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# Oral Hygiene in Adults

## United States - 1960-1962

Estimates of levels of oral hygiene by age, sex, race, and other demographic characteristics, with an analysis of differentials by income and education and an inquiry into the statistical relationship between oral hygiene and periodontal disease.

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Washington, D.C.

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U.S. DEPARTMENT OF  
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Secretary

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Surgeon General



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In accordance with specifications established by the National Health Survey, the Bureau of the Census, under a contractual agreement, participated in the design and selection of the sample, and carried out the first stage of the field interviewing and certain parts of the statistical processing.

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*IN THIS REPORT are included detailed national estimates of oral hygiene levels prevailing in U.S. adults by age, sex, race, and other major demographic characteristics. A brief analysis of the variation in oral hygiene occurring at various levels of education and family income is followed by a concluding inquiry into the statistical relationship between oral hygiene and periodontal disease.*

*All estimates are based on examinations conducted by the Health Examination Survey in 1960-62 on a probability sample of U.S. adults, aged 18-79 years, selected from the civilian population at large. Oral hygiene was assessed by the Simplified Oral Hygiene Index, a method by which the extent of debris (soft foreign material loosely attached to the tooth) and the extent of calculus (hardened foreign material firmly attached to the tooth and sometimes called tartar) on at least one of six pre-designated teeth are estimated.*

*Oral hygiene status was significantly related to many of the basic variables which demographically describe the U.S. population. For example, women were found to have cleaner teeth than men, as were white men and women in comparison with Negro adults. Oral hygiene also was found to improve with increasing education and with increasing family income. On the other hand, oral cleanliness worsened with advancing age because of a gradual increase in the amount of calculus.*

*A large part of the difference occurring in oral hygiene by race was attributable to differences in education and income levels. Interestingly, this was true to a much greater extent for men than for women. Oral hygiene was more closely associated with education, however, than it was with family income.*

*Trends in the oral hygiene status of U.S. adults were remarkably parallel to trends in periodontal disease in the same population. Analysis of the statistical relationship between the two dental conditions indicated that variations in periodontal disease by sex and race were secondary to underlying differences in oral hygiene. Among persons with equivalent oral hygiene, definite but greatly reduced trends persisted in the amount of periodontal disease by both income and education. Age, however, persisted throughout as a strong and separate factor in the prevalence and severity of periodontal disease.*

#### SYMBOLS

Data not available-----	---
Category not applicable-----	...
Quantity zero-----	-
Quantity more than 0 but less than 0.05-----	0.0
Figure does not meet standards of reliability or precision-----	*

# ORAL HYGIENE IN ADULTS

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## INTRODUCTION

Oral hygiene has been widely acclaimed and endorsed as an important preventive practice which assures better dental health. Americans brush their teeth with a regularity and a frequency which, by hearsay, are unmatched. Many visit their dentists at regular intervals for removal of hardened deposits—calculus or tartar—which form on teeth and cling so tightly that dislodgement by tooth brushing is impossible. Over the years an enormous outlay in both hours and dollars is expended in a conscientious effort to maintain oral cleanliness.

Far from misspent, the investment by all odds is a wise one, since the importance of oral cleanliness in preserving sound teeth and supporting structures has up to a point been unquestionably demonstrated. Contrary to popular expectation, however, proper oral hygiene is probably more beneficial in averting gingival and periodontal disease than in curbing dental decay. For example, the following Health Examination Survey estimates of the mean number of DMF (decayed, missing, and filled) teeth per person give no indication that men and women with better oral hygiene (lower index scores) have fewer teeth attacked by decay than do other persons (see Appendix I):

Sex	Simplified Oral Hygiene Index				
	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-6.0
Men, 18-34 years-----	15.9	14.3	13.3	12.8	15.1
Women, 18-34 years-----	17.2	15.0	13.9	13.3	13.5

The truth of the matter is that with the exception of relatively few studies there is scant evidence that clean teeth are more resistant to decay than dirty ones.<sup>1,2</sup>

On the other hand, data collected by numerous investigators have revealed that periodontal disease increases in prevalence and severity with increasing degrees of oral uncleanliness.<sup>3-9</sup> In one of these studies, differences in periodontal disease between white and Negro persons were noted only when the condition of their oral hygiene also differed.<sup>7</sup> In another, differences in severity by sex were accounted for by variations in oral hygiene, and in still another, the incidence of gingivitis was sharply lowered by a supervised program of oral cleanliness.<sup>4,6</sup>

To summarize recent survey findings, periodontal disease can be depicted as increasing in prevalence and severity with age, oral uncleanliness, and descending socioeconomic status. Men are more frequently and more severely attacked than women, and in the United States, Negroes more than white persons. Some of the observed variations are apparently secondary to differences in oral hygiene. It should be noted, however, that there were at least two instances, a difference observed by education and another by race, that could not fully be accounted for, suggesting that a factor other than hygiene and age may have been involved.<sup>7,9</sup>

It seems quite clear indeed that faulty oral hygiene not only invites the onset of periodontal disease but causes it. Although this reasoning is based largely on the close correlation repeatedly established between the two conditions, evidence of a more conclusive nature is to some extent beside the point. In the final analysis, establishing oral cleanliness and maintaining it have for decades been mainstays in the successful treat-

ment of periodontal disease. It is difficult to imagine that they will ever cease to be so, despite the fact that there is still much to be learned about periodontal disease, including its precise relationship with oral hygiene.

In this report, levels of oral hygiene in the U.S. adult population aged 18-79 years are presented by age, sex, race, and other selected demographic characteristics. National estimates of prevalence and distribution are based on examinations in 1960-62 of 6,672 persons selected by probability sampling to represent approximately 111 million adults in the civilian, noninstitutional population. A description of the selection of sample persons, a description and an assessment of the dental examination, and an explanation of the procedure for deriving national estimates were published in earlier reports of the *Vital and Health Statistics* series.<sup>10, 11</sup>

Another section of the present report briefly examines the statistical relationship between oral hygiene and periodontal disease.

Each dental examination was completed under comparable conditions by one of five dentists carefully instructed and uniformly trained to perform a prescribed examination procedure. Oral hygiene status was determined by the Simplified Oral Hygiene Index (OHI-S), an abridged version of the earlier index (OHI) developed by Greene and Vermillion to assess oral hygiene macroscopically by estimating the amount of foreign matter adhering to the teeth or, in the abbreviated method, adhering to selected surfaces of designated teeth.<sup>12, 13</sup> In the simplified method, as it was used by the Health Examination Survey, the extent of oral debris and the extent of oral calculus are measured on selected surfaces of six pre-designated teeth, or as many of the six as there are. The buccal of upper molars, the lingual of lower molars, and the labial of upper and lower central incisors are included among the assessed surfaces. The proportion (in thirds) of total surface area overlaid by debris and the proportion overlaid by calculus are averaged and summed to give the Simplified Oral Hygiene Index, which ranges from a low of 0.0 (no debris, stain, or calculus) to a maximum of 6.0 (more than two-thirds of the examined tooth surfaces covered with both debris and calculus). Appendix I gives a more detailed description of the examination.

Estimates of oral hygiene levels in this report are for men and women who had at least one of the six designated teeth. Based on examinations, approximately 90 million adults fulfilled the requirement, but more than 20 million others—mostly edentulous persons—did not. Exclusion of the latter resulted in a diminishing proportion of persons eligible for oral hygiene assessment within each older age group (fig. 1), and within specified age ranges, proportionately fewer white persons than Negroes and fewer women than men.

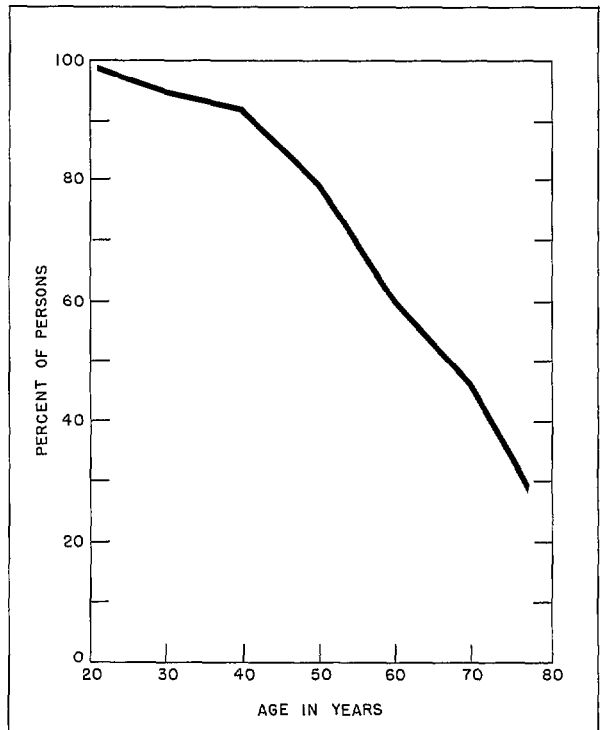


Figure 1. Percent of persons eligible for oral hygiene assessment, by age.

## FINDINGS

### Age and Sex

The estimated mean OHI-S for the nearly 90 million men and women with at least one of the six teeth eligible for assessment was 1.5. However, women had perceptibly cleaner teeth

than men. The same trend by sex prevailed within each of the various age ranges, resulting in a significantly lower mean score for women than for men—1.3 as contrasted with 1.8 (table 1 and fig. 2).

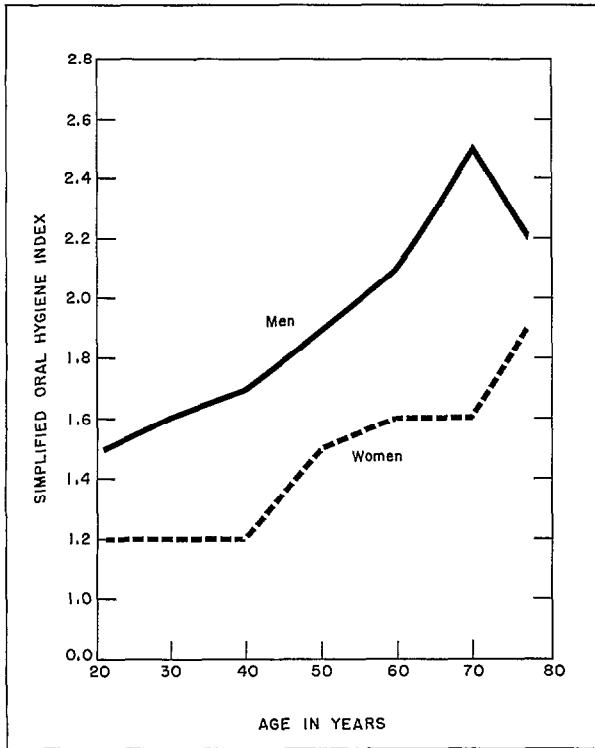


Figure 2. Average Simplified Oral Hygiene Index for men and women, by age.

The overall distribution of oral hygiene scores in the adult population is shown in table A.

The favorable balance of low scores in comparison with high scores attests the relatively good level of oral hygiene that prevailed among most adults. Nearly half had little or no debris and calculus (scores of 1.0 or less), and another quarter had so little that their scores did not exceed 2.0. Scores greater than 3.0, indicating serious and probably habitual neglect, were found in only about an eighth of all persons.

As men and women grew older, their oral hygiene slowly but steadily became worse. As a

Table A. Number and percent distribution of persons, by level of Simplified Oral Hygiene Index: United States, 1960-62

Simplified Oral Hygiene Index	Number of persons in thousands	Percent distribution
Total-----	88,568	100.0
0.0-1.0-----	42,367	47.8
1.1-2.0-----	21,348	24.1
2.1-3.0-----	13,367	15.1
3.1-4.0-----	7,437	8.4
4.1-6.0-----	4,047	4.6

result, mean scores rose from a low of 1.5 and 1.2 for the youngest group of men and women, respectively, to a high of 2.5 for men aged 65-74 years and 1.9 for women aged 75-79 years. The gradual deterioration in oral hygiene with time was due to a continuing accretion of calculus. By contrast, debris loosely attached to teeth neither increased nor decreased markedly, but remained relatively constant at all ages.

Mean Simplified Debris and Calculus Indexes, the two components whose sum is the mean Simplified Oral Hygiene Index, also appear in table 1. Until age 75, debris scores for men and women were higher than complementary calculus scores; only in the age group 75-79 years was the reverse true, with the oral hygiene score of the oldest men and women more heavily weighted by calculus. Within any given age group, however, women without fail had both less debris and less calculus than did men.

### Race

Pronounced differences in oral hygiene were found to exist by race. The amount of both debris and calculus measured on the teeth of Negro adults usually exceeded the amount measured on white adults. This observation was expressed quantitatively by the mean OHI-S for Negro men and women, 2.2, which was half again larger than the corresponding score for white adults, 1.5.

Mean oral hygiene scores by age, sex, and race are shown in table 2 and in figure 3. The



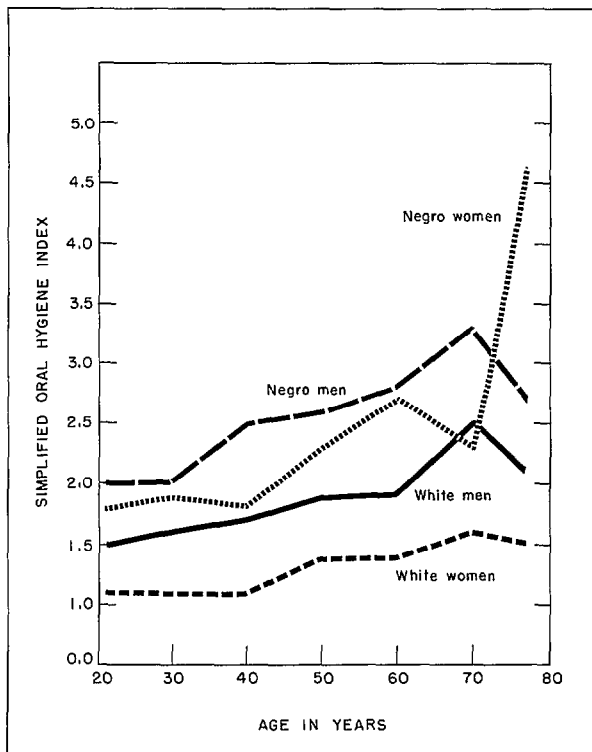


Figure 3. Average Simplified Oral Hygiene Index for white and Negro men and women, by age.

scores, higher at any given age for Negro than for white men and women, generally increased with advancing age up to 75 years. With the exception of Negro adults aged 75-79 years, men typically had poorer oral hygiene than did women of comparable age and race. However, because of the small number of sample persons, the sampling variability for the oldest group of adults was quite large.

In both races, debris measurements were trendless with changes in age. However, older persons still had increasingly heavier deposits of calculus. Within specified age ranges, the Simplified Debris and Calculus Indexes were higher for Negro adults than for white adults, as they also were for men as compared with women of the same race.

## Other Demographic Variables

The prevalence and severity of many dental conditions have been found to vary significantly with differences in income, education, and other demographic variables. For instance, the Health Examination Survey found that periodontal disease was selectively concentrated in distinct segments of the general U.S. adult population.<sup>14</sup> In the following section, the U.S. population has again been subdivided and grouped into graduated levels of income and education; in addition, it has been classified by specified place of residence.

After the population was grouped, any differences which appeared in oral hygiene among the various groups, as measured by the Simplified Oral Hygiene Index, were then observed. For example, mean oral hygiene scores for persons at five different levels of income were compared to determine whether the prevailing level of oral hygiene within one income range differed from that within another. Allowance was made for differences in the age and sex distribution of persons composing the various groups, since oral hygiene has already been shown to vary importantly by both of these characteristics.

Because of the relatively limited number of sample persons, sampling variability for specific age and sex groups was usually quite large. It is for this reason that summary comparisons of the actual and expected mean Simplified Oral Hygiene Index by sex and race were preferred to comparisons of mean age-specific scores.

Expected values were calculated by weighting age- and sex-specific mean scores for the total U.S. population by the age-sex distribution of respective groups. Actual and expected values for the same group may occasionally be expected to differ by chance. But when the difference is not statistically significant, it can generally be assumed that differences between mean oral hygiene scores for component age-sex groups fluctuated randomly.

## Income and Education

The degree of oral cleanliness maintained by adults varied widely according to their economic status. The poorest oral hygiene was en-

countered most frequently among persons whose family income was lowest, and, conversely, the best was found among persons whose income was highest (table 3 and fig. 4). Among adults of all races, the largest mean oral hygiene score per person, 2.6, belonged to men whose total family income was under \$2,000 per year. As yearly income increased, however, oral hygiene improved steadily. The smallest scores, or best hygiene, in any group of men were reported for those whose yearly income was in excess of \$9,999.

Oral hygiene was even more highly correlated with education than with family income (table 4 and fig. 5). Men and women of all races who had attended school for relatively brief periods were more likely to tolerate larger amounts of dental debris and calculus than were persons who had attended school for longer periods. Men who had completed at least 1 year in college had a low

mean OHI-S of 1.1. By contrast, the group of men with least formal education had an oral hygiene score nearly threefold greater, 3.0.

Within specified levels of income and education, mean scores continued to reflect appreciable differences in oral hygiene by sex. Without exception, Negro and white women had lower scores than did men of comparable age and race.

Earning power in the United States is closely scaled to educational attainment. Better educated persons usually earn higher salaries than men and women who have had less schooling. Yet, there are grounds for assuming that education and income have essentially different implications insofar as they pertain to dental health. Meager funds, for instance, may sometimes deter persons from seeking dental care, but it is not so clear that ample income alone motivates persons to obtain care, still less to begin more effective

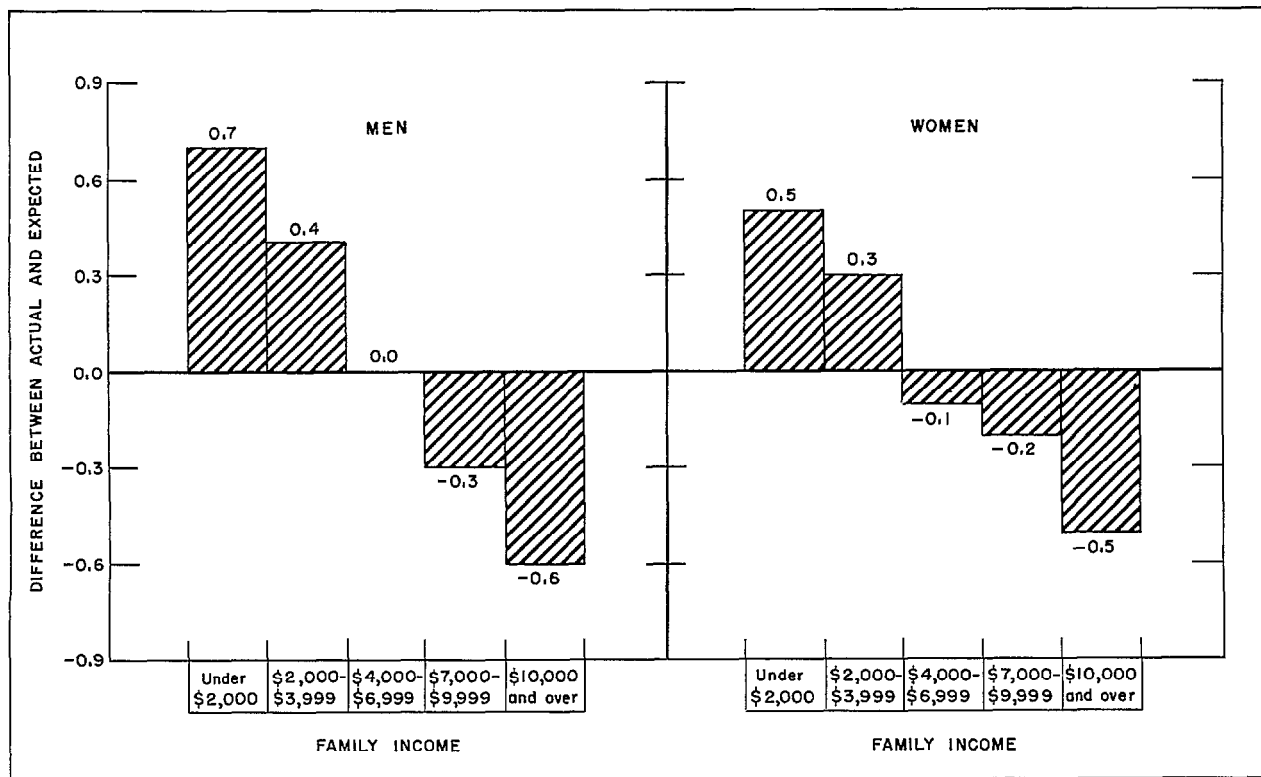


Figure 4. Differences between actual and expected mean Simplified Oral Hygiene Index for men and women, by family income.

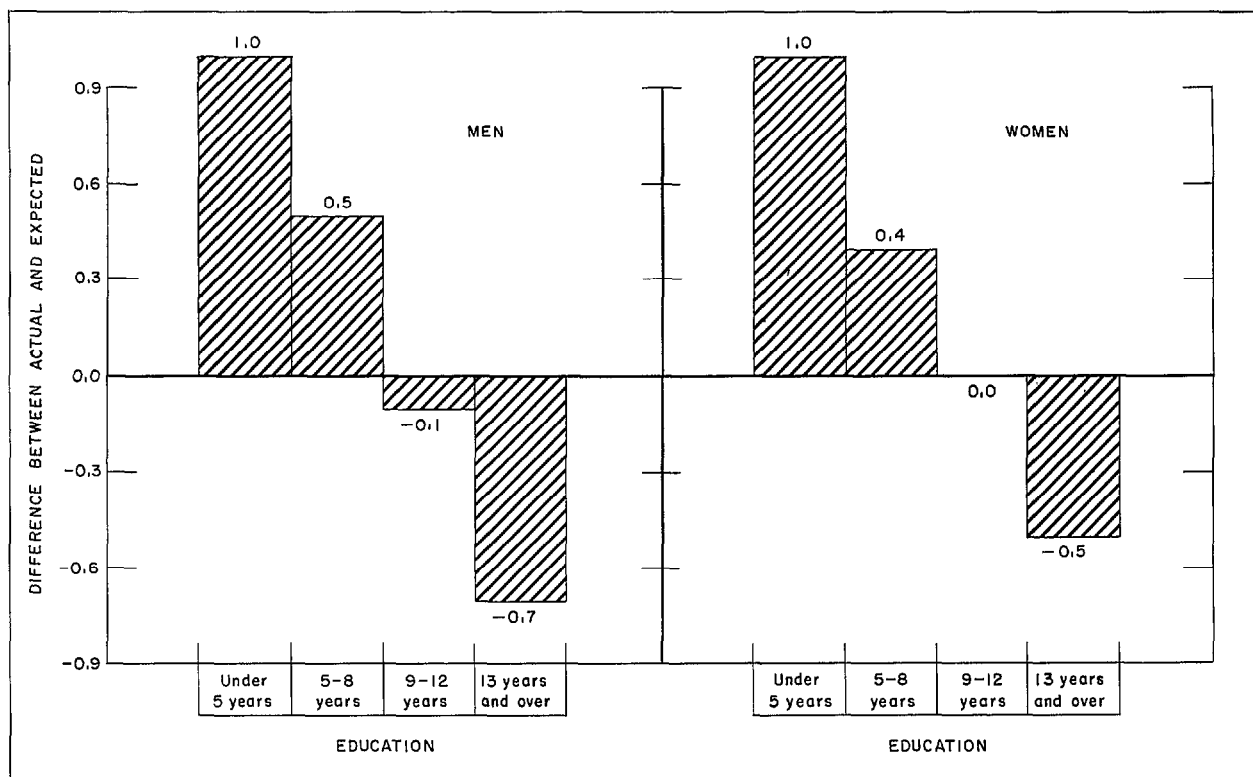


Figure 5. Differences between actual and expected mean Simplified Oral Hygiene Index for men and women, by education.

measures of oral hygiene. On the other hand, education presumably instills deeper awareness of the importance of good health and greater conversance with ways to attain it.

In figure 6, the effect of income (independent of education) upon changes in the Simplified Oral Hygiene Index is examined. As demonstrated, mean scores continued to vary inversely with family income. Adjustment for differences in education, however, reduced the variance of the mean Oral Hygiene Index attributable to income to approximately a quarter of its former value. This indicates, as forecast, that education exercised a stronger influence on oral hygiene than did family income.

### Race by Income and Education

A significantly large part of the difference observed in oral hygiene by race was accounted for by differences in income and education (table 5). However, when either income or education was kept constant, a greater reduction between mean scores by race resulted for men than for women. There were no differences between the mean Simplified Oral Hygiene Indexes of Negro and white men with less than 5 years and with 5-8 years of schooling, and there was relatively little for those who had completed at least 1 year of high school. Because proportionately few Negro adults had family incomes exceeding \$6,999

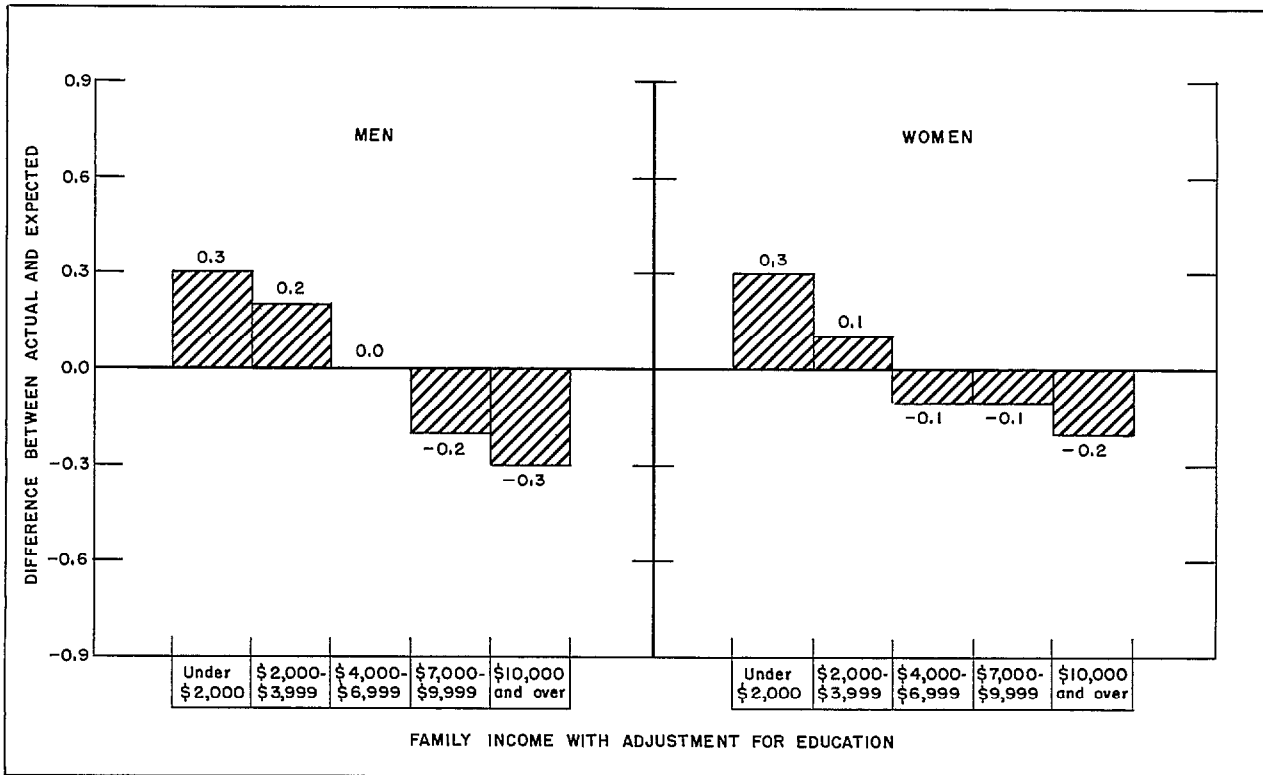


Figure 6. Differences between actual and expected mean Simplified Oral Hygiene Index for men and women, by income adjusted for education.

per year or education beyond high school, average scores could not be meaningfully compared at these levels.

#### Place of Residence

Estimates of the mean Simplified Oral Hygiene Index for men and women residing in three regions of the country were as follows:

	Men	Women
Northeast-----	1.7	1.3
South-----	1.9	1.3
West-----	1.9	1.3

The estimates did not vary widely enough to indicate significant regional variation in oral hygiene. However, it should be noted that the three geographic regions defined by the Health Exami-

nation Survey were extremely broad and did not conform with any of the more familiar definitions.

Estimates of oral hygiene were also obtained by place description, population size, and urban-rural residence (tables 6-8). Without exception, white rural residents—both farm and nonfarm—had significantly higher scores than did the white residents of nonrural areas. Other estimates of oral hygiene by place of residence did not vary significantly.

## ORAL HYGIENE AND PERIODONTAL DISEASE

The exposition of findings on oral hygiene in U.S. adults has closely followed in format a previous report which described the occurrence of periodontal disease in the same population.<sup>14</sup> The format was repeated to put greater stress on the

many striking analogies existing in the two conditions. These include a worsening with age of one and an increase with age in the prevalence and severity of the other. In addition, among persons of the same age, poorer oral hygiene and more periodontal disease were found in men than in women and in Negroes than in white adults. Finally, both oral hygiene and periodontal scores varied inversely with educational attainment and family income.

Oral debris and calculus have long been regarded as, at the very least, important contributing factors within the perplexing pathologic nexus clinically manifested as periodontal disease. The extremely high frequency with which the two conditions occur conjointly has largely been responsible for a growing conviction that poor oral hygiene actually causes periodontal disease. Findings of the present survey furnish neither proof positive, which rarely if ever results from an epidemiological study, nor even so much as new evidence on the nature of the linkage between oral hygiene and periodontal disease. They nonetheless tellingly demonstrate the close relationship of the dual conditions in a broadly representative sample of U.S. adults.

In table 9, mean periodontal scores are displayed by age and sex within specified ranges of the Simplified Oral Hygiene Index. Abrupt, step-like increases in mean periodontal scores, coincident with increasing levels of the Simplified Oral Hygiene Index, affirm the strong association between oral hygiene and periodontal disease. For instance, white men whose index ranged from 0.0 through 1.0 had a mean periodontal score of only 0.37, whereas those with indexes greater than 4.0 had a mean periodontal score of 4.20. Equally large gradients were obtained for both men and women regardless of their race.

The contents of table 9 suggest at once an underlying explanation for variations in periodontal disease contingent upon sex and race. With the Simplified Oral Hygiene Index constant, significant differences in the mean Periodontal Index by sex and by race disappear. To put it briefly, as long as men and women of the same age (either white or Negro) had the same level of oral hygiene, they also had the same level of periodontal disease. Furthermore, almost all of the variation in periodontal disease associated with income and education was accounted for by oral hygiene

(tables 10 and 11). Although it is perhaps simplistic to ascribe to oral debris and calculus the role of causal agent, periodontal disease in U.S. adults has behaved statistically as though it were a function of oral hygiene.

Age, on the other hand, apparently was independently correlated with periodontal disease, for, unlike variations by sex and race, variations occurring with age did not correspond with differences in oral hygiene. For example, the Periodontal Index for older persons was significantly higher than that for younger persons who had an equivalent level of oral cleanliness (fig. 7).

Debris and calculus, the components of poor oral hygiene, were both highly correlated with periodontal disease. Holding the former or the latter constant greatly narrowed the margin of difference between the mean Periodontal Indexes by sex and race (table 9). Residual differences were greater, however, when the Simplified Debris Index was constant, indicating a higher correlation between calculus and periodontal disease than between debris and periodontal disease.

Analysis of the several interrelated factors in oral hygiene and periodontal disease is complicated by the more chronic nature of calculus and destructive periodontal disease, both of which become increasingly severe with age compared with the more acute and often transitory nature of debris and gingivitis. As expected, the two component indexes, as well as the composite Simplified Oral Hygiene Index, were more sensitively associated with periodontal disease in younger adults than in older ones.

The relationship of oral hygiene and destructive periodontal disease can be examined firsthand by considering the percent of persons with periodontal pockets while at the same time controlling for both debris and calculus. People accordingly were placed into one of nine groups which ranged in order from a low for both debris and calculus to a high for both conditions. The percent of persons in each group actually having periodontal pockets and the percent expected to have them, by dint of their age-sex composition, were computed. As the last step, differences between actual and expected values were obtained.

In table 12 it will be noted that the percent of persons with advanced disease increased in relation to expected or average values when the Simplified Calculus Index increased and debris

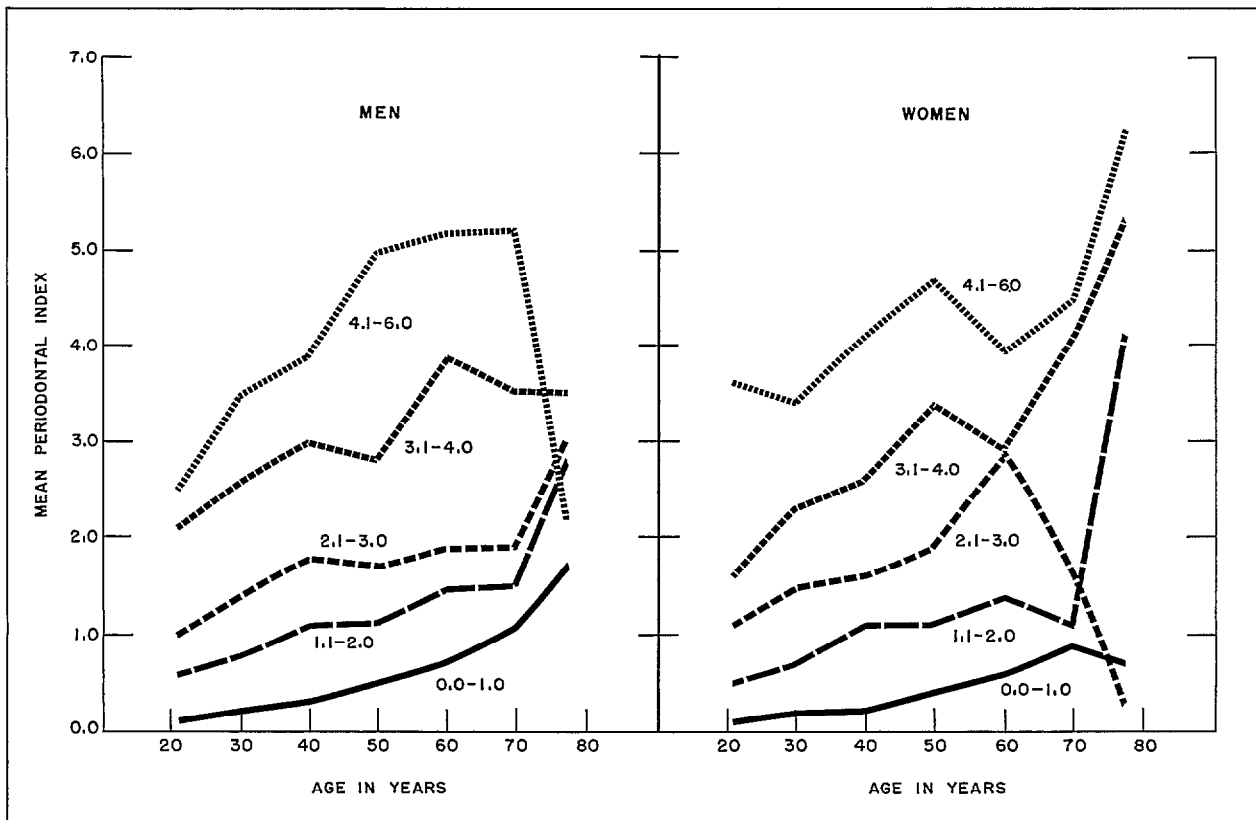


Figure 7. Mean Periodontal Index for men and women, by age and by specified levels of the Simplified Oral Hygiene Index.

was constant, and also when the reverse conditions prevailed. The smallest percent of persons with periodontal pockets was in the group whose debris and calculus scores were lowest; the largest percent was in the group with highest debris and calculus scores. Thus, both debris and calculus appeared to exert an independent influence upon destructive periodontal disease.

### SUMMARY

In spite of wide acceptance as an essential safeguard for lasting dental health, oral hygiene was gravely neglected by a multitude of U.S. adults. While it is true that men and women on

the whole observed a fairly good level of oral cleanliness, more than one out of four had substandard levels ranging from barely adequate to injuriously poor.

National estimates of oral hygiene are based on the examination in 1960-62 of a probability sample of 6,672 persons from the civilian, non-institutional population 18-79 years of age. Oral hygiene was assessed by the Simplified Oral Hygiene Index, a method requiring the presence of at least one of six predesignated teeth.

Healthier levels of oral hygiene were found in women than in men. As a result, the mean Simplified Oral Hygiene Index, which ranges from a low of 0.0 (no debris, calculus, or stain present)

to a high of 6.0 (more than two-thirds of the examined tooth surfaces covered by both debris and calculus), was estimated to be 1.3 for women and 1.8 for men. Because of a slow but steady accumulation of calculus, oral hygiene in both men and women became progressively worse with advancing age. By contrast, the quantity of debris showed no appreciable trend with age, but stayed comparatively constant.

Relatively large differences in oral hygiene were found by race. The mean oral hygiene score for Negro men and women was 2.2, an estimate which was half again higher than the corresponding score for white adults (1.5). Moreover, mean scores at any given age were higher for Negro adults than for white men and women.

Oral hygiene also varied markedly by levels of family income and education. Poorer oral hygiene was found more often among persons with low income rather than high and among persons who had less education. Oral hygiene, however, was more closely associated with education than with income.

Much of the difference observed in oral hygiene by race was attributed to corresponding differences in family income and education. With either variable constant, however, differences by race were more sharply reduced for men than they were for women.

The oral hygiene status of white adults residing in rural areas was decidedly less adequate than that of white urban dwellers. Variation by other specified places of residence and by region was negligible.

Many demographic variations in the distribution of periodontal disease were resolved in full or in large measure by analysis of the relationship between oral hygiene and periodontal disease. Among persons with equivalent levels of oral hygiene, periodontal disease continued to show slight but consistent trends with education and family income, but trends by sex and race were no longer apparent. Age, on the other hand, persisted as a strong and separate factor in the prevalence and severity of periodontal disease.

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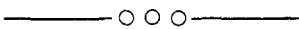
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Table 1. Average Simplified Oral Hygiene, Debris, and Calculus Indexes for men and women, by age:  
United States, 1960-62

Sex and age	Simplified Oral Hygiene Index	Simplified Debris Index	Simplified Calculus Index
<u>Both sexes</u>			
Total, 18-79 years-----	1.5	0.9	0.6
<u>Men</u>			
Total, 18-79 years-----	1.8	1.1	0.7
18-24 years-----	1.5	1.1	0.4
25-34 years-----	1.6	1.0	0.6
35-44 years-----	1.7	1.0	0.7
45-54 years-----	1.9	1.1	0.8
55-64 years-----	2.1	1.2	0.9
65-74 years-----	2.5	1.4	1.1
75-79 years-----	2.2	1.0	1.2
<u>Women</u>			
Total, 18-79 years-----	1.3	0.8	0.5
18-24 years-----	1.2	0.9	0.3
25-34 years-----	1.2	0.8	0.4
35-44 years-----	1.2	0.8	0.5
45-54 years-----	1.5	0.8	0.7
55-64 years-----	1.6	0.9	0.7
65-74 years-----	1.6	0.9	0.7
75-79 years-----	1.9	0.9	1.0

Table 2. Average Simplified Oral Hygiene, Debris, and Calculus Indexes for white and Negro men and women, by age: United States, 1960-62

Sex and age	Simplified Oral Hygiene Index		Simplified Debris Index		Simplified Calculus Index	
	White	Negro	White	Negro	White	Negro
<u>Both sexes</u>						
Total, 18-79 years-----	1.5	2.2	0.9	1.2	0.6	1.0
<u>Men</u>						
Total, 18-79 years-----	1.7	2.4	1.0	1.3	0.7	1.1
18-24 years-----	1.5	2.0	1.1	1.3	0.4	0.7
25-34 years-----	1.6	2.0	1.0	1.1	0.6	0.9
35-44 years-----	1.7	2.5	1.0	1.3	0.7	1.2
45-54 years-----	1.9	2.6	1.1	1.4	0.8	1.2
55-64 years-----	1.9	2.8	1.1	1.5	0.8	1.3
65-74 years-----	2.5	3.3	1.4	1.6	1.1	1.7
75-79 years-----	2.1	2.7	1.0	0.9	1.1	1.8
<u>Women</u>						
Total, 18-79 years-----	1.3	2.0	0.8	1.1	0.5	0.9
18-24 years-----	1.1	1.8	0.8	1.1	0.3	0.7
25-34 years-----	1.1	1.9	0.7	1.1	0.4	0.8
35-44 years-----	1.1	1.8	0.7	1.0	0.4	0.8
45-54 years-----	1.4	2.3	0.8	1.1	0.6	1.2
55-64 years-----	1.4	2.7	0.8	1.3	0.6	1.4
65-74 years-----	1.6	2.3	0.9	1.2	0.7	1.1
75-79 years-----	1.5	4.6	0.7	2.3	0.8	2.3

Table 3. Actual and expected average Simplified Oral Hygiene Index for men and women, by race and family income: United States, 1960-62

Race and income	Men			Women		
	Actual	Expected	Difference	Actual	Expected	Difference
<u>All races</u>						
Under \$2,000-----	2.6	1.9	0.7	1.9	1.4	0.5
\$2,000-\$3,999-----	2.2	1.8	0.4	1.6	1.3	0.3
\$4,000-\$6,999-----	1.8	1.8	0.0	1.2	1.3	-0.1
\$7,000-\$9,999-----	1.5	1.8	-0.3	1.1	1.3	-0.2
\$10,000 and over-----	1.2	1.8	-0.6	0.9	1.4	-0.5
Unknown-----	2.1	1.8	0.3	1.5	1.4	0.1
<u>White</u>						
Under \$2,000-----	2.5	1.8	0.7	1.5	1.3	0.2
\$2,000-\$3,999-----	2.1	1.7	0.4	1.6	1.2	0.4
\$4,000-\$6,999-----	1.8	1.7	0.1	1.2	1.2	0.0
\$7,000-\$9,999-----	1.4	1.7	-0.3	1.1	1.2	-0.1
\$10,000 and over-----	1.1	1.8	-0.7	0.9	1.2	-0.3
Unknown-----	2.1	1.8	0.3	1.4	1.3	0.1
<u>Negro</u>						
Under \$2,000-----	2.7	2.5	0.2	2.4	2.1	0.3
\$2,000-\$3,999-----	2.3	2.5	-0.2	1.8	2.0	-0.2
\$4,000-\$6,999-----	2.4	2.3	0.1	1.6	1.9	-0.3
\$7,000-\$9,999-----	2.3	2.3	0.0	1.4	1.9	-0.5
\$10,000 and over-----	2.2	2.4	-0.2	1.2	1.8	-0.6
Unknown-----	2.1	2.5	-0.4	2.3	2.0	0.3

NOTE: Computation of expected values explained in Appendix II.

Table 4. Actual and expected average Simplified Oral Hygiene Index for men and women, by race and education: United States, 1960-62

Race and education	Men			Women		
	Actual	Expected	Difference	Actual	Expected	Difference
<u>All races</u>						
Under 5 years-----	3.0	2.0	1.0	2.4	1.4	1.0
5-8 years-----	2.4	1.9	0.5	1.8	1.4	0.4
9-12 years-----	1.7	1.8	-0.1	1.3	1.3	0.0
13 years and over-----	1.1	1.8	-0.7	0.8	1.3	-0.5
<u>White</u>						
Under 5 years-----	3.1	1.9	1.2	2.3	1.3	1.0
5-8 years-----	2.4	1.8	0.6	1.7	1.3	0.4
9-12 years-----	1.7	1.7	0.0	1.2	1.2	0.0
13 years and over-----	1.1	1.7	-0.6	0.8	1.2	-0.4
<u>Negro</u>						
Under 5 years-----	3.1	2.7	0.4	2.6	2.3	0.3
5-8 years-----	2.4	2.5	-0.1	2.3	2.1	0.2
9-12 years-----	2.1	2.3	-0.2	1.9	1.9	0.0
13 years and over-----	2.8	2.4	0.4	1.1	2.0	-0.9

NOTE: Computation of expected values explained in Appendix II.

Table 5. Mean Simplified Oral Hygiene Index for white and Negro men and women, by family income and education: United States, 1960-62

Family income and education	Men		Women	
	White <sup>1</sup>	Negro	White <sup>1</sup>	Negro
<u>Family income</u>				
Under \$2,000-----	2.6	2.7	1.6	2.4
\$2,000-\$3,999-----	2.1	2.3	1.6	1.8
\$4,000-\$6,999-----	1.7	2.4	1.2	1.6
<u>Education</u>				
Under 5 years-----	3.1	3.1	2.3	2.6
5-8 years-----	2.4	2.4	1.7	2.3
9-12 years-----	1.7	2.1	1.2	1.9

<sup>1</sup>Value for white population adjusted to be comparable with value for Negro population. Computation explained in Appendix II.

Table 6. Actual and expected average Simplified Oral Hygiene Index for men and women, by race and place description: United States, 1960-62

Race and place description	Men			Women		
	Actual	Expected	Difference	Actual	Expected	Difference
<u>All races</u>						
SMSA-in central city-----	1.8	1.8	0.0	1.4	1.4	0.0
SMSA-outside central city-----	1.6	1.8	-0.2	1.2	1.3	-0.1
Urban not SMSA-----	1.8	1.8	0.0	1.3	1.3	0.0
Rural farm-----	2.2	1.9	0.3	1.7	1.3	0.4
Rural nonfarm-----	2.1	1.8	0.3	1.5	1.3	0.2
<u>White</u>						
SMSA-in central city-----	1.7	1.8	-0.1	1.3	1.3	0.0
SMSA-outside central city-----	1.5	1.7	-0.2	1.1	1.2	-0.1
Urban not SMSA-----	1.7	1.7	0.0	1.2	1.2	0.0
Rural farm-----	2.1	1.8	0.3	1.5	1.2	0.3
Rural nonfarm-----	2.0	1.7	0.3	1.4	1.2	0.2
<u>Negro</u>						
SMSA-in central city-----	2.4	2.4	0.0	1.9	2.0	-0.1
SMSA-outside central city-----	2.0	2.3	-0.3	1.7	2.0	-0.3
Urban not SMSA-----	2.6	2.5	0.1	2.2	2.1	0.1
Rural farm-----	2.6	2.4	0.2	2.2	1.9	0.3
Rural nonfarm-----	2.6	2.5	0.1	2.4	2.2	0.2

NOTE: Computation of expected values explained in Appendix II.

Table 7. Actual and expected average Simplified Oral Hygiene Index for men and women, by race and urban-rural residence: United States, 1960-62

Race and urban-rural residence	Men			Women		
	Actual	Expected	Difference	Actual	Expected	Difference
<u>All races</u>						
Urban-----	1.7	1.8	-0.1	1.3	1.3	0.0
Rural-----	2.0	1.8	0.2	1.4	1.3	0.1
<u>White</u>						
Urban-----	1.7	1.7	0.0	1.2	1.2	0.0
Rural-----	1.9	1.7	0.2	1.3	1.2	0.1
<u>Negro</u>						
Urban-----	2.4	2.4	0.0	1.9	2.0	-0.1
Rural-----	2.6	2.5	0.1	2.3	2.1	0.2

NOTE: Computation of expected values explained in Appendix II.

Table 8. Actual and expected Simplified Oral Hygiene Index for men and women, by race and population-size group: United States, 1960-62

Race and population-size group	Men			Women		
	Actual	Expected	Difference	Actual	Expected	Difference
<u>All races</u>						
Giant metropolitan areas-----	1.7	1.8	-0.1	1.3	1.4	-0.1
Other very large metropolitan areas-	1.7	1.8	-0.1	1.4	1.3	0.1
Other standard metropolitan statistical areas-----	1.7	1.8	-0.1	1.2	1.3	-0.1
Other urban areas-----	1.9	1.8	0.1	1.3	1.3	0.0
Rural areas-----	2.1	1.8	0.3	1.6	1.3	0.3
<u>White</u>						
Giant metropolitan areas-----	1.7	1.8	-0.1	1.3	1.3	0.0
Other very large metropolitan areas-	1.7	1.7	0.0	1.3	1.2	0.1
Other standard metropolitan statistical areas-----	1.6	1.7	-0.1	1.1	1.2	-0.1
Other urban areas-----	1.8	1.7	0.1	1.2	1.2	0.0
Rural areas-----	2.0	1.7	0.3	1.4	1.2	0.2
<u>Negro</u>						
Giant metropolitan areas-----	2.3	2.3	0.0	1.6	2.0	-0.4
Other very large metropolitan areas-	2.1	2.3	-0.2	2.3	2.0	0.3
Other standard metropolitan statistical areas-----	2.5	2.5	0.0	2.1	2.1	0.0
Other urban areas-----	2.6	2.5	0.1	2.0	2.0	0.0
Rural areas-----	2.5	2.5	0.0	2.4	2.1	0.3

Note: Computation of expected values explained in Appendix II.

Table 9. Average Periodontal Index for white and Negro men and women, by Simplified Oral Hygiene, Debris, and Calculus Indexes: United States, 1960-62

Index levels	Men		Women	
	White	Negro	White	Negro
<u>Simplified Oral Hygiene Index</u>				
Total-----	1.21	1.77	0.81	1.41
Adjusted total <sup>1</sup> -----	1.79	1.77	1.42	1.41
0.0-1.0-----	0.37	0.23	0.31	0.25
1.1-2.0-----	0.98	1.04	0.91	1.11
2.1-3.0-----	1.65	1.55	1.68	1.71
3.1-4.0-----	2.99	2.96	2.85	2.48
4.1-6.0-----	4.20	4.36	4.21	4.28
<u>Debris Index</u>				
Adjusted total <sup>1</sup> -----	1.50	1.77	1.11	1.41
0.0-1.0-----	0.65	0.89	0.54	0.80
1.1-2.0-----	1.89	2.25	1.63	1.92
2.1-3.0-----	3.38	3.52	2.89	3.49
<u>Calculus Index</u>				
Adjusted total <sup>1</sup> -----	1.65	1.77	1.27	1.41
0.0-1.0-----	0.67	0.92	0.51	0.83
1.1-2.0-----	2.19	2.20	2.03	1.91
2.1-3.0-----	3.93	3.92	3.89	3.70

<sup>1</sup>Value for white population adjusted to be comparable with value for Negro population. Computation explained in Appendix II.

Table 10. Differences between actual and expected levels of the average Periodontal Index for men and women, by family income and Simplified Oral Hygiene Index: United States, 1960-62

Simplified Oral Hygiene Index	Family income					
	Under \$2,000	\$2,000-\$3,999	\$4,000-\$6,999	\$7,000-\$9,999	\$10,000 and over	Unknown
<u>Men</u>						
	Differences					
Total-----	0.55	0.22	0.05	-0.30	-0.59	0.28
Adjusted total-----	0.06	-0.03	0.06	-0.02	-0.03	0.05
0.0-1.0-----	0.13	-0.03	0.02	-0.05	-0.01	0.06
1.1-2.0-----	0.01	0.07	0.00	-0.01	-0.19	0.18
2.1-3.0-----	0.08	-0.33	0.22	0.09	-0.20	0.00
3.1-4.0-----	-0.29	0.00	0.30	-0.37	-0.06	0.26
4.1-6.0-----	0.06	0.28	-0.18	0.50	1.03	-0.78
<u>Women</u>						
Total-----	0.43	0.25	-0.06	-0.25	-0.40	0.10
Adjusted total-----	0.04	0.10	0.01	-0.13	-0.17	-0.01
0.0-1.0-----	-0.02	0.12	0.03	-0.03	-0.08	-0.06
1.1-2.0-----	0.05	0.18	-0.03	-0.23	-0.07	0.09
2.1-3.0-----	0.10	0.03	0.08	-0.22	-0.21	-0.10
3.1-4.0-----	-0.30	-0.16	0.48	-0.10	-0.17	0.17
4.1-6.0-----	0.88	0.20	-0.98	-0.34	-1.48	-0.08

NOTE: Computation of adjusted values explained in Appendix II.



Table 11. Difference between actual and expected levels of the average Periodontal Index for men and women, by education and Simplified Oral Hygiene Index: United States, 1960-62

Simplified Oral Hygiene Index	Education			
	Under 5 years	5-8 years	9-12 years	13 years and over
<u>Men</u>				
Differences				
Total-----	0.96	0.38	-0.06	-0.52
Adjusted total-----	0.10	0.10	-0.04	-0.06
0.0-1.0-----	0.16	0.21	-0.04	-0.03
1.1-2.0-----	-0.01	-0.03	0.04	-0.13
2.1-3.0-----	-0.04	0.06	-0.09	0.15
3.1-4.0-----	0.32	-0.03	-0.21	0.32
4.1-6.0-----	0.05	0.09	0.04	-1.15
<u>Women</u>				
Total-----	0.64	0.28	-0.01	-0.47
Adjusted total-----	0.24	0.00	0.05	-0.12
0.0-1.0-----	0.58	0.03	0.02	-0.11
1.1-2.0-----	-0.07	-0.09	0.11	-0.28
2.1-3.0-----	-0.50	0.17	-0.05	0.11
3.1-4.0-----	0.02	0.04	0.15	-0.40
4.1-6.0-----	1.08	-0.47	0.12	0.36

NOTE: Computation of adjusted values explained in Appendix II.

Table 12. Differences between actual and expected percent of men and women with periodontal pockets, by Simplified Debris and Calculus Indexes: United States, 1960-62

Calculus Index	Debris Index for men			Debris Index for women		
	0.0-1.0	1.1-2.0	2.1-3.0	0.0-1.0	1.1-2.0	2.1-3.0
Difference in percent with pockets						
0.0-1.0-----	-1.5	-0.1	1.2	-1.1	0.7	2.7
1.1-2.0-----	0.1	2.9	4.0	1.4	2.9	5.7
2.1-3.0-----	1.3	4.3	4.7	4.9	5.8	5.9

NOTE: Adjusted expected values explained in Appendix II.

## APPENDIX I

### THE DENTAL EXAMINATION

The Health Examination Survey was intended, at its inception as it is today, to gather comparable information on the health status of the U.S. population. In keeping with this goal, its dental examination procedure is rigidly standardized so that several examiners can obtain their findings on a more uniform basis than would otherwise be possible. The examination includes observation of the condition of each tooth—whether, for instance, it is decayed, filled, or missing—as well as so-called index assessment of oral hygiene and periodontal disease. Each examination is completed by one of five different dentists who use a mouth mirror and explorer.

Early in this report the mean numbers of decayed, missing, and filled (DMF) teeth per person for men and women 18-34 years old are cited, at various levels of oral hygiene, as a measure of the attack rate of dental decay. For anyone at any age, DMF teeth can be defined as the sum total of permanent teeth that are decayed, filled, and missing or indicated for extraction. In younger adults, who lose relatively few teeth because of periodontal disease, each DMF tooth is a count of at least one previous incident of decay. Thus, DMF teeth collectively are a measure of the accrued toll of dental decay in the permanent dentition of younger men and women.

It should also be noted that DMF counts in this report are based on 32 teeth, including third molars. Since unerupted third molars are not identified, they are included, along with extracted molars, in counts of missing teeth. This procedure results in over-estimates of DMF counts as a measure of the impact of dental disease, especially for younger adults, many of whom have unerupted third molars.

Descriptions of the Simplified Oral Hygiene Index and the Periodontal Index follow.

#### SIMPLIFIED ORAL HYGIENE INDEX (OHI-S)

Selected surfaces of six teeth are used in making this estimation of oral hygiene status. For the purposes of this examination, each surface that is used, buccal or lingual, is considered to encompass half of the circumference of the tooth. The buccal surface of a molar, for example, is considered to include half of the mesial surface and half of the distal.

The posterior teeth used for the assessment are the first fully erupted teeth distal to the bicuspid area on each side of each arch. In most cases this will be a first molar, but in others it may be a second or third molar. The buccal surfaces of upper molars and the lingual of lowers are examined. In the anterior portion of the mouth, the labial surfaces of the upper right central incisor and the lower left central incisor are examined. When one or both of these teeth are missing, the adjacent central incisor is substituted.

#### Examining for Oral Debris

The surface area covered by debris is estimated by running a number five explorer along the surface being examined and noting the occlusal or incisal extent of the debris as it is removed from the tooth surface and adheres to the explorer.

#### Scoring:

- 0 - No debris or stain present.
- 1 - (a) Soft debris covering not more than the gingival third of the tooth surface, or  
(b) the presence of the extrinsic stains without debris regardless of surface area covered.

- 2 - Soft debris covering more than one-third but not more than two-thirds of the exposed tooth surface.
- 3 - Soft debris covering more than two-thirds of the exposed tooth surface.

#### Examining for Oral Calculus

A number five explorer is also used to estimate surface area covered by supragingival calculus and to probe for subgingival calculus.

#### Scoring:

- 0 - No calculus present.
- 1 - Supragingival calculus covering not more than one-third of the exposed tooth surface.
- 2 - Supragingival calculus covering more than one-third but not more than two-thirds of the exposed tooth surface, and/or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth.
- 3 - Supragingival calculus covering more than two-thirds of exposed tooth surface and/or a continuous heavy band of subgingival calculus around the cervical portion of the tooth.

#### Calculating the Index

The debris scores are totaled and divided by the number of surfaces scored to obtain the Simplified Debris Index. The Simplified Calculus Index is deter-

mined similarly. The debris and calculus scores are then added to give the Simplified Oral Hygiene Index.

#### PERIODONTAL INDEX (PI)

A periodontal score is recorded for each tooth in the mouth, and the arithmetic average of all scores is the individual's Periodontal Index.

#### Scoring:

- 0 - *Negative*. There is neither overt inflammation in the investing tissues nor loss of function due to destruction of supporting tissues.
- 1 - *Mild gingivitis*. There is an overt area of inflammation in the free gingivae, but this area does not circumscribe the tooth.
- 2 - *Gingivitis*. Inflammation completely circumscribes the tooth, but there is no apparent break in the epithelial attachment.
- 6 - *Gingivitis with pocket formation*. The epithelial attachment has been broken and there is a pocket (not merely a deepened gingival crevice due to swelling in the free gingivae). There is no interference with normal masticatory function, the tooth is firm in its socket, and has not drifted.
- 8 - *Advanced destruction with loss of masticatory function*. The tooth may be loose; may have drifted; may sound dull on percussion with a metallic instrument; may be depressible in its socket.



## APPENDIX II

### STATISTICAL NOTES

#### The Survey Design

The first cycle of the Health Examination Survey employed a highly stratified multistage probability design in which a sample of the civilian, noninstitutional population of the conterminous United States 18-79 years of age was selected. At the first stage, a sample of 42 primary sampling units (PSU's) was drawn from among the 1,900 geographic units into which the United States was divided. Random selection was controlled within regional and size-of-urban-place strata into which the units were classified. As used here a PSU is a standard metropolitan statistical area or one to three contiguous counties. Later stages result in the random selection of clusters of typically about four persons from a neighborhood within the PSU. The total sample included some 7,700 persons in 29 different States. The detailed structure of the design and the conduct of the Survey have been described in previous reports.<sup>10,15</sup>

#### Reliability

The methodological strength of the Survey derives especially from its use of scientific probability sampling techniques and highly standardized and closely controlled measurement processes. This does not imply that statistics from the Survey are exact or without error. Data from the Survey are imperfect for three major reasons: (1) results are subject to sampling error, (2) the actual conduct of a survey never agrees perfectly with the design, and (3) the measurement processes themselves are inexact even though standardized and controlled.

The first-stage evaluation of the Survey was reported in reference 15, which dealt principally with an analysis of the faithfulness with which the sampling design was carried out. This study notes that out of the 7,700 sample persons the 6,670 who were examined—a response rate of over 86 percent—gave evidence that they were a highly representative sample of the civilian, noninstitutional population of the United States. Imputation of nonrespondents was accomplished by attributing to nonexamined persons the characteristics of comparable examined persons as described in reference 15. The specific procedure used amounted to inflating the sampling weight for each examined

person in order to compensate for sample persons at that stand of the same age-sex group who were not examined.

It is impossible to be certain that the Oral Hygiene Index is the same in the examined and the nonexamined groups. There were 6,672 persons who came in for examination. Of these, 19 did not receive a dental examination. Another 1,170 did not receive an oral hygiene score because they were edentulous, and 101 did not receive a score for other reasons. Thus a total of 5,382 persons received oral hygiene scores. The distribution of these persons by age and sex is given in table I.

#### Sampling and Measurement Error

In the present report, reference has been made to efforts to minimize bias and variability of the measurement techniques.

The probability design of the Survey makes possible the calculation of sampling errors. Traditionally the role of the sampling error has been the determination of how imprecise the survey results may be because they come from a sample rather than from the measurement of all elements in the universe.

The estimation of sampling errors for a study of the type of the Health Examination Survey is difficult for at least three reasons: (1) measurement error and "pure" sampling error are confounded in the data—it is not easy to find a procedure which will either completely include both or treat one or the other separately, (2) the survey design and estimation procedure are complex and, accordingly, require computationally involved techniques for the calculation of variances, and (3) from the survey are coming thousands of statistics, many for subclasses of the population for which there are a small number of sample cases. Estimates of sampling error are obtained from the sample data and are themselves subject to sampling error when the number of cases in a cell is small or, even occasionally, when the number of cases is substantial.

Estimates of approximate sampling variability for selected statistics used in this report are presented in tables II and III. These estimates have been prepared by a replication technique which yields overall varia-

bility through observation of variability among random subsamples of the total sample. The method reflects both "pure" sampling variance and a part of the measurement variance.

In accordance with usual practice, the interval estimate for any statistic may be considered the range within one standard error of the tabulated statistic, with 68 percent confidence; or the range within two standard errors of the tabulated statistic, with 95 percent confidence.

### Expected Values

In tables 3, 4, and 6-8, the actual mean Simplified Oral Hygiene Index for each of the selected demographic variables is compared with the expected. The computation of expected rates was done as follows:

Suppose that in a subgroup the Health Examination Survey estimates that there are  $N_i$  persons in the  $i^{\text{th}}$  age-sex-race group ( $i=1,2 \dots 42$ , sum of  $N_i = N$ ).

Suppose the Health Examination Survey estimates that the mean Simplified Oral Hygiene Index prevalence rate for the United States in the  $i^{\text{th}}$  age-sex-race group is  $X_i$ . Then the expected Oral Hygiene Index subgroup is

$$\frac{1}{N} \sum_i N_i \bar{X}_i$$

Comparison of an actual value for, say, a region with the expected value for that region is undertaken on the assumption that a meaningful statement can be made which holds, in some average way, for all persons in the region. This may or may not be true. The specified region may have higher values for younger persons and lower values for older persons than are found in other regions. In that case, an average comparison will obliterate one or both of these differentials. A similar remark may be made with respect to values computed for all races together, since relationships found in one race may not be found in another. In arriving at the general conclusions expressed in the text an effort was made to consider all the specific data, including data not presented in this report, but it must be recognized that balancing such evidence is a qualitative exercise rather than a quantitative one. The standard error of the difference between an actual and expected value may be approximated by the standard error of the actual value (table III).

Aside from tables 3, 4, and 6-8, expected values are computed for figure 6. The computation of  $D_k$ ,

the mean deviation adjusted for education of the Simplified Oral Hygiene Index for sex-income group  $k$  was done as follows:

Let  $X_{ijk}$  be the estimated mean Simplified Oral Hygiene Index for persons in sex-income group  $k$  who are in the  $i^{\text{th}}$  age group and the  $j^{\text{th}}$  education group. Let  $n_{ijk}$  be the estimated number of people in that group.

$$\text{Let } x_{ij} = \frac{\sum_k n_{ijk} x_{ijk}}{\sum_k n_{ijk}}$$

$$\text{Let } n_{jk} = \sum_i n_{ijk}$$

$$\text{Then } D_k = \frac{\sum_i n_{jk} d_{jk}}{\sum_j n_{jk}} \quad \text{where}$$

$$d_{jk} = \frac{\sum_j n_{ijk} (X_{ijk} - X_{ij})}{n_{jk}}$$

Computation of expected values for table 12 are done as follows:

Suppose a person belongs to class  $C_{ij}$  (calculus class  $i$ , debris class  $j$ ) and to age-sex group  $k$ . Then it is expected that the probability of his having a periodontal pocket is indicated by the proportion of persons having pockets in his age-sex group ( $X_k$ ). If there are  $n_{ijk}$  persons of age and sex  $k$  in class  $C_{ij}$ , the expected value for class  $C_{ij}$  is

$$\frac{\sum_k n_{ijk} X_k}{\sum_k n_{ijk}}$$

The difference tabulated in table 12 for class  $C_{ij}$  is the actual value minus the expected value for that class.

### Adjusted Values

In table 5, the oral hygiene scores for white persons in a specified income or education group were adjusted to the age distribution of the Negroes in the same group. The adjusted mean score for white persons in the  $k^{\text{th}}$  sex-income or education group was computed as follows:

Let  $x_{ik}$  be the estimated mean OHI-S for white persons in the sex-income group or sex-education group  $k$  who are in the age group  $i$ .

Let  $n_{ik}$  be the number of Negro persons in that group.

$$\text{Then } \hat{X}_k = \frac{\sum x_{ik} n_{ik}}{n_k} \quad \text{where } \sum_i n_{ik} = n_k$$

In table 9, the total Periodontal Index (PI) score for white persons was adjusted to the distribution of Negroes with the specified OHI-S debris or calculus levels.

The adjusted total of mean PI for white persons,  $X$ , was computed as follows:

Let  $X_k$  be the estimated mean PI for white persons of one sex with an OHI-S (or debris or calculus) score  $K$ .

Let  $n_k$  be the number of Negro persons in that group.

$$\text{Then } \hat{X} = \frac{\sum x_k n_k}{n} \quad \text{where } n = \sum_k n_k$$

In tables 10 and 11 the adjusted difference between actual and expected PI scores for persons in specific income or education groups was obtained by weighting the differences between actual and expected levels of PI in the specific income or education group by the overall percent of persons with specified OHI-S levels. The expected value for each specific group was computed by the method described above. The adjusted difference between actual and expected PI scores for a specific income or education group,  $D$ , was computed as follows:

Let  $d_{ik}$  be the difference between actual and expected PI scores for a specific income or education group  $i$  with OHI-S level  $k$ .

Let  $n_k$  be the number of people with OHI-S level  $k$ .

$$\text{Then } \hat{D}_i = \frac{\sum_k d_{ik} n_k}{n} \quad \text{where } n = \sum_k n_k$$

### Small Numbers

In some tables magnitudes are shown for cells for which the sample size is so small that the sampling error may be several times as great as the statistic itself. Obviously in such instances the statistic has no meaning in itself except to indicate that the true quantity is small. Such numbers, if shown, have been included to convey an impression of the overall story of the table.

### Tests of Significance

Tests of significance for demographic variables were performed in two ways. The first was to determine if the difference between the actual and expected value was greater than 2 times its standard error. For example, for men with incomes of less than \$2,000 the actual score was 0.7 higher than the expected score and the standard error was 0.1. Since the difference was 7 times its standard error, it may be deemed statistically significant.

The second method was to examine the age-specific differences (not published) between the prevalence for the specified group and the prevalence for all persons. Thus, when classified by population size, men from rural areas had a mean oral hygiene score which was greater than the overall mean score for all six age groups under 75 years. The probability of such an occurrence is 0.06, and the difference is considered statistically significant. In this instance, the difference between the actual and expected value is 1.4 times its standard error, which (using tables of the normal distribution) has a probability of 0.08 and is not statistically significant.

Table I. Number of men and women examined and number on whom oral hygiene scores are available, by age: Health Examination Survey, 1960-62

Age	Number examined		Number with oral hygiene scores	
	Men	Women	Men	Women
Total, 18-79 years-----	3,091	3,581	2,528	2,855
18-24 years-----	411	534	403	523
25-34 years-----	675	746	661	696
35-44 years-----	703	784	653	700
45-54 years-----	547	705	421	544
55-64 years-----	418	443	240	254
65-74 years-----	265	299	126	119
75-79 years-----	72	70	24	19

Table II. Standard error in mean Oral Hygiene Index of men and women, by race and age: United States, 1960-62

Sex and age	Simplified Oral Hygiene Index			Simplified Debris Index			Simplified Calculus Index		
	All races	White	Negro	All races	White	Negro	All races	White	Negro
<u>Both sexes</u>									
Total, 18-79 years-----	0.03	0.03	0.04	0.01	0.02	0.04	0.03	0.03	0.04
<u>Men</u>									
Total, 18-79 years-----	0.04	0.05	0.10	0.02	0.02	0.05	0.04	0.04	0.06
18-24 years-----	0.06	0.07	0.23	0.04	0.04	0.14	0.04	0.04	0.09
25-34 years-----	0.07	0.06	0.16	0.04	0.04	0.10	0.05	0.05	0.12
35-44 years-----	0.07	0.07	0.20	0.04	0.04	0.10	0.05	0.06	0.13
45-54 years-----	0.08	0.09	0.21	0.05	0.04	0.11	0.07	0.07	0.14
55-64 years-----	0.08	0.13	0.31	0.05	0.07	0.14	0.07	0.10	0.16
65-74 years-----	0.15	0.17	0.46	0.07	0.08	0.15	0.10	0.12	0.26
75-79 years-----	0.32	0.32	0.67	0.11	0.12	0.52	0.24	0.24	1.05
<u>Women</u>									
Total, 18-79 years-----	0.03	0.04	0.06	0.02	0.02	0.04	0.03	0.03	0.04
18-24 years-----	0.05	0.06	0.16	0.03	0.04	0.10	0.03	0.03	0.09
25-34 years-----	0.05	0.05	0.16	0.03	0.03	0.08	0.03	0.03	0.08
35-44 years-----	0.05	0.06	0.16	0.03	0.03	0.08	0.04	0.04	0.08
45-54 years-----	0.06	0.07	0.19	0.03	0.04	0.09	0.05	0.05	0.14
55-64 years-----	0.09	0.08	0.30	0.05	0.05	0.16	0.05	0.06	0.17
65-74 years-----	0.11	0.11	0.38	0.05	0.05	0.17	0.09	0.08	0.20
75-79 years-----	0.43	0.48	0.33	0.19	0.24	0.51	0.34	0.37	0.51



Table III. Standard error in mean Oral Hygiene Index of men and women, by race and specified characteristics: United States, 1960-62

Specified characteristic	Men			Women		
	All races	White	Negro	All races	White	Negro
<u>Income</u>						
Under \$2,000-----	0.10	0.10	0.16	0.07	0.08	0.12
\$2,000-\$3,999-----	0.09	0.08	0.12	0.05	0.06	0.11
\$4,000-\$6,999-----	0.04	0.05	0.19	0.04	0.04	0.13
\$7,000-\$9,999-----	0.06	0.07	0.51	0.04	0.04	0.42
\$10,000 and over-----	0.05	0.06	0.48	0.04	0.05	0.61
Unknown-----	0.08	0.12	0.41	0.06	0.07	0.18
<u>Education</u>						
Under 5 years-----	0.09	0.09	0.19	0.12	0.18	0.18
5-8 years-----	0.07	0.10	0.14	0.07	0.07	0.14
9-12 years-----	0.05	0.07	0.13	0.04	0.04	0.10
13 years and over-----	0.04	0.05	0.56	0.03	0.04	0.10
Unknown-----	0.22	0.26	0.49	0.22	0.20	0.45
<u>Place description</u>						
SMSA-in central city-----	0.06	0.07	0.12	0.03	0.06	0.11
SMSA-outside central city-----	0.06	0.06	0.18	0.06	0.06	0.14
Urban not SMSA-----	0.20	0.28	0.52	0.09	0.09	0.20
Rural farm-----	0.18	0.21	0.24	0.20	0.26	0.15
Rural nonfarm-----	0.06	0.20	0.32	0.11	0.11	0.29
<u>Population-size group</u>						
Giant metropolitan areas-----	0.05	0.08	0.14	0.04	0.08	0.16
Other very large metropolitan areas-----	0.10	0.17	0.19	0.11	0.10	0.14
Other standard metropolitan statistical areas-----	0.08	0.13	0.25	0.05	0.07	0.21
Other urban areas-----	0.12	0.15	0.36	0.11	0.10	0.12
Rural areas-----	0.12	0.16	0.15	0.11	0.11	0.29
<u>Urban-rural residence</u>						
Urban-----	0.05	0.08	0.10	0.02	0.03	0.07
Rural-----	0.08	0.08	0.21	0.09	0.08	0.20

## APPENDIX III

### DEMOGRAPHIC TERMS

*Age.*—The age recorded for each person is the age at last birthday. Age is recorded in single years.

*Race.*—Race is recorded as "white," "Negro," or "other." "Other" includes American Indian, Chinese, Japanese, and so forth. Mexican persons are included with "white" unless definitely known to be Indian or other nonwhite race.

*Income of family or unrelated individuals.*—Each member of a family is classified according to the total income of the family of which he is a member. Within the household all persons related to each other by blood, marriage, or adoption constitute a family. Unrelated individuals are classified according to their own income.

The income recorded is the total of all income received by members of the family in the 12-month period preceding the week of interview. Income from all sources is included, e.g., wages, salaries, rents from properties, pensions, and help from relatives.

*Education.*—Each person is classified by education in terms of the highest grade of school completed. Only grades completed in regular schools, where persons are given a formal education, are included. A "regular" school is one which advances a person toward an elementary or high school diploma or a college, university, or professional school degree. Thus, education in vocational, trade, or business schools outside the regular school system is not counted in determining the highest grade of school completed.

*Population size.*—The five classes comprising this characteristic were derived from the design of the sample, which accomplished a stratification of the primary sampling units by population size in each of three broad geographic locations. Because the survey was started in 1960, the primary sampling units within each of the five population-size classes were necessarily based on populations and definitions of the 1950 census. The name of each selected primary sampling unit within each population-size class and geographic location, along with other selected sample data, is presented in an earlier report.<sup>15</sup>

The definitions for each of the five population-size classes are as follows:

*Giant metropolitan areas.*—This class includes primary sampling units defined in the census as standard metropolitan statistical areas (SMSA's) having a population of 3,000,000 persons or more.

*Other very large metropolitan areas.*—Included in this class are standard metropolitan statistical areas with populations of 500,000 to 3,000,000 as defined by the 1950 census.

*Other standard metropolitan statistical areas.*—This class includes other SMSA's.

*Other urban areas.*—This includes primary sampling units which were highly urban in composition but were not defined as SMSA's.

*Rural areas.*—This includes primary sampling units which were primarily rural in composition according to census definitions.

*Region.*—For the purpose of classifying the population by geographic area, the United States was divided into three major regions. This division was especially made for the design of the HES sample. The regions and the States included are as follows:

<i>Region</i>	<i>States Included</i>
Northeast-----	Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Ohio, and Michigan
South-----	Delaware, Maryland, District of Columbia, West Virginia, Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas
West-----	Washington, Oregon, California, Idaho, Nevada, Montana, Utah, Arizona, Wyoming, Colorado, New Mexico, North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, and Indiana

*Urban and rural.*—For the first six primary sampling units at which examinations were conducted, the definition of urban and rural was the same as that used in the 1950 census. These locations were Philadelphia, Pa., Valdosta, Ga., Akron, Ohio, Muskegon, Mich.,

Chicago, Ill., and Butler, Mo. For the remainder of the sampling units the 1960 census definitions were used.

The change from 1950 to 1960 definitions is of small consequence in the Survey, since only six locations were affected; the major difference is the designation in 1960 of urban towns in New England and of urban townships in New Jersey and Pennsylvania.

According to the 1960 definition, the urban population comprises all persons living in (a) places of 2,500 inhabitants or more incorporated as cities, boroughs, villages, and towns (except towns in New England, New York, and Wisconsin); (b) the densely settled urban fringe, whether incorporated or unincorporated, of urbanized areas; (c) towns in New England and townships in New Jersey and Pennsylvania which contain no incorporated municipalities as subdivisions and have either 25,000 inhabitants or more or a population of 2,500-25,000 and a density of 1,500 persons or more per square mile; (d) counties in States other than the New England States, New Jersey, and Pennsylvania that have no incorporated municipalities within their boundaries and have a density of 1,500 persons or more per square mile; and (e) unincorporated places of 2,500 inhabitants or more not included in any urban fringe. The remaining population is classified as rural.

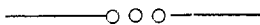
*Place description.*—In this survey the urban population is classified as living "in the central city" or "outside the central city" of an SMSA. The remaining urban population is classified as "not in SMSA."

The definitions and titles of standard metropolitan statistical areas are established by the U.S. Bureau of the Budget with the advice of the Federal Committee on Standard Metropolitan Statistical Areas.

The definition of an individual standard metropolitan statistical area involves two considerations: first, a city or cities of specified population to constitute the central city and to identify the county in which it is located as the central county; and, second, economic and social relationships with contiguous counties which are metropolitan in character so that the periphery of the specific metropolitan area may be determined.

Persons "in the central city" of an SMSA are therefore defined as those whose residency is in the city appearing in the standard metropolitan statistical area title. Persons residing in an SMSA but not in the city appearing in the SMSA title are considered to reside "outside the central city."

The remaining population is allocated into rural-farm and rural-nonfarm groups. The farm population includes all persons living in rural territory on places of 10 acres or more from which sales of farm products amounted to \$50 or more during the previous 12 months or in places of less than 10 acres from which sales of farm products amounted to \$250 or more during the preceding 12 months. Other persons living in rural territory are classified as nonfarm. Persons are also classified as nonfarm if their household paid rent for the house but their rent did not include any land used for farming.



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