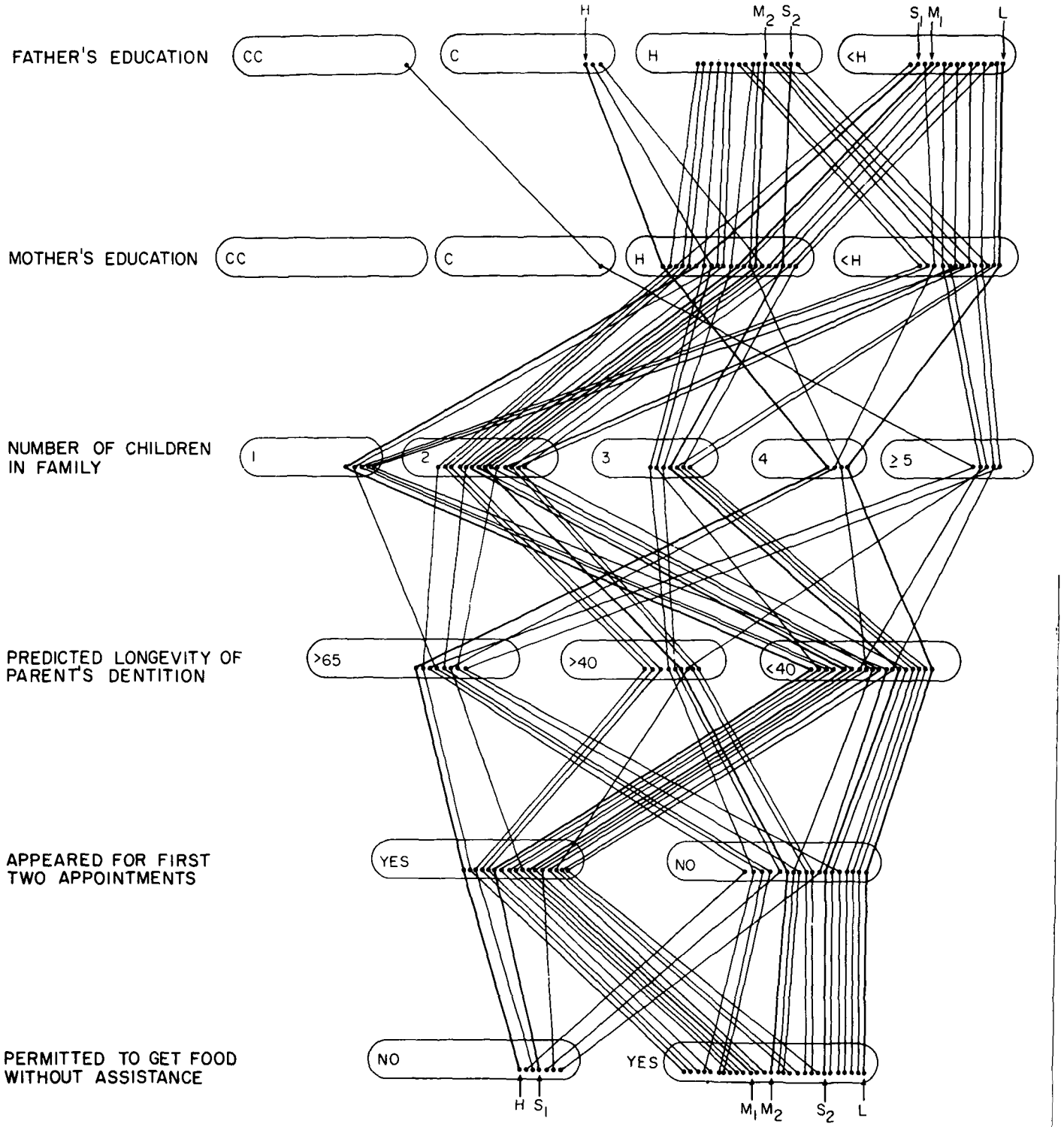

Figure 4. Graph from the high-caries group. Abbreviations are the same as those in Figure 3.

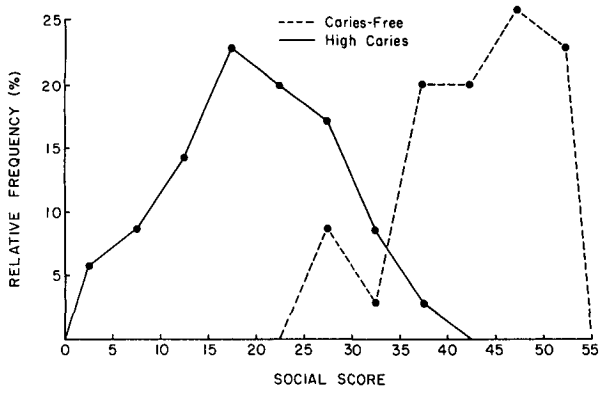

Figure 5. Cumulative scores for the social factors listed in Figures 3 and 4.

Discussion

The association of social factors and dental caries found in this study of children presenting for care is similar to the consensus of previous studies of general populations in other localities.[1,2,3,4] Differences between the high-caries and caries-free groups may be useful in further identifying outlooks and lifestyles which are associated with dental caries.

The three categories in this study most directly associated with control of life style are (1) ability to keep appointments, (2) allowing the child to get snacks without assistance, and (3) reason for presenting at the dentist. Pursuit of a college education and limitation of family size are more complex. While some planning and discipline are necessary to achieve these ends, instances are possible where lack of college and a large family are a result of planning. A low priority for dental care on the part of parents of high-caries children is reflected by a pessimistic outlook on personal dental health and prevalent belief of "soft teeth" as the primary reason for dental caries. Total ignorance of preventive measures is unlikely as indicated by comparable performances by the two groups on the snack tray test and by reported attempts at regular brushing.

The study should not be generalized to the population at large since the study group was composed of people seeking care and the study group had unique social factors such as almost all Caucasian and coming from essentially intact families.

Interpretation of data from the diet diaries is viewed in the context of social circumstances. If it is assumed that sucrose is a major dietary contributor to dental caries,[23,24] several explanations are possible for the comparable levels of sucrose exposure recorded for the two groups. First, caries is a dynamic process and the disease may be at a low level of activity at the time of the survey with a corresponding low level of sucrose intake. Second, due to a lower educational level, the parents may have difficulty in managing a project resulting in a written form of communication. Third, the parents may feel a stigma in recording something they know is responsible for the disease. Questions are raised regarding use of the diet diary as an educational tool.[14,25,26] Alternative methods and refinement of present procedures for dietary counseling may be necessary for specific populations.

While history of fluoride intake was difficult to document, the data are of some value. It appears that while fluoridation, supplemental fluorides, brushing, and flossing play a role in caries prevention, social factors presented here are also important.

Conclusions

Caries-free children presenting for dental care differed significantly from those with extensive interproximal carious lesions in the primary molars for several social factors. Caries-free children had parents of higher educational levels who were optimistic about prolonged retention of their own dentitions, came from smaller families, kept scheduled dental appointments, were restricted in getting snacks, had earlier birth orders and were less likely to have parents who considered "soft teeth" as the primary reason for caries. The cumulative effect was such that from these factors alone, over 90% of the children could be correctly designated as to caries experience. No significant differences were found in sucrose exposures listed on diet diaries when considering timing, concentration and consistency of sucrose-containing foods. Perceived cariogenicity of snack foods was the same for the two groups.

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