

# **An Assessment of the Occlusion of the Teeth of Children 6-11 Years**

## **United States**

Estimates of the distribution of selected major components of occlusion among children; the prevalence of degrees of malocclusion; the average Treatment Priority Index per child by age, sex, race, family income, parent's education, and region of residence; and a brief analysis of the relationship of occlusal status with thumbsucking and a reported need for orthodontic care.

DHEW Publication No. (HRA) 74-1612

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
Public Health Service

Health Resources Administration  
National Center for Health Statistics  
Rockville, Md.      November 1973

Series 11 reports present findings from the National Health Examination Survey, which obtains data through direct examination, tests, and measurements of samples of the U.S. population. Reports 1 through 38 relate to the adult program, Cycle I of the Health Examination Survey. The present report is one of a number of reports of findings from the children and youth programs, Cycles II and III of the Health Examination Survey. These latter reports from Cycles II and III are being published in Series 11 but are numbered consecutively beginning with 101. It is hoped this will guide users to the data in which they are interested.



Vital and Health Statistics-Series 11-No.130

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## COOPERATION OF THE BUREAU OF THE CENSUS

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.

Vital and Health Statistics-Series 11-No. 130

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DHEW Publication No. (HRA) 74-1612

*Library of Congress Catalog Card Number 73-600226*

# Acknowledgment

The National Center for Health Statistics thanks Dr. James P. Carlos, Associate Director for National Caries Program, National Institute of Dental Research, for his assistance in planning the present report; Dr. Ralph A. Frew and Janet A. Brunelle, National Caries Program, for the program used to compute the Treatment Priority Index; and Coenraad F. A. Moorrees, Professor of Orthodontics, Forsyth Dental Center, for the photographs used to illustrate selected components of the Treatment Priority Index (TPI).

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**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-----	*

# AN ASSESSMENT OF THE OCCLUSION OF THE TEETH OF CHILDREN

James E. Kelly, D.D.S., Marcus Sanchez, and Lawrence E. Van Kirk, D.D.S.,  
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## INTRODUCTION

In December 1965 the Division of Health Examination Statistics successfully concluded a survey of the health of the Nation's children aged 6-11 years. The survey began in June 1963 and was the second of the Health Examination Survey programs, or "cycles," which, launched successively, produce statistical information about the health of specific segments of the United States population. The conduct and operation of the children's cycle closely followed a blueprint prepared for the preceding adult cycle. Examinations were conducted at 40 randomly selected locations in 25 States by means of mobile examination centers manned by physicians, dentists, psychologists, nurses, and technicians.<sup>1</sup> Before a child was examined, information was obtained from the parent of the child, including demographic and socioeconomic data on the household members as well as medical history, behavioral, and related data on the child to be examined.

The target population totaled approximately 23.8 million children (table III, appendix III). It was defined as all noninstitutionalized children aged 6-11 living in the United States (including Alaska and Hawaii) except those living on lands reserved for the use of American Indians. To obtain statistically valid estimates about the health of so many people, a probability sample was designed and selected by a complex scientific procedure (appendix III). The sample consisted of approximately 7,400 children, or about 185 at each location.

Each sample child whose parents consented to his or her participation in the survey received the same examination, which usually lasted about 3 hours. Many tests undergone by the children and

many measurements recorded by examiners focused on factors related to biological and psychological aspects of growth and development. A pediatrician examined the nose, throat, ears, heart, and neuromuscular system of each child. The teeth and their supporting structures were examined by a dentist; and tests of intellectual development, school achievement, and personality development were administered by a psychologist. Other procedures included tests of vision, hearing, exercise tolerance, grip strength, and breathing capacity. Blood pressure levels and electrocardiograms were recorded as well as height, weight, and other body measurements.

The dental examination was conducted by five dentists employed at various times during the survey. Teeth were classified as sound, filled, decayed, filled-defective, and nonfunctional-carious. The absence of permanent teeth was recorded as well as the presence of artificial teeth and exposed root remnants. Radiographs of the teeth were not taken. An adjustable examining chair, a standard light source, and a mouth mirror and explorer were used during the examination, which usually lasted about 10 minutes.

The dental examination also included the measurement of various components of occlusion. The procedure for assessing the occlusion of children and the training received by examining dentists are described in appendix I. Among the variables recorded were

- Vertical overbite or openbite
- Overjet of upper of lower incisors
- Posterior crossbite
- Tooth displacement
- Buccal segment relationship

At the survey's close, 96.0 percent of the 7,417 sample children had been examined. Information about the dental condition of the 298 unexamined children is not available to the survey staff. There are grounds, however, for assuming that nonresponse did not seriously bias estimates based on survey findings. Nonrespondents made up only a small proportion of the entire sample and, moreover, information collected by household interview about both respondents and nonrespondents revealed no marked differentials in response rates associated with various demographic characteristics including age, sex, race, geographic region, population density, parents' education, and family income.<sup>1</sup>

This report presents estimates of the occurrence and distribution of selected components of the occlusion of children's teeth. It includes national estimates of the number of children with normal occlusion and the number with various degrees of malocclusion. In addition, the relationship of occlusal status with age, sex, race, and other selected demographic characteristics (appendix II) is examined and, finally, the relationship of occlusal status with both thumbsucking and orthodontic care is briefly analyzed.

Occlusion was assessed by the Treatment Priority Index (TPI), which combines selected major components of occlusion to obtain a weighted score indicating the severity of malocclusion present in an individual.<sup>2</sup> As measured by the TPI, occlusal status ranges from virtually ideal occlusion (score of 0) to very severe malocclusion (score of 10 or more).

The TPI, an important outgrowth of the Burlington Orthodontic Research Project of the University of Toronto, was developed to find out whether preventive orthodontic treatment significantly reduced the occurrence of malocclusion among children. The proposed TPI was initially described in the 1960 Annual Report of the Burlington Orthodontic Research Centre.<sup>3</sup> Its later development was described in a publication of the National Center for Health Statistics.<sup>2</sup>

Largely because of the varying tooth eruption status of children aged 6-11, population estimates of the number of children with given occlusal variables differed widely. For example, both displaced teeth and posterior teeth in a crossbite relationship could be measured for all

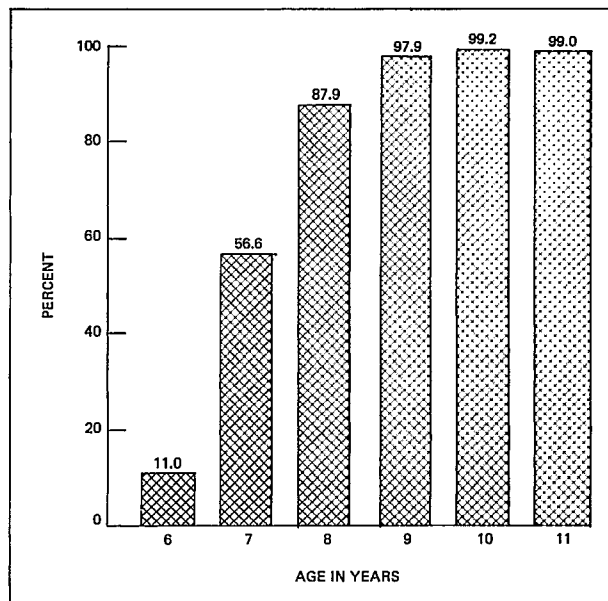


Figure 1. Percent of children with TPI scores, by age: United States, 1963-65.

sample children. Thus estimates of the distribution of those two variables are presented for the entire population of U.S. children aged 6-11 years. On the other hand, estimates of the Treatment Priority Index apply only to 17.7 million children. The smaller referent population resulted in this instance because to be given a TPI score a sample child must have had fully erupted upper and lower permanent central incisors and many younger children did not. In addition, the child must have had all or all but one of the other component measurements needed to compute a TPI score. When one component was missing, it was imputed by the procedure explained in appendix III. The estimated percent of U.S. children with TPI scores by age is shown in figure 1. The estimated population is shown in each detailed table when the number is less than 23.8 million, the total U.S. population of noninstitutionalized children aged 6-11 at the time of the survey.

## FINDINGS

### Components of Occlusion

#### Vertical Overbite or Openbite

"Overbite" and "openbite" are descriptive terms referring to the vertical relationship of



the upper and lower incisors (appendix I). With the teeth resting together, overbite is present when the leading (incisal) edges of the upper front teeth overlap those of the opposing lower teeth. When that relationship is reversed so the leading edges of the upper teeth lie above those of the lower, an openbite is present. The estimates in tables 1 and 2 apply to children with fully erupted permanent upper and lower incisors whose vertical relationship could be measured.

Anterior openbite was found in only 5.7 percent of the children. An estimated 50.7 percent of the children had overbite measurements of 0-3 mm., the normal range. An estimated 37.0 percent had slightly excessive overbites of 4-5 mm. More severe overbites of 6 mm. or more, which can be clinically significant, were found in about 7 percent of the children. The percent of boys and girls with specified overbite measurements did not differ significantly.

Both the prevalence and severity of vertical overbite were associated with race. About 96 percent of the white children had overbites compared with about 84 percent of the Negro children. In addition, extreme overbites (figure 2) measuring 6 mm. or more occurred in significantly more white children (7.6 percent) than Negro children (0.8 percent).

On the other hand, significantly more Negro children than white children had openbites—16.3 percent as against only 4.0 percent. Significantly more Negro children also had severe openbites (figure 3), which can impair function and adversely affect children's appearance. For example, about 10 percent of the Negro children had openbites measuring 2 mm. or more, but only about 1 percent of the white children had openbites of such severity.

A small number of children had upper and lower incisors that met edge-to-edge. They were classified as having openbites measuring 0 and lower overjets measuring 0.

### **Overjet of Upper or Lower Incisors**

"Upper overjet" and "lower overjet" are terms that describe the horizontal relationship of the upper and lower incisors (appendix I). With the teeth resting together, upper overjet is present when the upper anterior teeth lie in front of

the opposing teeth; when that position is reversed the lowers lie in front of the uppers, resulting in a lower overjet. Upper overjet of 0-5 mm. is generally accepted as the normal relationship. The estimates in tables 3 and 4 apply to children with fully erupted permanent upper and lower incisors whose horizontal relationship could be measured.

An estimated 82.0 percent of the children had upper overjets measuring from 0 through 5 mm. Severe upper overjets of 6 mm. or more occurred in about 17 percent of the children. Excessive overjet of the lower incisors (figure 4) of 1 mm. or more which, as well as excessive upper overjet (figure 5), impair function and mar children's appearance, occurred in about 1 percent of the children. The percent of children with specified upper or lower overjets did not vary significantly by either race or sex.

### **Posterior Crossbite**

Approximately 8 percent of the children had at least one upper premolar or molar in crossbite to the lingual (toward the tongue) of the opposing lower teeth, and approximately 2 percent had upper posterior teeth in crossbite buccally (toward the cheek). (See tables 5 and 6 and appendix I.) Figure 6 illustrates a child's upper posterior teeth in a lingual crossbite relationship.

### **Tooth Displacement Score**

Crooked teeth, perhaps the most widely recognized sign of malocclusion, impair biting and chewing. The appearance of children with extremely crooked front teeth is unsightly, sometimes even to the point of disfigurement. Malaligned teeth may also be a predisposing factor in the onset of gingivitis and more advanced periodontal disease.

Because the degree of malalignment, as well as the number of malaligned teeth, can adversely affect both the appearance and function of children, the estimates presented in table 7 are displacement scores, not merely counts of malaligned teeth. A displacement score is the sum of the number of teeth with minor malalignment plus twice the sum of the number of teeth with



Figure 2. Illustration of vertical overbite.



Figure 3. Illustration of anterior openbite.

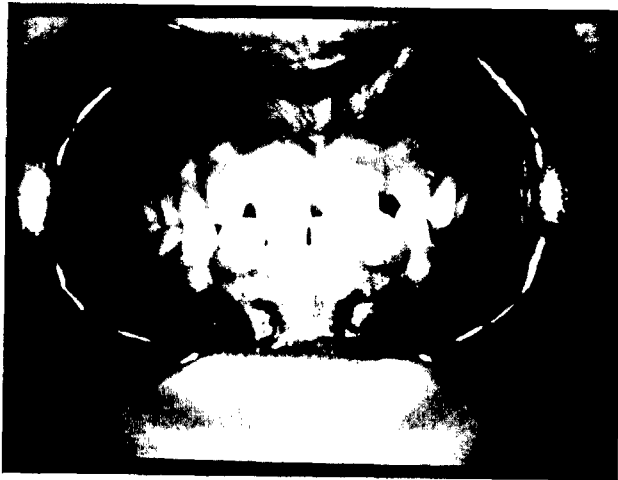


Figure 4. Illustration of overjet of lower front teeth.

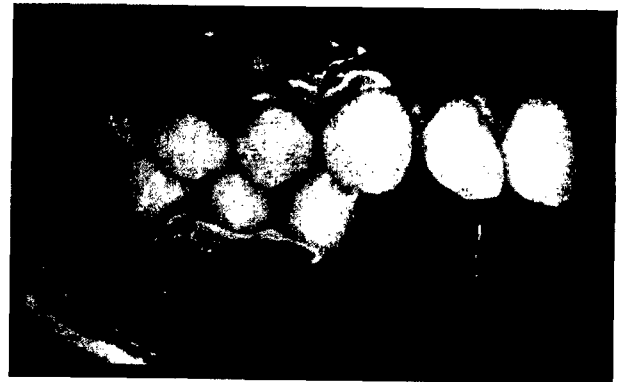


Figure 5. Illustration of overjet of upper front teeth.



Figure 6. Illustration of upper posterior teeth in lingual cross-bite relationship.



Figure 7. Illustration of malaligned teeth and anterior openbite.

major malalignment (appendix I). A tooth with major malalignment is displaced 2 mm. or more or rotated 45° or more; a tooth with minor malalignment is obviously displaced but displaced less than 2 mm. or obviously rotated but rotated less than 45°. In the development of the Treatment Priority Index, a tooth displacement score of 4 or more was assumed to be of critical severity. Figure 7 illustrates the appearance of a child with severely malaligned teeth.

Approximately 58 percent of the children had no teeth that were obviously displaced or rotated (table 7). About a third had tooth displacement scores of 3 or less, and only about a tenth had scores of 4 or more.

### Buccal Segment Relationship

Neuroclulsion is the normal anteroposterior relationship of the upper with the lower teeth. When opposing molars interdigitate in front of the normal position, mesioclusion is the resulting relationship and when behind the normal position, distoclusion (appendix I).

Approximately 54 percent of the children were found to have neuroclulsion, 35 percent distoclusion, 10 percent mesioclusion, and 1 percent an asymmetrical relationship (table 8). The buccal segment relationship was determined largely by observing the interdigitation of opposing 6-year molars on both the right and left sides (appendix I).

The prevalence of buccal segment relationships other than the mixed (asymmetrical) varied significantly by race. About 72 percent of the Negro children had neuroclulsion as compared with only about 51 percent of the white children. Significantly more Negro children than white children were classified as having mesioclusion--13.7 percent as against 9.4 percent. On the other hand, the percent of white children (38.8) with distoclusion was about three times larger than the percent of Negro children (13.6).

## Treatment Priority Index

### Distribution of TPI Scores

Approximately one-fourth of the estimated 17.7 million children with TPI scores had zero scores (figure 8, table 9). About three-quarters

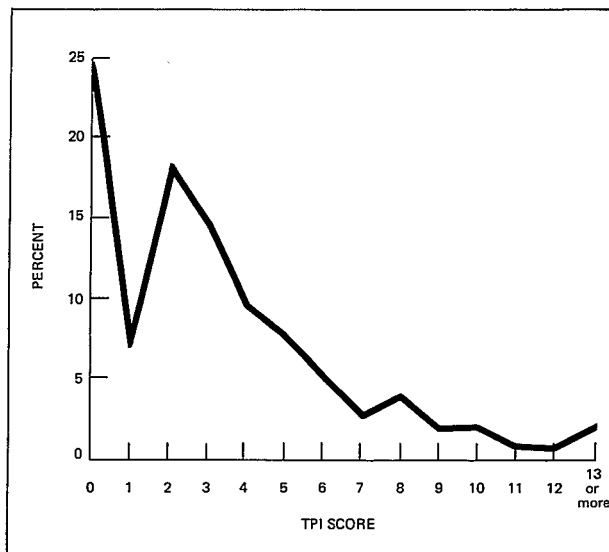


Figure 8. Percent of children with specified TPI scores: United States, 1963-65.

had scores less than 5. Scores for the remaining children were as high as 13 or more, but only about 1 out of every 20 children had scores of 10 or more.

Significantly more Negro children than white children had zero scores, 33.1 and 22.9 percent, respectively. Differences between the percents of children with specified scores greater than 0 were not consistently associated with either sex or race.

Children are distributed according to specified TPI scores and by age in table 10. The proportion of children with higher scores increased neither markedly nor consistently with advancing age, suggesting that individual TPI scores change relatively little during ages 6 through 11. Data from the Burlington serial control group also showed only a small increase in TPI scores with age.<sup>2</sup> From ages 6 through 16, the average TPI for Burlington children increased only about one point, a rise largely attributed to increasing tooth displacement scores.

### Severity of Malocclusion

During the development of the Treatment Priority Index, a scale ranging from 0 (virtually classic normal occlusion) to 10 (very severe handicap with treatment mandatory) was selected arbitrarily to express the relative severity of malocclusions occurring among children.<sup>3</sup> The scale was constructed with the assumption that

no score, or cutoff point, clearly distinguishes children requiring orthodontic treatment from those who do not. Thus even as orthodontists do not always agree on the severity of malocclusion in a particular child, equivalent TPI scores do not always exactly reflect the same degree of severity. Variability in evaluating the severity of malocclusion is due chiefly to the several occlusal components whose deviations either by themselves or in various combinations may constitute malocclusion. However, the TPI is highly reproducible in the hands of trained examiners, and significant differences between average scores for large groups of people undoubtedly reflect real differences in occlusal status.<sup>4</sup>

To establish a scale to classify children according to their relative need for orthodontic treatment (case severity), six conditions which can be associated with malocclusion including unacceptable appearance, impaired masticatory function, and speech impairment were taken into consideration.<sup>2</sup> The resulting scale suggested by Grainger is as follows:

Malocclusion severity scale	Interpretation
0	Virtually classic normal occlusion
1-3	Minor manifestations and treatment need is slight
4-6	Definite malocclusion but treatment elective
7-9	Severe handicap, treatment highly desirable
10	Very severe handicap with treatment mandatory

National estimates of the percent of children according to case severity are shown by race and sex in table 11. An estimated 24.4 percent of the children were classified as having normal occlusion, and 39.0 percent as having only minor manifestations of malocclusion. An estimated 22.4 percent had definite malocclusion for which treatment was elective. The scores of the remaining children ranged from 7 through 10, with treatment "highly desirable" for an estimated 8.7 percent and "mandatory" for an additional 5.5 percent.

Not only did significantly more Negro children than white children have zero scores (normal occlusion), as previously noted, but significantly more also had very severe malocclusion with treatment mandatory—8.2 percent as against 5.0 percent for white children. Differences in the prevalence of malocclusion classified by case severity were not associated with sex.

### Malocclusion Syndromes

Table 12 shows the distribution of children according to type of malocclusion syndrome and specific TPI score. The syndrome under which a child's malocclusion was classified was determined by the occlusal component that contributed the greatest weight to his or her TPI score. When tooth displacement was the dominant weight, the child's condition was assigned to one of two syndromes: maxillary expansion (when either distocclusion or buccal crossbite was present) or maxillary collapse (figure 1, appendix 1). It should be understood that classification by syndrome type is not a diagnosis of the child's malocclusion but a crude description of the defect involved. The occlusal defects only of those children with TPI scores of 4.5 or more were classified by type of syndrome.

Upper overjet, the most prevalent syndrome, occurred in an estimated 1.7 million children, and lower overjet, the least prevalent, occurred in an estimated 76 thousand. An estimated 214,000 children who had two or more equal weights were classified as having a "mixed" syndrome.

Interestingly, TPI scores of 10 or more were most highly associated with the lower overjet syndrome. About 61 percent of the children with that syndrome had scores of 10 or more whereas, by contrast, only about 15 percent with the upper overjet syndrome had equally high scores.

### Average TPI Score Associated With Selected Demographic Characteristics

#### Age, Sex, and Race

The average TPI score per child for U.S. children of all races was 3.3 (table 13). Mean scores did not increase with advancing age. In addition, differences in mean TPI scores were not associated with either race or sex.

## Other Demographic Characteristics

Because estimates of the percent of children with specified TPI scores according to age as well as data from the Burlington serial control group suggest that TPI scores for individual children increase at least slightly with advancing age, actual and expected (age-adjusted) estimates of the average TPI per child are presented in the following section. The U.S. population 6-11 years of age has been classified by family income, education of head of household, and geographic region, and any differences that appeared in the mean TPI per child among various groups were examined. For example, the estimates for white boys whose family income was within one of five income ranges were examined to determine whether the mean TPI score for a given income range differed significantly from those for other ranges. In addition, mean scores per child for all income ranges were compared to determine whether the TPI trended higher or lower with increasing income. The comparisons were made among children of the same race and sex, and adjustment was made for differences in the age distribution of the children within each income and education group and within each geographic region by calculating age-adjusted values.

Expected (age-adjusted) values were calculated by weighting the age-sex-race-specific mean TPI per child for the total U.S. population of children 6-11 years by the number of children in that age-sex-race group within specified ranges of income or education. Actual and expected values may differ by chance. But, when the difference between them is statistically significant, one may conclude that the mean TPI of a given sex-race-income group or a sex-race-education group is excessively larger or smaller than the mean of that sex-race group for the United States and that this excess is independent of age.

Because of the relatively limited number of sample children, sampling variability for specific age groups is usually quite large. It is for this reason that summary comparisons of actual and expected values were preferred to a comparison of mean age-specific values.

**Family income and education of head of household.**—The average TPI per child is shown by specified levels of yearly family income in table

14 and by specified levels of the educational attainment of the head of household in table 15. The estimates did not differ significantly by levels of either income or education.

**Geographic region of residence.**—Estimates of the average TPI per child by region of residence, race, and sex gave little evidence that the occurrence of malocclusion varied significantly among four broad geographic regions of the United States (table 16). The average score for Negro girls living in the South (2.5) was significantly lower, however, than the average score for Negro girls living in the Northeast (4.5).

## ADDITIONAL FINDINGS

Additional information about children's health was collected by a self-administered medical history questionnaire left in each household where there were sample children. The questionnaire was filled out by parents and collected later by a survey representative who checked it for completeness and consistency.

The questionnaire included the following items relating to the occlusal status of children:

Does the child at present ever suck his (her) thumb or fingers, either during the day or at night?

- 1  Yes
- 2  No
- 3  Don't know

If yes, about how often?

- 1  Almost every day or night
- 2  Just one in a while
- 3  Don't know

Has this child ever had his (her) teeth straightened or had bands on his (her) teeth?

- 1  Yes
- 2  No
- 3  Don't know

If no, do you think the child's teeth need straightening?

- 1  Yes
- 2  No
- 3  Don't know

An estimated 10.0 percent, about 2.4 million children, were reported to suck their thumb or fingers (table 17). The percent of children with a thumbsucking habit was inversely associated with age, declining from a high of 13.6 for 6-year-old children to a low of 5.9 for 11-year-old children. The percent of girls (11.7) who suck their thumb was higher than the percent of boys (8.3).

Information about the frequency of thumbsucking was obtained for children who were reported to suck their thumb or fingers at all. Approximately 60 percent of them were reported to suck their thumb or fingers "almost every day or night" and approximately 40 percent "just once in a while" (table 18). Significantly more Negro children than white children were reported to suck their thumbs frequently—about 66 percent as against only 54 percent.

Thumbsucking that persists after the permanent teeth erupt is frequently associated with a familiar and unsightly condition--excessively protruding front teeth. An extremely narrow upper arch may also be associated with thumbsucking. If thumbsucking causes or contributes in any way to the development of malocclusion, the degree of impairment will obviously vary according to how frequently or how long children suck their thumb. Thus more severe malocclusion would be expected to occur not only among children with a thumbsucking habit but also among those who suck their thumb frequently.

The average TPI per child is shown in table 19 for children who do and those who do not suck their thumb and in table 20 by frequency of the habit. Note in table 19 that the average TPI for those who suck their thumb at all was significantly higher than the average for those who do not—4.9 as against 3.2. Also note in table 20 that the TPI for children who suck their thumb almost every day or night (5.6) was higher than that for those who do so only once in a while (4.1). Thus both thumbsucking and its frequency were associated with malocclusion as measured by the TPI.

Interview and examination findings can also be interrelated in an attempt to determine whether thumbsucking was associated with specific aspects of malocclusion. Children with TPI scores of 4.5 or more are distributed in table 21 according to malocclusion syndrome and status of

the thumbsucking habit. As expected, thumbsucking was associated with an abnormal relationship of the upper and lower incisors: significantly higher proportions of children with both openbite and overjet syndromes were reported to suck their thumb. The estimates also show that relatively more children with the openbite syndrome than with the overjet syndrome had a thumbsucking habit.

Table A provides information about the relationship of the frequency of thumbsucking with openbite and overjet syndromes. As can be seen, a significantly higher proportion of children with openbite syndrome than with overjet syndrome sucked their thumb almost every day or night.

Table A. Percent of children aged 6-11 with a reported thumbsucking habit who had overbite or overjet syndromes, by frequency of thumbsucking, with standard errors of the estimates: United States, 1963-65

Syn- drome	Every day or night		Sometimes	
	Per- cent of chil- dren	Stand- ard error	Per- cent of chil- dren	Stand- ard error
Openbite--	79.4	5.40	20.6	5.40
Overjet---	58.6	3.59	41.4	3.59

In summary, thumbsucking was significantly associated with both severe openbite and overjet, and frequent thumbsucking was significantly associated with severe openbite.

Estimates based on answers to the question about teeth straightening are presented in table 22. An estimated 2.5 percent, or about 590,000 children, were reported to have had orthodontic treatment. The percent currently or previously under care increased with advancing age, rising from 0.4 for children aged 6 to 5.1 for those aged 11. The estimates also indicate that about as many boys as girls have had their teeth straightened.

The parents of an estimated 11.3 percent of the children whose teeth had not been straightened thought their children's teeth needed straightening (table 23). The percent of boys and girls reported to need orthodontic treatment did not differ significantly. Interestingly, the parents of relatively many children (8.6 percent) responded "don't know" to the question.

Parents were not asked why they answered "yes" or "no" to the question about need for straightening. Many who answered "yes" probably did so out of concern for their child's crooked or crowded front teeth. Others may have answered "yes" because a dentist or an orthodontist had told them their child had malocclusion. Although the present survey cannot specifically validate the parents' responses, the average TPI per child for those children reported to need orthodontic care and for those reported not to need care can be examined to see whether one group had poorer occlusion than the other.

As the estimates in table 24 show, the average TPI for children reported to need their teeth straightened (5.2) was significantly higher than that for children reported not to need their teeth straightened (2.9). Significant differences in the average TPI per child occurred between comparable groups of both white and Negro boys and girls. It is noteworthy that the average TPI for every given group reported to need orthodontic care exceeded 4.0, the lowest score interpreted as "definite malocclusion but treatment elective."

## DISCUSSION

The conditions generally classified as malocclusion occur when various relationships of children's teeth either deviate from the normal or are in disharmony with one another. The occlusion and alignment of teeth vary from the theoretically ideal to a dislocation or disharmony of occlusal elements so obviously severe that it is immediately classified as malocclusion. Between the extremes, however, there is an ill-defined area of occlusal variation where arbitrary judgment must be made as to how far occlusal components or sets of components must deviate to constitute malocclusion.

Table B presents estimates of the number and percent of children with various findings

which, because of either their nature or severity, probably indicate a need for orthodontic correction. It seems reasonable to assume that children with any of these findings need, at the least, further orthodontic evaluation and that most of them would rank high on any treatment priority scale. The same children may be included in more than one category.

Among the approximately 721,000 children with impinging overbites are some who need urgent attention. The condition may injure the soft tissues of the palate, may impair biting and chewing, and especially when extreme may not be self-correcting. Children with any of the other conditions may also have difficulty in biting or chewing or have an unsightly appearance. However, a severe deviation of one occlusal component is frequently associated with other occlusal deviations. Thus the number of children with TPI scores of 7 or more (2.5 million) is probably the best estimate of the total number of children aged 6-11 who need orthodontic treatment.

The estimates in this report indicate that malocclusion is highly prevalent among American children and that need for orthodontic care is not exclusively associated with any of various selected demographic characteristics. Extreme deviations of certain occlusal components such as overbite and openbite were associated with race, and proportionately more Negro children than white children had TPI scores of 10 or more. However, the average TPI per child did not vary significantly with age, sex, race, family income, parent's education, and region of residence.

Previous findings on U.S. adults aged 18-79 and U.S. children aged 6-11 link dental health or the lack of it with selected demographic characteristics, most notably family income and educational attainment. For instance, the average number of filled teeth per child increased from a low of 0.7 for children from families with incomes less than \$3,000 yearly to a high of 3.6 for those from families earning \$15,000 or more.<sup>5</sup> By contrast, the average number of decayed teeth per child fell from 3.4 for children in families with the lowest incomes to 0.7 for those in families with the highest incomes. The same relationship also prevailed among U.S. adults.<sup>6</sup>

Table B. Number and percent of children aged 6-11 with high priority for orthodontic treatment, by specified malocclusion findings and race: United States, 1963-65

Finding and race	Number in thousands	Percent of those measured
<u>Tissue impingement</u>		
Total <sup>1</sup> -----	711	4.0
White-----	697	4.6
Negro-----	31	1.2
<u>Posterior crossbite 4 teeth or more to lingual</u>		
Total <sup>1</sup> -----	261	1.1
White-----	224	1.1
Negro-----	55	1.7
<u>Posterior crossbite 4 teeth or more to buccal</u>		
Total <sup>1</sup> -----	24	0.1
White-----	20	0.1
Negro-----	-	-
<u>Tooth displacement scores 7 or more</u>		
Total <sup>1</sup> -----	665	2.8
White-----	571	2.8
Negro-----	52	1.6
<u>TPI scores</u>		
7-9 (severe handicap with treatment highly recommended)		
Total <sup>1</sup> -----	1,525	8.6
White-----	1,299	8.6
Negro-----	218	8.6
<u>TPI scores</u>		
10 or more (very severe handicap with treatment mandatory)		
Total <sup>1</sup> -----	975	5.5
White-----	771	5.1
Negro-----	211	8.3
<u>Overbite 6 mm. or more</u>		
Total <sup>1</sup> -----	1,169	6.6
White-----	1,147	7.6
Negro-----	20	0.8
<u>Openbite 2 mm. or more</u>		
Total <sup>1</sup> -----	443	2.5
White-----	211	1.4
Negro-----	244	9.6
<u>Upper overjet 7 mm. or more</u>		
Total <sup>1</sup> -----	1,672	9.4
White-----	1,471	9.7
Negro-----	201	7.9
<u>Lower overjet 1 mm. or more</u>		
Total <sup>1</sup> -----	142	0.8
White-----	121	0.8
Negro-----	15	0.6

<sup>1</sup>Includes data for "other races," which are not shown separately.



The estimates in table 25 and figure 9 underscore the close association that exists between receipt of orthodontic care and family income. Overall, about 25 per 1,000 children were reported to have had their teeth straightened. However, the number of children who had received orthodontic care ranged from a low of only about 16 per 1,000 for those from families earning less than \$7,000 to a high of about 73 per 1,000 for those from families earning \$15,000 or more.

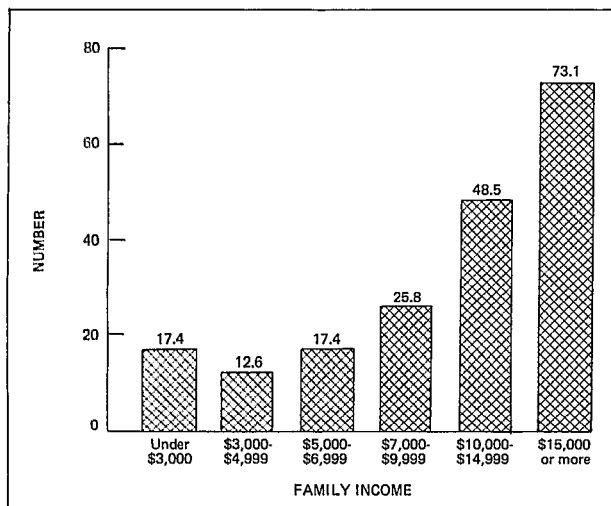


Figure 9. Number per 1,000 children reported to have had their teeth straightened, by annual family income: United States, 1963-65.

Further insight into the restriction imposed on American children from poorer families by the high cost of orthodontic treatment is evident in recent findings from the Health Interview Survey, another program of the National Center for Health Statistics. Table 26 shows the rate of dental visits during 1971 and the percent of dental visits involving tooth straightening for children aged 5-14 and for youths and young adults aged 15-24 according to family income. The estimates are based on a sample of approximately 42,000 households containing approximately 134,000 persons. About one-fourth of all dental visits by children and about one-eighth of all by youths and young adults involved orthodontic treatment. The percent of visits involving orthodontic treatment ranged from a low of 14.0 for children whose families earned less than \$7,000 yearly to a

high of 38.1 for those whose families earned \$15,000 or more. However, the rate of all dental visits also was directly associated with increasing income. Thus the disadvantage of children from poorer families in obtaining orthodontic care is more fully revealed by calculating the annual rate of orthodontic visits associated with levels of family income. Specifically, as derived from the estimates in table 26, the rate of orthodontic visits per 100 children was only about 14 for children whose families earned less than \$7,000 as against about 108 for children whose families earned \$15,000 or more. The same trend also prevailed among youths and young adults; it is noteworthy that those whose families earned less than \$7,000 made too few visits involving tooth straightening to yield a reliable estimate.

There are several reasons which, added together, explain why orthodontic care and income are so highly correlated. First, orthodontic care is largely provided by a relatively small number of highly trained specialists whose total number in 1970 was only 4,335.<sup>7</sup> Next, the high prevalence of malocclusion among children aged 6-11 indicates that the need for corrective services far exceeds the capacity of orthodontists to provide them. Finally, complicated cases often require continuous treatment for months on end, further limiting the number of children that can be treated. Thus a combination of factors has apparently pushed the cost of orthodontic care beyond the means of many lower income families.

## SUMMARY

The estimates in this report are based on dental examinations conducted during 1963-65 on 7,119 children, or 96 percent of a probability sample of 7,417 children representative of approximately 23.8 million noninstitutionalized U.S. children aged 6-11.

The distribution among children of several major components of occlusion was presented. The components were

- Vertical overbite or openbite
- Overjet of upper or lower incisors
- Posterior crossbite

## Tooth displacement

### Buccal segment relationship

The prevalence and severity of malocclusion, as measured by the Treatment Priority Index, were also estimated. In addition, the average TPI per child was examined to determine whether occlusal status was associated with various demographic characteristics as, for instance, age, sex, race, and family income. Finally, the relationship of the occlusion of children's teeth with both a thumbsucking habit and a reported need for orthodontic care was briefly analyzed.

The following items were among the findings:

1. Many more U.S. children had vertical overbites than openbites—94.3 percent as against 5.7 percent. An estimated 6.6 percent had severe overbites measuring 6 mm. or more, and 2.5 percent had severe openbites measuring 2 mm. or more. Both extreme overbites and openbites are occlusal anomalies that interfere with function and seriously mar appearance.
2. Most U.S. children, about 99 percent of them, had upper overjets, and about 17 percent had severe overjets of 6 mm. or more. The remaining children had lower overjets which are, as well as extreme upper overjets, clinically significant deviations.
3. Only relatively few children had back teeth that were laterally displaced to the degree that they were in a crossbite relationship. About 8 percent had one tooth or more displaced lingually (toward the tongue), and even fewer—about 2 percent—had teeth displaced buccally (toward the cheek).
4. Crooked (malaligned) teeth occurred in about 2 out of 5 children. About 1 out of 10 had displacement scores of 4 or more, a finding that can be clinically significant.
5. About 54 percent of U.S. children had neutroclusion, the anteroposterior relationship of the upper with the lower back teeth characteristic of normal occlusion. On the other hand, about 35 percent had distocclusion, 10 percent mesioclusion, and 1 percent an asymmetrical relationship. Significant differences in the occurrence of the various types of anteroposterior relationships were associated with race.
6. About three-quarters of the 17.7 million U.S. children with Treatment Priority Index scores had scores less than 5. The remaining scores ranged as high as 13 or more, and about 1 out of every 20 was 10 or more. More Negro children than white children had zero scores, 33.1 and 22.8 percent, respectively. Significant differences between the percent of children with scores greater than zero were not consistently associated with either race or sex.
7. As classified by the TPI, 24.4 percent of the children had normal occlusion, and 39.0 percent had only minor manifestations of malocclusion. Approximately 22 percent had definite malocclusion with treatment elective. Scores for the remaining children ranged from 7 through 10, indicating that treatment was highly desirable for 8.7 percent and mandatory for an additional 5.5 percent. Significantly more Negro children than white children had very severe malocclusion with treatment mandatory—8.2 percent as against 5.0 percent. Significant differences in case severity were not associated with sex.
8. Differences in occlusal status, as measured by the average TPI per child, were not associated with age, sex, race, family income, parent's education, or geographic region.
9. About 2.4 million U.S. children were reported to suck their thumb or fingers. Of them, more than half sucked their thumb almost every day or night and about 2 out of 5 just once in a while. Findings indicated that both thumbsucking and its frequency were associated with malocclusion.
10. About 590,000 U.S. children aged 6-11 had had their teeth straightened. The percent receiving orthodontic treatment increased

with advancing age. About as many boys as girls had had their teeth straightened.

11. The parents of about 2.6 million children thought their children's teeth needed straightening. The average TPI per child for children reported to need their teeth straightened (5.2) was significantly higher than that for children reported not to need their teeth straightened (2.9).
12. Estimates of the number of U.S. children aged 6-11 who needed orthodontic care, because of either the nature or severity of selected findings, include 711,000 children whose lower front teeth were either contacting the palate or biting into it.

The estimates also include about 1.5 million with a severe handicap for which treatment was highly recommended and 975,000 with a very severe handicap for which treatment was mandatory.

13. About 25 per 1,000 U.S. children aged 6-11 had had their teeth straightened. Receipt of orthodontic care was highly associated with family income. The number of children who had received orthodontic care ranged from about 16 per 1,000 for those from families earning less than \$7,000 yearly to 73 per 1,000 for those from families earning \$15,000 or more.

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<sup>7</sup>National Center for Health Statistics: Health Manpower and Health Facilities. DHEW Pub. No. (HSM) 72-1509. Health Services and Mental Health Administration. Washington. U.S. Government Printing Office, 1972. p. 77.

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Table 1. Number of children aged 6-11 and percent distribution by specified vertical overbite measurements, according to race and sex, with standard errors of the estimates: United States, 1963-65

Vertical overbite in mm.	Total <sup>1</sup>			White			Negro		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thousands-----	17,718	8,792	8,926	15,098	7,505	7,593	2,541	1,245	1,296
	Percent distribution								
All measures-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Negative-----	5.7	4.8	6.6	3.9	2.9	4.9	16.3	16.1	16.6
0-----	0.5	0.4	0.6	0.5	0.4	0.6	0.4	0.5	0.4
1-----	11.3	10.4	12.2	9.8	8.2	11.2	19.8	22.5	17.3
2-----	16.5	15.9	17.1	15.5	14.8	16.2	22.9	23.0	22.7
3-----	22.4	21.9	22.8	22.6	22.4	22.8	20.6	18.9	22.2
4-----	23.1	23.5	22.8	24.5	25.2	24.1	15.2	13.5	16.7
5-----	13.9	14.4	13.3	15.6	16.1	15.0	4.0	4.5	3.4
6 or more-----	6.6	8.7	4.6	7.6	10.0	5.2	0.8	1.0	0.7
	Standard error								
Negative-----	0.31	0.39	0.44	0.32	0.33	0.52	1.04	1.38	1.33
0-----	0.14	0.17	0.16	0.16	0.19	0.19	0.25	0.33	0.26
1-----	0.66	0.72	0.93	0.68	0.69	1.02	1.25	2.23	2.11
2-----	0.56	0.86	0.63	0.59	0.87	0.65	1.32	1.70	1.78
3-----	0.56	0.92	0.81	0.61	1.05	0.88	1.23	1.58	1.80
4-----	0.64	0.81	1.02	0.77	1.00	1.18	1.32	1.69	1.99
5-----	0.70	0.76	0.90	0.74	0.84	0.97	1.06	1.31	0.98
6 or more-----	0.36	0.48	0.44	0.40	0.52	0.51	0.37	0.56	0.34

<sup>1</sup>Includes data for "other races," which are not shown separately.

NOTE: This table does not include an estimated 65,000 children with a lower overjet and a lower overbite.

Table 2. Number of children aged 6-11 and percent distribution by specified openbite measurements, according to race and sex, with standard errors of the estimates: United States, 1963-65

Openbite in mm.	Total <sup>1</sup>			White			Negro		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thousands-----	17,718	8,792	8,926	15,098	7,505	7,593	2,541	1,245	1,296
Percent distribution									
All measures-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Negative-----	94.3	95.2	93.4	96.0	97.1	95.2	83.7	84.0	83.5
0-----	2.0	1.8	2.2	1.6	1.2	1.9	4.4	4.7	4.1
1-----	1.2	0.8	1.6	1.0	0.7	1.2	2.3	1.5	3.1
2-----	1.1	0.8	1.4	0.8	0.5	1.1	3.2	3.0	3.4
3-----	0.7	0.6	0.8	0.4	0.2	0.5	2.8	3.2	2.3
4 or more-----	0.7	0.8	0.6	0.2	0.3	0.1	3.6	3.6	3.6
Standard error									
Negative-----	0.31	0.39	0.44	0.32	0.33	0.52	1.04	1.38	1.33
0-----	0.20	0.25	0.26	0.21	0.24	0.28	1.04	1.39	0.93
1-----	0.15	0.21	0.20	0.16	0.20	0.19	0.53	0.72	0.86
2-----	0.16	0.19	0.28	0.16	0.14	0.28	0.60	0.89	1.05
3-----	0.10	0.12	0.20	0.08	0.08	0.16	0.63	0.75	0.91
4 or more-----	0.08	0.13	0.14	0.08	0.14	0.06	0.56	0.87	1.07

<sup>1</sup>Includes data for "other races," which are not shown separately.

NOTE: This table does not include an estimated 65,000 children with a lower overjet and a lower overbite.



Table 3. Number of children aged 6-11 and percent distribution by specified upper anterior overjet measurements, according to race and sex, with standard errors of the estimates: United States, 1963-65

Upper anterior overjet in mm.	Total <sup>1</sup>			White			Negro		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thou- sands-----	17,783	8,834	8,949	15,160	7,546	7,614	2,543	1,245	1,298
Percent distribution									
All measures-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Negative-----	1.3	1.4	1.1	1.1	1.2	1.0	2.4	2.7	2.0
0-----	0.3	0.3	0.4	0.3	0.2	0.4	0.5	0.8	0.2
1-----	5.2	4.7	5.8	5.0	4.4	5.6	6.4	6.2	6.5
2-----	17.0	14.9	19.1	17.1	14.7	19.4	17.0	16.5	17.4
3-----	27.1	26.2	27.9	26.7	26.6	27.1	29.0	24.9	33.4
4-----	20.5	21.0	20.0	20.4	20.7	20.2	20.5	22.3	18.7
5-----	11.9	12.6	11.2	12.1	12.6	11.5	10.7	11.9	9.7
6-----	7.3	8.5	6.0	7.6	8.8	6.3	5.6	6.7	4.4
7-----	4.6	5.2	4.1	4.7	5.4	4.0	4.2	4.1	4.2
8-----	2.2	2.3	2.1	2.3	2.5	2.1	1.7	1.4	1.9
9-----	1.3	1.3	1.3	1.4	1.4	1.4	0.5	0.3	0.6
10 or more-----	1.3	1.6	1.0	1.3	1.5	1.0	1.5	2.2	0.8
Standard error									
Negative-----	0.20	0.25	0.27	0.22	0.17	0.34	0.85	1.36	0.52
0-----	0.08	0.12	0.10	0.09	0.11	0.12	0.26	0.47	0.23
1-----	0.47	0.55	0.47	0.52	0.59	0.55	0.90	1.08	1.13
2-----	0.66	0.99	0.65	0.67	0.90	0.85	1.68	3.18	1.84
3-----	0.75	1.26	0.99	0.82	1.22	1.11	2.48	4.67	2.06
4-----	0.51	0.84	0.71	0.61	0.93	0.69	1.03	3.54	2.01
5-----	0.41	0.55	0.57	0.44	0.57	0.60	1.24	1.46	1.38
6-----	0.43	0.48	0.58	0.46	0.53	0.64	0.91	1.26	1.22
7-----	0.28	0.46	0.41	0.29	0.46	0.46	0.84	1.07	0.84
8-----	0.18	0.27	0.30	0.20	0.28	0.32	0.32	0.74	0.62
9-----	0.12	0.21	0.18	0.14	0.24	0.22	0.18	0.36	0.34
10 or more-----	0.17	0.27	0.17	0.17	0.26	0.19	0.50	0.88	0.43

<sup>1</sup>Includes data for "other races," which are not shown separately.

NOTE: This table includes an estimated 65,000 children with a lower overjet and a lower overbite. Lower overbite was not measured (appendix I).

Table 4. Number of children aged 6-11 and percent distribution by specified lower anterior overjet measurements, according to race and sex, with standard errors of the estimates: United States, 1963-65

Lower anterior overjet in mm.	Total <sup>1</sup>			White			Negro		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thou- sands-----	17,783	8,834	8,949	15,160	7,546	7,614	2,543	1,245	1,298
	Percent distribution								
All measures-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Negative-----	98.7	98.6	98.9	99.0	98.8	99.1	97.6	97.2	98.0
0-----	0.5	0.4	0.6	0.2	0.1	0.4	1.8	2.2	1.4
1-----	0.3	0.5	0.2	0.3	0.4	0.2	0.5	0.6	0.4
2-----	0.4	0.4	0.2	0.4	0.6	0.2	0.1	-	0.2
3 or more-----	0.1	0.1	0.1	0.1	0.1	0.1	-	-	-
	Standard error								
Negative-----	0.20	0.25	0.27	0.22	0.17	0.34	0.85	1.36	0.52
0-----	0.16	0.17	0.22	0.16	0.06	0.26	0.70	1.14	0.35
1-----	0.07	0.11	0.08	0.08	0.11	0.10	0.24	0.40	0.29
2-----	0.09	0.14	0.10	0.10	0.17	0.11	0.12	-	0.23
3 or more-----	0.09	0.07	0.07	0.07	0.08	0.08	-	-	-

<sup>1</sup>Includes data for "other races," which are not shown separately.

NOTE: This table includes an estimated 65,000 children with a lower overjet and a lower overbite. Lower overbite was not measured (appendix I).

Table 5. Number of children aged 6-11 and percent distribution by specified number of upper posterior teeth in buccal crossbite relationship, according to race and sex, with standard errors of the estimates: United States, 1963-65

Number of upper posterior teeth in buccal crossbite	Total <sup>1</sup>			White			Negro		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thousands-----	23,754	12,065	11,689	20,381	10,376	10,005	3,263	1,640	1,623
Percent distribution									
All measures-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0-----	98.2	97.9	98.3	98.0	97.9	98.1	98.6	98.2	99.1
1-----	1.0	1.1	0.9	1.0	1.1	1.0	1.0	1.3	0.8
2-----	0.4	0.5	0.4	0.5	0.5	0.4	0.2	0.3	-
3-----	0.3	0.3	0.3	0.4	0.3	0.4	0.2	0.2	0.1
4-----	0.1	0.1	0.1	0.1	0.1	0.1	-	-	-
5-----	0.0	0.1	-	0.0	0.1	-	-	-	-
6-----	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-
7 or more-----	-	-	-	-	-	-	-	-	-
Standard error									
0-----	0.18	0.28	0.22	0.20	0.30	0.25	0.57	0.89	0.43
1-----	0.14	0.21	0.18	0.14	0.20	0.22	0.51	0.86	0.43
2-----	0.10	0.14	0.11	0.12	0.17	0.13	0.12	0.25	-
3-----	0.07	0.07	0.12	0.07	0.07	0.14	0.14	0.24	0.14
4-----	0.02	0.07	0.03	0.03	0.08	0.04	-	-	-
5-----	0.02	0.04	-	0.02	0.04	-	-	-	-
6-----	0.03	0.03	0.04	0.03	0.04	0.04	-	-	-
7 or more-----	-	-	-	-	-	-	-	-	-

<sup>1</sup>Includes data for "other races," which are not shown separately.

Table 6. Number of children aged 6-11 and percent distribution by specified number of upper posterior teeth in lingual crossbite relationship, according to race and sex, with standard errors of the estimates: United States, 1963-65

Number of upper posterior teeth in lingual crossbite	Total <sup>1</sup>			White			Negro		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thousands -----	23,754	12,065	11,689	20,381	10,376	10,005	3,263	1,640	1,623
Percent distribution									
All measures -----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0-----	92.1	92.5	91.8	91.9	92.3	91.6	92.9	93.8	91.8
1-----	3.0	3.2	2.7	3.2	3.4	2.9	1.8	2.0	1.6
2-----	1.9	1.7	2.0	1.9	1.8	2.0	1.6	1.0	2.3
3-----	1.9	1.6	2.1	1.9	1.6	2.1	2.0	1.7	2.3
4-----	0.6	0.6	0.7	0.6	0.5	0.7	0.9	0.8	1.0
5-----	0.3	0.2	0.4	0.3	0.2	0.4	0.3	0.2	0.4
6-----	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.5	0.4
7 or more-----	0.1	0.1	0.2	0.1	0.1	0.2	0.1	-	0.2
Standard error									
0-----	0.34	0.52	0.39	0.37	0.50	0.43	0.87	1.17	1.43
1-----	0.29	0.38	0.37	0.31	0.42	0.41	0.38	0.64	0.47
2-----	0.14	0.16	0.24	0.16	0.20	0.24	0.33	0.36	0.64
3-----	0.14	0.17	0.25	0.18	0.17	0.27	0.41	0.73	0.52
4-----	0.09	0.11	0.14	0.10	0.10	0.14	0.21	0.34	0.47
5-----	0.09	0.10	0.14	0.09	0.11	0.15	0.14	0.16	0.24
6-----	0.05	0.07	0.06	0.03	0.05	0.05	0.27	0.37	0.26
7 or more-----	0.05	0.04	0.08	0.06	0.05	0.09	0.10	-	0.21

<sup>1</sup>Includes data for "other races," which are not shown separately.

Table 7. Number of children aged 6-11 and percent distribution by specified tooth displacement scores, according to race and sex, with standard errors of the estimates: United States, 1963-65

Tooth displacement scores	Total <sup>1</sup>			White			Negro		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thousands-----	23,754	12,065	11,689	20,381	10,376	10,005	3,263	1,640	1,623
	Percent distribution								
All measures-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0-----	57.8	59.7	55.9	56.8	58.6	54.9	64.6	65.8	63.6
1-----	12.3	11.8	12.7	12.6	12.0	13.2	10.7	11.0	10.3
2-----	13.1	12.6	13.6	13.5	13.0	13.6	11.7	10.1	13.3
3-----	5.7	6.0	5.5	5.8	6.1	5.5	5.3	5.4	5.3
4-----	4.4	3.9	4.9	4.5	4.0	5.0	3.4	2.9	3.8
5-----	2.4	1.9	3.0	2.5	2.0	3.1	1.7	1.2	2.2
6-----	1.5	1.4	1.5	1.5	1.5	1.6	1.0	1.4	0.6
7-----	1.1	1.1	1.1	1.2	1.2	1.2	0.2	0.4	-
8-----	0.7	0.6	0.8	0.7	0.6	0.9	0.3	0.7	-
9-----	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.2	0.4
10-----	0.2	0.2	0.2	0.2	0.3	0.2	0.1	-	0.2
11-----	0.2	0.2	0.2	0.1	0.1	0.2	0.4	0.7	-
12 or more-----	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.3
	Standard error								
0-----	2.32	2.33	2.49	2.47	2.41	2.72	2.66	3.52	3.70
1-----	0.52	0.63	0.73	0.59	0.68	0.84	0.85	1.60	1.09
2-----	0.68	0.76	0.86	0.72	0.76	0.93	0.94	1.38	1.65
3-----	0.55	0.66	0.55	0.55	0.62	0.58	1.11	1.87	0.84
4-----	0.37	0.32	0.53	0.42	0.35	0.58	0.48	0.98	0.80
5-----	0.30	0.29	0.39	0.33	0.32	0.45	0.67	0.66	0.78
6-----	0.23	0.29	0.24	0.25	0.32	0.27	0.44	0.62	0.35
7-----	0.20	0.27	0.23	0.23	0.29	0.27	0.18	0.36	-
8-----	0.14	0.16	0.17	0.16	0.18	0.20	0.21	0.43	-
9-----	0.10	0.16	0.08	0.11	0.18	0.08	0.13	0.23	0.35
10-----	0.07	0.06	0.10	0.07	0.07	0.11	0.09	-	0.18
11-----	0.06	0.06	0.10	0.06	0.03	0.11	0.23	0.45	-
12 or more-----	0.06	0.09	0.06	0.07	0.10	0.07	0.24	0.28	0.30

<sup>1</sup>Includes data for "other races," which are not shown separately.

Table 8. Number of children aged 6-11 and percent distribution by specified buccal segment relationship, according to race and sex, with standard errors of the estimates: United States, 1963-65

Buccal segment relationship	Total <sup>1</sup>			White			Negro		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thousands-----	23,492	11,914	11,578	20,145	10,243	9,902	3,239	1,624	1,615
Percent distribution									
All relationships-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Neuroclusion <sup>2</sup> -----	53.8	52.8	55.0	50.9	49.8	51.8	72.1	70.6	73.3
Mesioclusion									
Unilateral-----	4.8	4.5	5.0	4.5	4.2	4.7	6.7	6.6	6.9
Bilateral-----	5.2	5.5	4.9	4.9	5.3	4.6	7.0	7.0	7.1
Distoclusion									
Unilateral-----	14.9	14.9	15.0	16.1	16.0	16.3	7.6	8.5	6.6
Bilateral-----	20.4	21.3	19.4	22.7	23.6	21.8	6.0	6.4	5.7
Mixed-----	0.9	1.0	0.7	0.9	1.1	0.8	0.6	0.9	0.4
Standard error									
Neuroclusion <sup>2</sup> -----	1.54	1.52	1.74	1.58	1.50	1.87	2.42	3.38	2.16
Mesioclusion-----									
Unilateral-----	0.38	0.39	0.48	0.37	0.34	0.50	1.09	1.44	1.52
Bilateral-----	0.40	0.58	0.38	0.41	0.56	0.41	0.78	1.49	0.70
Distoclusion									
Unilateral-----	0.63	0.77	0.69	0.70	0.83	0.79	0.94	1.42	1.28
Bilateral-----	0.77	0.71	1.05	0.90	0.86	1.19	1.01	1.47	1.20
Mixed-----	0.12	0.18	0.19	0.12	0.19	0.22	0.30	0.47	0.39

<sup>1</sup>Includes data for "other races," which are not shown separately.

<sup>2</sup>Only children with both right and left buccal segments scored normal were classified as having neuroclusion.

Table 9. Number of children aged 6-11 and percent distribution by specified Treatment Priority Index (TPI), according to race and sex, with standard errors of the estimates: United States, 1963-65

Treatment Priority Index	Total <sup>1</sup>			White			Negro		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thousands-----	17,728	8,810	8,918	15,109	7,526	7,583	2,540	1,241	1,299
	Percent distribution								
All TPI-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0-----	24.4	24.5	24.3	22.9	22.9	22.8	33.1	33.7	32.6
1-----	5.9	5.2	6.6	5.8	5.2	6.3	6.6	5.2	7.8
2-----	18.4	17.4	19.4	18.6	17.8	19.8	17.2	16.4	17.9
3-----	14.7	14.8	14.7	15.3	15.3	15.3	11.2	11.4	11.0
4-----	9.6	9.8	9.5	10.4	10.3	10.4	5.4	6.6	4.2
5-----	7.8	8.4	7.1	8.1	8.7	7.5	6.0	6.9	5.2
6-----	5.0	5.2	4.9	5.2	5.4	5.0	3.6	3.2	4.0
7-----	2.8	3.0	2.7	2.8	3.1	2.5	2.8	2.1	3.6
8-----	4.0	3.8	4.0	4.0	3.9	4.0	4.2	3.7	4.4
9-----	1.9	2.0	1.8	1.9	2.0	1.8	1.7	1.7	1.8
10-----	2.0	2.3	1.6	1.8	2.1	1.6	2.4	3.3	1.5
11-----	0.8	1.1	0.6	0.8	1.0	0.6	1.3	1.8	0.8
12-----	0.7	0.5	0.9	0.6	0.4	0.8	1.6	1.2	2.0
13 or more-----	2.0	2.0	1.9	1.8	1.9	1.6	2.9	2.8	3.2
	Standard error								
0-----	1.46	1.60	1.52	1.50	1.62	1.61	2.68	3.76	2.21
1-----	0.36	0.49	0.50	0.37	0.51	0.54	0.69	1.19	0.73
2-----	0.63	0.75	1.02	0.66	0.90	1.09	1.66	1.72	2.34
3-----	0.41	0.60	0.47	0.42	0.66	0.46	1.22	1.99	1.25
4-----	0.51	0.83	0.55	0.58	0.89	0.56	0.83	1.66	1.14
5-----	0.42	0.55	0.57	0.50	0.58	0.66	1.02	1.62	0.76
6-----	0.38	0.68	0.45	0.42	0.75	0.49	0.53	0.84	0.81
7-----	0.22	0.38	0.39	0.23	0.42	0.44	0.57	0.80	0.63
8-----	0.33	0.35	0.58	0.35	0.33	0.60	0.97	1.56	1.02
9-----	0.25	0.30	0.28	0.29	0.33	0.32	0.45	0.67	0.68
10-----	0.24	0.39	0.28	0.31	0.47	0.32	0.36	0.55	0.62
11-----	0.15	0.23	0.16	0.14	0.20	0.17	0.59	0.94	0.40
12-----	0.12	0.13	0.17	0.11	0.11	0.19	0.51	0.47	0.85
13 or more-----	0.20	0.34	0.21	0.22	0.35	0.25	0.69	1.03	0.83

<sup>1</sup>Includes data for "other races," which are not shown separately.

Table 10. Number of children and percent distribution by specified Treatment Priority Index (TPI), according to age and sex, with standard errors of the estimates: United States, 1963-65

Treatment Priority Index	6-11 years			6 years			7 years		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thousands-----	17,728	8,810	8,918	451	205	246	2,310	1,064	1,246
Percent distribution									
All TPI-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0-----	24.5	24.4	24.3	28.2	29.2	27.3	23.6	20.1	26.7
1-----	5.9	5.2	6.6	3.1	1.6	4.5	6.8	8.3	5.6
2-----	18.4	17.4	19.4	18.6	18.1	18.8	21.5	21.3	21.6
3-----	14.7	14.8	14.7	16.3	16.7	15.9	11.1	12.6	9.8
4-----	9.6	9.8	9.5	6.0	9.9	2.8	10.8	11.0	10.6
5-----	7.8	8.4	7.1	6.8	6.6	6.9	6.6	7.7	5.7
6-----	5.0	5.2	4.9	1.9	-	3.5	4.5	3.1	5.6
7-----	2.8	3.0	2.7	2.5	1.3	3.5	4.3	5.7	3.2
8-----	3.9	3.9	4.0	8.2	9.5	7.2	4.9	3.6	6.0
9-----	1.9	2.0	1.8	2.8	2.8	2.9	2.1	2.3	2.0
10-----	2.0	2.3	1.6	2.2	2.9	1.6	2.1	2.2	2.0
11-----	0.8	1.1	0.6	0.6	1.4	-	0.4	0.8	-
12-----	0.7	0.5	0.9	2.2	-	4.0	0.8	0.7	0.8
13 or more-----	2.0	2.0	1.9	0.6	-	1.1	0.5	0.6	0.4
Standard error									
0-----	1.46	1.60	1.52	3.20	6.31	4.37	1.99	2.59	2.63
1-----	0.36	0.49	0.50	1.63	1.53	2.58	1.11	1.66	1.34
2-----	0.63	0.75	1.02	2.99	4.78	4.87	1.86	2.25	2.63
3-----	0.41	0.60	0.47	3.34	5.84	4.24	1.03	1.82	1.27
4-----	0.51	0.83	0.55	2.06	4.17	2.22	1.50	1.76	2.44
5-----	0.42	0.55	0.57	2.29	3.40	2.86	0.89	1.28	1.21
6-----	0.38	0.68	0.45	1.11	-	2.10	0.84	1.15	1.66
7-----	0.22	0.38	0.39	2.01	1.30	3.51	0.91	1.88	1.06
8-----	0.33	0.35	0.55	2.49	4.12	3.34	0.91	1.10	1.05
9-----	0.25	0.30	0.28	1.58	2.12	2.51	0.60	0.88	0.75
10-----	0.24	0.39	0.28	1.14	1.82	1.55	0.54	0.94	1.18
11-----	0.15	0.23	0.16	0.66	1.48	-	0.24	0.51	-
12-----	0.12	0.13	0.17	1.68	-	3.12	0.42	0.48	0.50
13 or more-----	0.20	0.34	0.21	0.63	-	1.16	0.29	0.48	0.32



Table 10. Number of children and percent distribution by specified Treatment Priority Index (TPI), according to age and sex, with standard errors of the estimates: United States, 1963-65—Con.

8 years			9 years			10 years			11 years		
Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
3,504	1,728	1,776	3,875	1,967	1,908	3,835	1,943	1,892	3,753	1,904	1,849
Percent distribution											
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
24.2	24.1	24.2	25.3	25.8	24.6	24.4	25.1	23.7	23.8	25.0	22.7
5.8	4.5	7.1	6.4	5.6	7.2	5.4	3.6	7.4	5.8	5.8	5.9
17.6	17.3	17.9	18.0	17.1	18.7	18.9	15.7	22.0	17.5	17.7	17.4
16.2	17.0	15.4	15.8	16.7	15.0	16.4	16.0	16.9	12.5	10.6	14.4
10.6	11.2	9.9	8.1	7.4	8.8	10.5	12.3	8.6	9.3	7.7	10.8
7.6	7.5	7.8	7.0	7.9	6.1	7.3	9.3	5.3	9.8	9.3	10.3
5.6	6.2	5.1	5.6	5.1	6.2	4.4	5.3	3.3	5.1	5.7	4.5
2.8	3.3	2.3	2.2	2.1	2.4	2.4	1.9	3.0	3.0	3.3	2.7
3.8	4.0	3.6	4.0	4.2	3.9	3.0	3.0	2.9	3.8	3.9	3.8
2.2	1.4	3.0	2.2	2.6	1.7	1.6	2.3	0.8	1.4	1.2	1.6
1.4	1.4	1.4	2.0	2.7	1.4	1.6	1.7	1.6	2.6	3.2	1.8
0.6	0.8	0.5	1.0	1.0	1.0	1.1	1.6	0.7	0.8	0.9	0.7
0.5	0.3	0.7	0.6	0.5	0.6	1.1	0.5	1.8	0.6	0.8	0.3
1.1	1.0	1.1	1.8	1.3	2.4	1.9	1.7	2.0	4.0	4.9	3.1
Standard error											
1.77	1.92	2.22	1.82	2.26	1.89	2.24	2.66	2.95	2.11	1.88	2.85
0.56	1.04	1.32	0.67	0.72	1.02	0.57	0.49	1.09	0.79	1.05	1.37
1.34	1.89	1.78	1.00	1.69	1.60	1.52	2.32	1.90	1.28	1.40	1.77
0.86	1.36	1.75	1.16	1.37	1.61	1.34	1.95	1.71	1.00	1.35	1.42
1.26	1.85	1.52	0.82	1.18	1.03	0.98	1.52	1.12	0.47	0.91	1.17
0.78	1.21	1.15	0.89	1.17	1.32	1.02	1.62	1.18	1.29	1.10	2.17
0.90	1.03	1.14	0.75	1.16	0.77	0.41	0.88	0.45	0.67	0.99	1.10
0.57	0.85	1.01	0.38	0.62	0.75	0.57	0.63	0.81	0.56	0.64	0.79
0.63	1.12	0.90	0.52	0.73	1.08	0.49	0.73	0.58	0.77	0.88	0.96
0.53	0.50	0.81	0.51	0.84	0.70	0.54	0.98	0.38	0.34	0.50	0.46
0.44	0.62	0.48	0.46	0.74	0.52	0.42	0.73	0.60	0.42	0.82	0.55
0.25	0.41	0.28	0.29	0.48	0.41	0.31	0.64	0.35	0.25	0.32	0.36
0.25	0.21	0.43	0.26	0.44	0.22	0.29	0.29	0.58	0.25	0.44	0.21
0.26	0.46	0.25	0.50	0.61	0.86	0.52	0.72	0.59	0.64	0.90	0.77

Table 11. Number of children aged 6-11 and percent distribution by specified case severity, according to race and sex, with standard errors of the estimates: United States, 1963-65

Specified case severity	Total <sup>1</sup>			White			Negro		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thousands-----	17,728	8,810	8,918	15,109	7,526	7,583	2,540	1,241	1,299
Percent distribution									
All causes-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0 (Normal occlusion)-----	24.4	24.5	24.3	22.9	22.9	22.8	33.1	33.7	32.6
1-3 (Minor malocclusion)---	39.0	37.4	40.7	39.7	38.3	41.4	35.0	33.0	36.7
4-6 (Definite malocclusion)-----	22.4	23.4	21.5	23.7	24.4	22.9	15.0	16.7	13.4
7-9 (Severe malocclusion)--	8.7	8.8	8.5	8.7	9.0	8.3	8.7	7.5	9.8
10 or more (very severe malocclusion)-----	5.5	5.9	5.0	5.0	5.4	4.6	8.2	9.1	7.5
Standard error									
0 (Normal occlusion)-----	1.46	1.60	1.52	1.50	1.62	1.61	2.68	3.76	2.21
1-3 (Minor malocclusion)---	0.74	1.13	1.05	0.88	1.32	1.23	1.76	2.70	2.11
4-6 (Definite malocclusion)-----	1.07	1.34	1.06	1.23	1.56	1.18	1.55	1.95	1.51
7-9 (Severe malocclusion)--	0.56	0.58	0.98	0.64	0.64	1.10	1.66	2.23	1.37
10 or more (very severe malocclusion)-----	0.46	0.76	0.44	0.50	0.84	0.54	0.85	1.32	1.36

<sup>1</sup>Includes data for "other races," which are not shown separately.

Table 12. Number of children aged 6-11 and percent distribution by specified Treatment Priority Index (TPI), according to type of malocclusion syndrome, with standard errors of the estimates: United States, 1963-65

Treatment Priority Index	Type of malocclusion syndrome							
	Normal	Tooth displacement		Anterior				
		Maxillary expansion	Maxillary collapse	Overbite	Openbite	Lower overjet	Upper overjet	Mixed <sup>1</sup>
Estimated number of children in thousands -----	12,965	462	529	991	774	76	1,717	214
	Percent distribution							
All TPI -----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0 -----	33.4	...	...	...	...	...	...	...
1 -----	8.1	...	...	...	...	...	...	...
2 -----	25.2	...	...	...	...	...	...	...
3 -----	20.1	...	...	...	...	...	...	...
4 -----	13.2	...	...	...	...	...	...	...
5 -----	-	37.4	29.1	17.4	8.9	...	40.3	53.7
6 -----	-	18.7	26.8	13.0	19.2	...	20.6	13.2
7 -----	-	16.4	2.2	3.6	16.6	13.0	13.0	7.4
8 -----	-	7.6	15.7	23.8	22.6	22.8	8.2	5.5
9 -----	-	4.7	3.6	18.3	6.6	3.6	3.0	2.9
10 or more -----	-	15.2	22.6	23.9	26.1	60.6	14.9	17.3
	Standard error							
0 -----	1.54	...	...	...	...	...	...	...
1 -----	0.56	...	...	...	...	...	...	...
2 -----	0.71	...	...	...	...	...	...	...
3 -----	0.61	...	...	...	...	...	...	...
4 -----	0.82	...	...	...	...	...	...	...
5 -----	...	3.74	3.68	3.21	2.34	...	2.30	6.73
6 -----	...	2.31	3.92	3.48	2.77	...	1.75	4.50
7 -----	...	3.25	1.03	1.32	2.42	4.36	1.42	3.47
8 -----	...	2.03	2.86	3.76	3.10	10.25	1.30	3.17
9 -----	...	2.54	1.43	3.10	1.86	4.29	0.69	1.96
10 or more -----	...	3.52	2.65	4.08	3.65	11.32	1.46	4.28

<sup>1</sup>Two or more TPI components of equally high weight.

Table 13. Average Treatment Priority Index (TPI) per child, by sex, age, and race, with standard errors of the estimates: United States, 1963-65

Sex and age	Total <sup>1</sup>	White	Negro	Total <sup>1</sup>	White	Negro
	Average TPI			Standard error		
Both sexes 6-11 years-----	3.3	3.3	3.2	0.11	0.12	0.18
6 years-----	3.3	3.5	2.8	0.24	0.28	0.69
7 years-----	3.2	3.1	3.4	0.13	0.13	0.41
8 years-----	3.1	3.2	2.8	0.11	0.13	0.30
9 years-----	3.2	3.3	3.1	0.16	0.18	0.15
10 years-----	3.2	3.2	3.6	0.14	0.13	0.55
11 years-----	3.7	3.7	3.5	0.20	0.23	0.26
Boys 6-11 years-----	3.4	3.4	3.3	0.12	0.13	0.20
6 years-----	3.1	3.5	2.0	0.43	0.54	0.71
7 years-----	3.2	3.2	3.5	0.18	0.18	0.41
8 years-----	3.2	3.2	2.7	0.13	0.12	0.46
9 years-----	3.3	3.3	3.4	0.19	0.21	0.24
10 years-----	3.4	3.3	3.7	0.21	0.20	0.71
11 years-----	3.9	3.9	3.4	0.24	0.28	0.52
Girls 6-11 years-----	3.2	3.2	3.2	0.11	0.13	0.21
6 years-----	3.4	3.5	3.3	0.37	0.35	1.25
7 years-----	3.1	3.0	3.3	0.15	0.16	0.58
8 years-----	3.1	3.1	2.9	0.16	0.18	0.37
9 years-----	3.2	3.3	2.8	0.17	0.19	0.19
10 years-----	3.1	3.0	3.5	0.17	0.20	0.57
11 years-----	3.5	3.5	3.5	0.23	0.25	0.34

<sup>1</sup>Includes data for "other races," which are not shown separately.

Table 14. Differences between actual and expected average Treatment Priority Index (TPI) per child for children aged 6-11, by race, annual family income, and sex, with standard errors of the estimates: United States, 1963-65

Race and annual family income	Both sexes			Boys			Girls			Both sexes	Boys	Girls
	Actual	Expected	Difference	Actual	Expected	Difference	Actual	Expected	Difference			
Total <sup>1</sup> -----	Average TPI			Average TPI			Average TPI			Standard error		
	3.3	3.3	0.0	3.4	3.4	0.0	3.2	3.2	0.0	0.11	0.12	0.11
Less than \$3,000-----	3.2	3.3	-0.1	3.4	3.4	0.0	3.0	3.2	-0.2	0.27	0.38	0.20
\$3,000-\$4,999-----	3.3	3.3	0.0	3.4	3.4	0.0	3.2	3.2	0.0	0.16	0.21	0.19
\$5,000-\$6,999-----	3.4	3.3	0.1	3.4	3.4	0.0	3.3	3.2	0.1	0.13	0.15	0.17
\$7,000-\$9,999-----	3.4	3.3	0.1	3.4	3.4	0.0	3.4	3.2	0.2	0.15	0.17	0.18
\$10,000-\$14,999-----	3.2	3.3	-0.1	3.3	3.4	-0.1	3.2	3.2	0.0	0.16	0.17	0.21
\$15,000 or more-----	3.2	3.3	-0.1	3.4	3.4	0.0	3.0	3.2	-0.2	0.20	0.22	0.29
Unknown-----	3.3	3.3	0.0	3.4	3.4	0.0	3.2	3.2	0.0	0.24	0.39	0.34
White-----	3.3	3.3	0.0	3.4	3.4	0.0	3.2	3.2	0.0	0.12	0.13	0.13
Less than \$3,000-----	3.2	3.3	-0.1	3.4	3.4	0.0	3.0	3.2	-0.2	0.45	0.62	0.33
\$3,000-\$4,999-----	3.3	3.3	0.0	3.5	3.4	0.1	3.1	3.2	-0.1	0.18	0.26	0.20
\$5,000-\$6,999-----	3.4	3.3	0.1	3.4	3.4	0.0	3.3	3.2	0.1	0.11	0.14	0.18
\$7,000-\$9,999-----	3.4	3.3	0.1	3.4	3.4	0.0	3.4	3.2	0.2	0.15	0.18	0.19
\$10,000-\$14,999-----	3.3	3.3	0.0	3.3	3.4	-0.1	3.2	3.2	0.0	0.16	0.18	0.23
\$15,000 or more-----	3.2	3.3	-0.1	3.4	3.4	0.0	3.0	3.2	-0.2	0.20	0.22	0.28
Unknown-----	3.4	3.3	0.1	3.3	3.4	-0.1	3.4	3.2	0.2	0.24	0.28	0.40
Negro-----	3.2	3.2	0.0	3.3	3.3	0.0	3.2	3.2	0.0	0.18	0.20	0.21
Less than \$3,000-----	3.2	3.2	0.0	3.3	3.3	0.0	3.0	3.2	-0.2	0.20	0.35	0.18
\$3,000-\$4,999-----	3.4	3.2	0.2	3.3	3.3	0.0	3.5	3.1	0.4	0.23	0.26	0.42
\$5,000-\$6,999-----	3.5	3.2	0.3	3.0	3.2	-0.2	3.9	3.2	0.3	0.48	0.64	0.61
\$7,000-\$9,999-----	2.6	3.3	-0.7	3.0	3.4	-0.4	2.1	3.2	-1.1	0.51	0.82	0.63
\$10,000-\$14,999-----	3.8	3.2	0.6	3.2	3.4	-0.2	4.4	3.1	1.3	1.75	1.84	2.33
\$15,000 or more-----	-	-	-	-	-	-	-	-	-	-	-	-
Unknown-----	3.2	3.2	0.0	4.5	3.4	1.1	2.1	3.2	1.1	0.74	2.07	0.49

<sup>1</sup>Includes data for "other races," which are not shown separately.

Table 15. Differences between actual and expected average Treatment Priority Index (TPI) per child for children aged 6-11, by sex, race, and education of head of household, with standard errors of the estimates: United States, 1963-65

Race and education of head of household	Both sexes			Boys			Girls			Both sexes	Boys	Girls
	Actual	Expected	Difference	Actual	Expected	Difference	Actual	Expected	Difference			
Total <sup>1</sup> -----	Average TPI			Average TPI			Average TPI			Standard error		
	3.3	3.3	0.0	3.4	3.4	0.0	3.2	3.2	0.0	0.11	0.12	0.11
None or less than 5 years-----	2.9	3.3	-0.4	3.2	3.4	-0.2	2.7	3.2	-0.5	0.38	0.72	0.24
5-7 years-----	3.5	3.3	0.2	3.6	3.4	0.2	3.3	3.2	0.1	0.34	0.37	0.39
8 years-----	3.2	3.3	-0.1	3.2	3.4	-0.2	3.2	3.2	0.0	0.16	0.15	0.22
9-11 years-----	3.3	3.3	0.0	3.4	3.4	0.0	3.2	3.2	0.0	0.13	0.19	0.15
12 years-----	3.4	3.3	0.1	3.4	3.4	0.0	3.3	3.2	0.1	0.12	0.12	0.15
13-15 years-----	3.3	3.3	0.0	3.4	3.4	0.0	3.2	3.2	0.0	0.15	0.23	0.20
16 years-----	3.5	3.3	0.2	3.5	3.4	0.1	3.5	3.2	0.3	0.19	0.22	0.22
17 years or more-----	3.0	3.3	-0.3	3.2	3.4	-0.2	2.9	3.2	-0.3	0.20	0.30	0.35
Unknown-----	3.6	3.2	0.4	3.9	3.4	0.5	3.4	3.2	0.2	0.51	1.45	0.50
White-----	3.3	3.3	0.0	3.4	3.4	0.0	3.2	3.2	0.0	0.12	0.13	0.13
None or less than 5 years-----	3.0	3.3	-0.3	3.2	3.4	-0.2	2.9	3.2	-0.3	0.55	1.05	0.33
5-7 years-----	3.4	3.3	0.1	3.5	3.4	0.1	3.4	3.2	0.2	0.49	0.51	0.55
8 years-----	3.2	3.3	-0.1	3.3	3.4	-0.1	3.0	3.2	-0.2	0.18	0.17	0.27
9-11 years-----	3.4	3.3	0.1	3.6	3.4	0.2	3.3	3.2	0.1	0.14	0.22	0.19
12 years-----	3.3	3.3	0.0	3.4	3.4	0.0	3.3	3.2	0.1	0.11	0.10	0.15
13-15 years-----	3.3	3.3	0.0	3.5	3.4	0.1	3.2	3.2	0.0	0.14	0.22	0.20
16 years-----	3.5	3.3	0.2	3.5	3.4	0.1	3.4	3.2	0.2	0.20	0.22	0.24
17 years or more-----	3.0	3.3	-0.3	3.2	3.4	-0.2	2.9	3.2	-0.3	0.20	0.31	0.32
Unknown-----	3.4	3.3	0.1	1.8	3.3	-1.5	4.2	3.2	1.0	0.74	1.07	0.61
Negro-----	3.2	3.2	0.0	3.3	3.3	0.0	3.2	3.2	0.0	0.18	0.20	0.21
None or less than 5 years-----	2.7	3.2	-0.5	3.1	3.3	-0.2	2.4	3.2	-0.8	0.47	0.67	0.41
5-7 years-----	3.5	3.2	0.3	3.8	3.3	0.5	3.2	3.2	0.0	0.35	0.50	0.42
8 years-----	3.9	3.2	0.7	3.2	3.4	-0.2	4.4	3.1	1.3	0.47	0.45	0.65
9-11 years-----	2.5	3.2	-0.7	2.3	3.3	-1.0	2.7	3.2	-0.5	0.30	0.40	0.37
12 years-----	3.7	3.2	0.5	3.7	3.3	0.4	3.6	3.2	0.4	0.37	0.50	0.43
13-15 years-----	3.4	3.2	0.2	3.2	3.3	-0.1	3.8	3.2	0.6	0.87	1.00	0.93
16 years-----	3.3	3.2	0.1	1.8	3.4	-1.6	6.1	3.0	3.1	1.03	1.21	2.84
17 years or more-----	3.8	3.3	0.5	1.2	3.0	-1.8	5.1	3.2	1.9	2.75	0.84	3.30
Unknown-----	3.9	3.2	0.7	6.2	3.5	2.7	2.3	3.0	-0.7	0.73	2.78	0.85

<sup>1</sup>Includes data for "other races," which are not shown separately.

Table 16. Differences between actual and expected average Treatment Priority Index (TPI) per child for children aged 6-11, by race, geographic region, and sex, with standard errors of the estimates: United States, 1963-65

Race and region	Both sexes			Boys			Girls			Both sexes	Boys	Girls
	Actual	Expected	Difference	Actual	Expected	Difference	Actual	Expected	Difference			
Total <sup>1</sup> -----	Average TPI			Average TPI			Average TPI			Standard error		
	3.3	3.3	0.0	3.4	3.4	0.0	3.2	3.2	0.0	0.11	0.12	0.11
Northeast-----	3.3	3.3	0.0	3.2	3.4	-0.2	3.3	3.2	0.1	0.22	0.21	0.26
Midwest-----	3.6	3.3	0.3	3.7	3.4	0.3	3.5	3.2	0.3	0.14	0.19	0.12
South-----	3.1	3.3	-0.2	3.3	3.4	-0.1	2.9	3.2	-0.3	0.32	0.41	0.25
West-----	3.2	3.3	-0.1	3.3	3.4	-0.1	3.0	3.2	-0.2	0.23	0.26	0.28
White-----	3.3	3.3	0.0	3.4	3.4	0.0	3.2	3.2	0.0	0.12	0.13	0.13
Northeast-----	3.2	3.3	-0.1	3.2	3.4	-0.2	3.2	3.2	0.0	0.23	0.22	0.30
Midwest-----	3.6	3.3	0.3	3.7	3.4	0.3	3.5	3.2	0.3	0.13	0.18	0.12
South-----	3.2	3.3	-0.1	3.3	3.4	-0.1	3.1	3.2	-0.1	0.43	0.52	0.39
West-----	3.2	3.3	-0.1	3.3	3.4	-0.1	3.0	3.2	-0.2	0.23	0.26	0.29
Negro-----	3.2	3.2	0.0	3.3	3.3	0.0	3.2	3.2	0.0	0.18	0.20	0.21
Northeast-----	3.9	3.3	0.6	3.2	3.3	-0.1	4.5	3.2	1.3	0.25	0.39	0.40
Midwest-----	3.4	3.3	0.1	3.3	3.3	0.0	3.6	3.2	0.4	0.66	0.85	0.67
South-----	2.9	3.2	-0.3	3.3	3.3	0.0	2.5	3.2	-0.7	0.26	0.40	0.21
West-----	3.2	3.2	0.0	3.4	3.3	0.1	3.0	3.2	-0.2	0.37	0.44	0.50

<sup>1</sup>Includes data for "other races," which are not shown separately.

Table 17. Number of children and percent distribution by reported thumbsucking habit, according to sex and age, with standard errors of the estimates; United States, 1963-65

Sex and age	Reported thumbsucking habit				
	Total	Present	Absent	Don't know	Not re-ported
Estimated number of children in thousands-----	23,784	2,371	21,325	15	73
	Percent distribution				
Both sexes-----	100.0	10.0	89.6	0.1	0.3
6 years-----	100.0	13.6	85.8	-	0.6
7 years-----	100.0	13.0	86.8	0.1	0.1
8 years-----	100.0	8.7	90.8	0.2	0.3
9 years-----	100.0	10.8	88.9	-	0.3
10 years-----	100.0	7.5	92.0	0.1	0.4
11 years-----	100.0	5.9	93.8	0.1	0.2
Boys-----	100.0	8.3	91.2	0.1	0.4
6 years-----	100.0	11.8	87.3	-	0.9
7 years-----	100.0	11.5	88.3	-	0.2
8 years-----	100.0	5.7	93.8	0.2	0.3
9 years-----	100.0	8.6	90.9	-	0.5
10 years-----	100.0	6.3	93.3	0.1	0.3
11 years-----	100.0	8.3	91.2	0.1	0.4
Girls-----	100.0	11.7	88.0	0.1	0.2
6 years-----	100.0	15.4	84.4	-	0.2
7 years-----	100.0	14.4	85.4	0.2	-
8 years-----	100.0	11.8	87.8	0.1	0.3
9 years-----	100.0	13.1	86.8	-	0.1
10 years-----	100.0	8.7	90.9	-	0.4
11 years-----	100.0	6.2	93.2	0.2	0.4
	Standard error				
Both sexes-----	...	0.44	0.44	0.02	0.10
6 years-----	...	1.11	1.21	-	0.33
7 years-----	...	0.84	0.84	0.07	0.11
8 years-----	...	0.57	0.66	0.12	0.17
9 years-----	...	1.26	1.24	-	0.11
10 years-----	...	0.71	0.86	0.06	0.27
11 years-----	...	0.68	0.70	0.09	0.14
Boys-----	...	0.50	0.50	0.04	0.15
6 years-----	...	1.50	1.61	-	0.63
7 years-----	...	1.04	1.04	-	0.22
8 years-----	...	0.91	1.00	0.19	0.22
9 years-----	...	1.60	1.55	-	0.18
10 years-----	...	0.84	1.02	0.12	0.34
11 years-----	...	0.77	0.77	0.12	-
Girls-----	...	0.68	0.72	0.03	0.10
6 years-----	...	1.61	1.62	-	0.16
7 years-----	...	1.46	1.48	0.15	-
8 years-----	...	0.76	0.87	0.12	0.25
9 years-----	...	0.61	0.63	-	0.13
10 years-----	...	1.28	1.32	-	0.24
11 years-----	...	0.93	1.00	0.18	0.28



Table 18. Number of children aged 6-11 and percent distribution with a reported thumbsucking habit by reported frequency of thumbsucking, according to race and sex, with standard errors of the estimates: United States, 1963-65

Reported frequency of thumbsucking	Total <sup>1</sup>			White			Negro		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thousands--	2,371	1,004	1,367	1,899	797	1,102	469	204	265
Percent distribution									
All thumbsucking-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Every day or night-----	56.6	57.8	55.8	54.4	56.6	52.7	66.2	63.2	68.4
Sometimes-----	38.7	38.6	38.8	42.5	41.5	43.2	23.0	26.4	20.4
Don't know-----	0.6	0.4	0.7	0.7	0.6	0.9	-	-	-
Not reported-----	4.1	3.2	4.7	2.4	1.3	3.2	10.8	10.4	11.2
Standard error									
Every day or night-----	2.13	3.63	3.33	2.25	4.31	3.82	5.38	9.36	6.04
Sometimes-----	2.11	3.32	3.39	2.37	4.27	3.94	3.79	7.28	4.47
Don't know-----	0.30	0.45	0.40	0.38	0.57	0.50	-	-	-
Not reported-----	0.94	1.46	1.03	0.72	0.86	1.09	3.39	5.12	3.31

<sup>1</sup>Includes data for "other races," which are not shown separately.

Table 19. Number of children and average Treatment Priority Index (TPI) per child for children aged 6-11, by reported thumbsucking habit, race, and sex, with standard errors of the estimates: United States, 1963-65

Race and sex	Reported thumbsucking habit				
	Total	Present	Absent	Don't know	Not reported
<b>Total<sup>1</sup></b>	<b>Estimated number of children in thousands</b>				
Both sexes-----	17,728	1,555	16,115	12	46
Boys-----	8,810	605	8,179	4	22
Girls-----	8,918	950	7,936	8	24
<b>White</b>					
Both sexes-----	15,109	1,197	13,865	12	35
Boys-----	7,526	451	7,054	4	17
Girls-----	7,583	746	6,811	8	18
<b>Negro</b>					
Both sexes-----	2,540	355	2,174	-	11
Boys-----	1,241	151	1,086	-	4
Girls-----	1,299	204	1,088	-	7
<b>Total<sup>1</sup></b>	<b>Average TPI per child</b>				
Both sexes-----	3.3	4.9	3.2	2.0	3.0
Boys-----	3.4	4.8	3.3	4.3	3.5
Girls-----	3.2	5.0	3.0	1.0	2.6
<b>White</b>					
Both sexes-----	3.3	4.5	3.2	2.0	3.7
Boys-----	3.4	4.4	3.3	4.3	4.3
Girls-----	3.2	4.6	3.1	1.0	3.1
<b>Negro</b>					
Both sexes-----	3.2	6.2	2.8	-	0.8
Boys-----	3.3	5.9	2.9	-	0.3
Girls-----	3.2	6.3	2.6	-	1.2
<b>Total<sup>1</sup></b>	<b>Standard error</b>				
Both sexes-----	0.11	0.18	0.11	1.00	1.18
Boys-----	0.12	0.32	0.13	3.04	1.59
Girls-----	0.11	0.24	0.12	0.55	1.25
<b>White</b>					
Both sexes-----	0.12	0.18	0.12	1.00	1.35
Boys-----	0.13	0.28	0.13	3.04	1.70
Girls-----	0.13	0.25	0.13	0.55	1.50
<b>Negro</b>					
Both sexes-----	0.18	0.36	0.13	-	0.55
Boys-----	0.20	0.65	0.21	-	0.21
Girls-----	0.21	0.46	0.11	-	0.80

<sup>1</sup>Includes data for "other races," which are not reported separately.

Table 20. Number of children and average Treatment Priority Index (TPI) per child for children aged 6-11, by reported frequency of thumbsucking habit, race, and sex, with standard errors of the estimates: United States, 1963-65

Race and sex	Reported frequency of thumbsucking				
	All thumb-sucking	Every day or night	Sometimes	Don't know	Not reported
Estimated number of children in thousands					
Total <sup>1</sup>					
Both sexes-----	17,728	845	639	6	16,238
Boys-----	8,810	333	245	-	8,232
Girls-----	8,918	512	394	6	8,006
White					
Both sexes-----	15,109	603	554	6	13,946
Boys-----	7,526	233	208	-	7,085
Girls-----	7,583	370	346	6	6,861
Negro					
Both sexes-----	2,540	241	83	-	2,216
Boys-----	1,241	101	35	-	1,105
Girls-----	1,299	140	48	-	1,111
Average TPI per child					
Total <sup>1</sup>					
Both sexes-----	3.3	5.6	4.1	1.0	3.2
Boys-----	3.4	5.5	3.9	-	3.3
Girls-----	3.2	5.6	4.2	1.0	3.0
White					
Both sexes-----	3.3	5.0	4.0	1.0	3.2
Boys-----	3.4	4.6	4.3	-	3.3
Girls-----	3.2	5.3	3.9	1.0	3.1
Negro					
Both sexes-----	3.2	6.8	4.7	-	2.8
Boys-----	3.3	7.5	2.1	-	3.0
Girls-----	3.2	6.2	6.6	-	2.6
Standard error					
Total <sup>1</sup>					
Both sexes-----	0.11	0.28	0.17	0.64	0.11
Boys-----	0.12	0.50	0.35	-	0.13
Girls-----	0.11	0.37	0.25	0.64	0.12
White					
Both sexes-----	0.12	0.25	0.20	0.64	0.12
Boys-----	0.13	0.48	0.25	-	0.13
Girls-----	0.13	0.36	0.32	0.64	0.13
Negro					
Both sexes-----	0.18	0.56	0.72	-	0.15
Boys-----	0.20	0.94	1.20	-	0.20
Girls-----	0.21	0.85	1.27	-	0.13

<sup>1</sup>Includes data for "other races," which are not shown separately.

Table 21. Percent distribution of children aged 6-11 with Treatment Priority Index (TPI) of 4.5 or more by status of thumbsucking habit, according to type of malocclusion syndrome, with standard errors of the estimates: United States, 1963-65

Reported thumbsucking habit	Total	Type of malocclusion syndrome						
		Tooth displacement		Anterior				Mixed <sup>1</sup>
		Maxillary expansion	Maxillary collapse	Overbite	Openbite	Lower overjet	Overjet	
Percent distribution								
All thumbsucking---	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Present-----	16.7	10.4	5.5	2.0	39.7	9.4	21.2	9.0
Absent-----	83.1	88.9	94.5	98.0	59.9	90.6	78.5	91.0
Not reported-----	0.2	0.6	-	-	0.4	0.3	0.3	-
Standard error								
Present-----	0.65	1.69	1.87	0.97	4.20	5.59	1.71	4.99
Absent-----	0.68	1.83	1.87	0.97	4.11	5.59	1.73	4.99
Not reported-----	0.16	0.65	-	-	0.45	-	0.21	-

<sup>1</sup>Two or more TPI components of equally high weight.

Table 22. Percent distribution of children by whether or not it was reported that teeth were straightened, according to sex and age, with standard errors of the estimates: United States, 1963-65

Sex and age	Total	Teeth straightened	Teeth not straightened	Don't know	Not reported
Percent distribution					
Both sexes 6-11 years -----	100.0	2.5	97.3	0.0	0.2
Boys 6-11 years -----	100.0	2.4	97.4	0.0	0.2
6 years -----	100.0	0.4	99.5	-	0.1
7 years -----	100.0	0.5	99.1	-	0.4
8 years -----	100.0	1.5	98.3	-	0.2
9 years -----	100.0	3.3	96.5	-	0.2
10 years -----	100.0	3.6	96.0	0.2	0.2
11 years -----	100.0	5.1	94.9	-	-
Girls 6-11 years -----	100.0	2.6	97.2	0.1	0.1
6 years -----	100.0	0.5	99.2	0.3	-
7 years -----	100.0	0.9	98.7	-	0.4
8 years -----	100.0	1.9	98.0	-	0.1
9 years -----	100.0	3.6	96.3	-	0.1
10 years -----	100.0	4.1	95.8	-	0.1
11 years -----	100.0	4.7	95.3	-	-
Standard error					
Both sexes 6-11 years -----	...	0.23	0.25	0.02	0.05
Boys 6-11 years -----	...	0.22	0.22	0.03	0.07
6 years -----	...	0.28	0.32	-	0.14
7 years -----	...	0.27	0.38	-	0.28
8 years -----	...	0.46	0.48	-	0.18
9 years -----	...	0.54	0.55	-	0.22
10 years -----	...	0.85	0.98	0.15	0.20
11 years -----	...	0.80	0.80	-	-
Girls 6-11 years -----	...	0.42	0.47	0.04	0.06
6 years -----	...	0.41	0.48	0.26	-
7 years -----	...	0.42	0.42	-	0.25
8 years -----	...	0.87	0.88	-	0.15
9 years -----	...	1.05	1.07	-	0.13
10 years -----	...	1.02	1.04	-	0.13
11 years -----	...	0.88	0.88	-	-

Table 23. Number of children aged 6-11 and percent distribution by reported need for tooth straightening, according to race and sex, with standard errors of the estimates: United States, 1963-65

Reported need for tooth straightening	Total <sup>1</sup>			White			Negro		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
Estimated number of children in thousands-----	23,151	11,772	11,379	19,824	10,105	9,719	3,221	1,618	1,603
Percent distribution									
All children-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Yes-----	11.3	10.6	11.9	11.1	10.6	11.6	12.4	10.7	14.0
No-----	74.9	76.4	73.5	74.8	76.2	73.3	76.3	78.4	74.1
Don't know-----	8.6	8.0	9.3	8.9	8.2	9.7	6.9	6.4	7.5
Not reported-----	5.2	5.0	5.3	5.2	5.0	5.4	4.4	4.5	4.4
Standard error									
Yes-----	0.55	0.62	0.73	0.55	0.59	0.79	1.22	1.97	1.79
No-----	0.98	0.96	1.34	1.10	1.07	1.51	1.66	1.73	2.24
Don't know-----	0.47	0.48	0.68	0.43	0.50	0.64	1.48	1.25	2.29
Not reported-----	0.82	0.81	0.91	0.83	0.80	0.93	1.47	1.53	1.55

<sup>1</sup>Includes data for "other races," which are not shown separately.

NOTE: Excludes children whose teeth reportedly had been straightened.

Table 24. Number of children and average Treatment Priority Index (TPI) per child for children aged 6-11 by reported need for tooth straightening, race, and sex, with standard errors of the estimates: United States, 1963-65

Race and sex	All children	Reported need for tooth straightening			
		Yes	No	Don't know	Not reported <sup>1</sup>
Total <sup>2</sup>		Estimated number of children in thousands			
Both sexes-----	17,728	2,313	12,598	1,381	1,436
Boys-----	8,810	1,091	6,384	623	712
Girls-----	8,918	1,222	6,214	758	724
White					
Both sexes-----	15,109	1,949	10,691	1,220	1,249
Boys-----	7,526	937	5,420	551	618
Girls-----	7,583	1,012	5,271	669	631
Negro					
Both sexes-----	2,540	349	1,856	158	177
Boys-----	1,241	148	940	69	84
Girls-----	1,299	201	916	89	93
Total <sup>2</sup>		Average TPI per child			
Both sexes-----	3.3	5.2	2.9	3.8	3.3
Boys-----	3.4	5.4	3.0	3.8	3.5
Girls-----	3.2	5.0	2.8	3.9	3.2
White					
Both sexes-----	3.3	5.2	2.9	4.0	3.3
Boys-----	3.4	5.4	3.0	4.0	3.4
Girls-----	3.2	5.1	2.8	4.0	3.3
Negro					
Both sexes-----	3.2	5.0	2.9	2.9	3.4
Boys-----	3.3	5.6	2.9	2.2	4.4
Girls-----	3.2	4.5	2.9	3.5	2.6
Total <sup>2</sup>		Standard error			
Both sexes-----	0.11	0.22	0.12	0.19	0.17
Boys-----	0.12	0.31	0.14	0.32	0.18
Girls-----	0.11	0.28	0.11	0.25	0.32
White					
Both sexes-----	0.12	0.22	0.13	0.20	0.18
Boys-----	0.13	0.30	0.14	0.36	0.13
Girls-----	0.13	0.31	0.13	0.26	0.30
Negro					
Both sexes-----	0.18	0.54	0.18	0.58	0.34
Boys-----	0.20	0.94	0.30	0.42	1.21
Girls-----	0.21	0.64	0.11	0.81	1.09

<sup>1</sup>Includes data for children whose teeth had reportedly been straightened.

<sup>2</sup>Includes data for "other races," which are not shown separately.

Table 25. Number of children per 1,000 children aged 6-11 reported to have had their teeth straightened, by annual family income and sex, with standard errors of the estimates: United States, 1963-65

Annual family income	Both sexes	Boys	Girls
	Number per 1,000 children		
All incomes-----	24.7	23.6	26.0
Less than \$3,000-----	17.4	14.2	20.5
\$3,000-\$4,999-----	12.6	11.2	14.1
\$5,000-\$6,999-----	17.4	19.3	15.4
\$7,000-\$9,999-----	25.8	26.9	24.6
\$10,000-\$14,999-----	48.5	47.9	49.2
\$15,000 or more-----	73.1	44.5	108.3
Unknown-----	23.5	26.2	20.7
	Standard error		
All incomes-----	2.29	2.18	4.22
Less than \$3,000-----	4.27	6.61	7.67
\$3,000-\$4,999-----	2.49	4.52	3.90
\$5,000-\$6,999-----	2.52	3.99	5.08
\$7,000-\$9,999-----	3.05	6.20	6.44
\$10,000-\$14,999-----	7.99	10.97	9.28
\$15,000 or more-----	16.55	13.21	31.48
Unknown-----	10.88	12.63	14.18



Table 26. Number of dental visits per year per 100 persons and percent of dental visits involving straightening for persons 5-14 and 15-24 years of age, by annual family income, with approximate standard errors of percents: United States, 1971

Age and annual family income	Number of dental visits per year per 100 persons	Percent of dental visits involving straightening	Standard error of percent of dental visits involving straightening <sup>1</sup>
5-14 years <sup>2</sup> -----	181	23.6	1.3
Less than \$7,000-----	98	14.0	2.8
\$7,000-\$9,999-----	177	14.7	2.6
\$10,000-\$14,999-----	202	20.9	2.4
\$15,000 or more-----	284	38.1	2.8
15-24 years <sup>2</sup> -----	181	12.2	1.1
Less than \$7,000-----	130	*	*
\$7,000-\$9,999-----	174	10.0	2.5
\$10,000-\$14,999-----	208	13.4	2.5
\$15,000 or more-----	259	21.4	2.9

<sup>1</sup>Based on curve A4BM in relative standard error chart, p. 42, Series 10, No. 79, Vital and Health Statistics.

<sup>2</sup>Includes unknown family income.

## APPENDIX I

### ASSESSMENT OF OCCLUSION AND TRAINING OF EXAMINERS

Two different forms were used to record dental findings on sample children examined during 1963-65. On the first form, used at 31 survey locations, a recorder either wrote down the measurements obtained for various occlusal components or circled printed values corresponding to the measurements. The examination documents were reviewed daily for completeness and legibility. At the last nine locations a different form was used to eliminate the time-consuming tasks of coding, keypunching, and verification necessitated by use of the initial form. The new form was processed on an IBM Optical Mark Page Reader, Model I, which entered the examination data directly onto punchcards.

After the data recorded on both forms had been put on punchcards, they were transferred to magnetic tape. As the final step in data processing, an edit program was used to search for impossible codes and inconsistencies. Each record that failed an edit was printed out for review and correction by the survey's dental advisors.

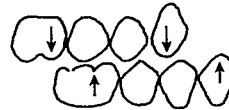
#### Procedures for Assessment of Occlusion

1. Buccal segment relation.—This assessment describes the anterior-posterior position relationship of the teeth in the lower arch with the teeth in the upper arch. Most often, the score is based on the relationship of the permanent upper and lower first molars. When the permanent molars are absent, not fully erupted, or misshapened because of extensive decay or fillings, primary molars or the permanent cuspids and bicuspid are used to determine the buccal segment relation. For assessment purposes, the position of the upper cuspid can be regarded as in the position of the mesiobuccal cusp of the upper first molar.

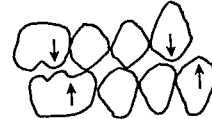
With the teeth resting together, the right and left sides are assessed separately. To enable a right-angle view of the area, the mouth mirror can be used. The schematic drawings that follow serve as a scoring guide.

#### A. Permanent molars.— Buccal Aspect—Right Side

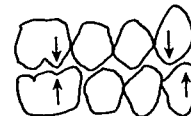
1. Mesial severe (more than cusp-to-cusp mesial).—A mesial positioning of the lower molar beyond a cusp-to-cusp deviation.



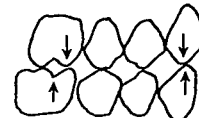
2. Mesial moderate (cusp-to-cusp mesial or less).—A mesial positioning of the lower molar resulting in a cusp-to-cusp relation.



3. Normal.—Normal relation, mesiobuccal cusp of upper molar in buccal groove of lower molar.



4. Distal moderate (cusp-to-cusp distal or less).—A distal positioning of the lower molar resulting in a cusp-to-cusp relation.

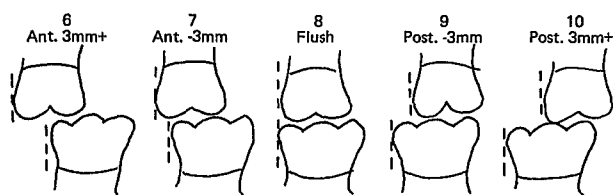


5. Distal severe (more than cusp-to-cusp distal).—A distal positioning of the lower molar beyond a cusp-to-cusp deviation.



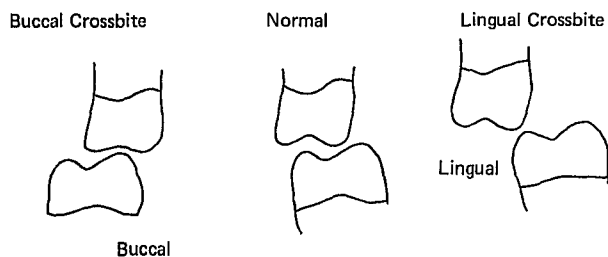
B. Primary molars.—The assessment is made by observing the position of the distal surface of the primary lower second molar in relation to the distal surface of the primary upper second molar. The schematic drawings that follow serve as a scoring guide.

Buccal Aspect—Right Side



- Primary 1. Lower is anterior to upper by 3 mm. or more.
- Primary 2. Lower is anterior to upper but less than 3 mm.
- Primary 3. Lower is flush with upper.
- Primary 4. Lower is posterior to upper but less than 3 mm.
- Primary 5. Lower is posterior to upper 3 mm. or more.

2. Posterior crossbite.—This is a measure of buccal-lingual deviation in the bicuspid and molar areas. Both primary and permanent teeth are included in the appraisal. To simplify the assessment it is assumed that the upper tooth has deviated. The entire tooth must be deviated, not merely rotated, as far as or beyond a cusp-to-cusp relation (see drawings below). The scores that are recorded are the number of upper teeth in buccal crossbite and the number in lingual crossbite. The totals are entered on the form in the designated space.



3-4. Incisor relationship.—This assessment is made only when the permanent central incisors, at least one upper and one lower, are present and fully erupted. When fully erupted permanent central incisors are not present, a mark is made in the not applicable space on the form.

A. Upper anterior overjet-lower anterior overjet.—With the teeth occluding, the distance from the most anterior labial surface of a permanent lower incisor to the most anterior labial surface of an upper incisor is measured with a Boley gauge. The measurement is made parallel to both the occlusal and the midsagittal planes. The measurements are rounded to the nearest whole millimeter and recorded in the

appropriate box ("overjet" for overjet of the upper incisor and "mandibular protrusion" for overjet of the lower incisors). Since upper overjet and lower overjet are mutually exclusive, N.A. is marked for the one not present. An edge-to-edge bite is recorded as zero-zero for mandibular protrusion box, N.A. for overjet box, N.A. for overbite, zero-zero for openbite, and code 3 marked for incisor vertical relation.

B. Anterior overbite-openbite.—The measurement, in millimeters, of the vertical overlap of the incisal edges of the upper incisors (overbite) or the vertical space between the incisal edges of the upper and lower incisors (openbite) is made with a Boley gauge.

When overlapping is present, a pencil mark is made on the permanent lower right or left central incisor to indicate the extent of overlap. The distance from the incisal edge to the pencil mark is measured, rounded to nearest whole millimeter, and entered in the overbite space.

When openbite is present, the vertical space separating the incisal edges of the upper and lower central incisors is entered in the openbite space.

When lower overjet occurs with anterior crossbite, N.A. is marked for openbite, overbite, and vertical incisal relation.

When it is difficult to measure upper or lower overjet, edge-to-edge bite, or anterior crossbite because of the presence of rotated or displaced anterior teeth, the examiner uses his judgment to select the set of measurements and codes that best describe the vertical and horizontal incisor relations. When indicated, the condition is described under "Remarks."

C. Incisor vertical relationship.—This assessment is made in conjunction with the overbite or openbite measurement. When lower overjet is measured, the most applicable box is checked for item 18.

The appropriate code number is marked to describe the location of the line on the lower incisor (the incisal third, 0-1/3; the middle third, 1/3-2/3; the gingival third, 2/3-3/3). If the line would appear on tissue below the gingival margin of the lower incisor or if the lower incisors are in contact with the soft tissue of the palate (impinging overbite (E), it is coded as *Tis* or *Imp. Ob.*, respectively.

If an openbite is present, the code number 1, 2, or 3 is marked to correspond to the measurement recorded for openbite.

FIRST MOLAR RELATION Choose appropriate column			(6) Distocclusion				N e u t r o	(7) Mesioclusion				Weights	Syndrome Type
			2 sides full c	1 side c to c and 1 side full	2 sides c to c or 1 side full	1 side c to c		1 side c to c	2 sides c to c or 1 side full	1 side c to c and 1 side full	2 sides full c		
Horizontal incisor relation	(1) Upper Overjet	mm											
		9+	2.0	3.4	5.4	9.3	10+	9.3	5.4	3.4	2.0	Retrognathism	
		9	1.4	2.5	4.0	6.9	10+	6.9	4.0	2.5	1.4		
		8	1.0	1.8	2.8	4.8	8.0	4.8	2.8	1.8	1.0		
		7	.6	1.1	1.8	3.0	5.1	3.0	1.8	1.1	.6		
	6	.4	.6	1.0	1.7	2.9	1.7	1.0	.6	.4			
	5	.2	.3	.4	.8	1.3	.8	.4	.3	.2			
	2-4 mm.												
	NORMAL Score 0												
	(2) Lower Overjet	1	.2	.3	.4	.8	1.3	.8	.4	.3	.2	Prognathism	
0		.4	.6	1.0	1.7	2.9	1.7	1.0	.6	.4			
1		.6	1.1	1.8	3.0	5.	3.0	1.8	1.1	.6			
2		1.0	1.8	2.8	4.8	8.0	4.8	2.8	1.8	1.0			
3		1.4	2.5	4.0	6.9	10+	6.9	4.0	2.5	1.4			
3+	2.0	3.4	5.4	9.3	10+	9.3	5.4	3.4	2.0				
Vertical incisor relation	(3) Overbite in crown thirds	Bite	2.9	3.8	4.8	6.2	8.0	6.2	4.8	3.8	2.9	Overbite	
		3/3+	1.5	2.0	2.4	3.2	4.1	3.2	2.4	2.0	1.5		
	2/3-3/3	.5	.7	.9	1.1	1.5	1.1	.9	.7	.5			
	0-2/3												
NORMAL Score 0													
(4) Openbite in mm.	<2	1.5	2.0	2.4	3.2	4.1	3.2	2.4	2.0	1.5	Openbite		
	2-4	2.9	3.8	4.8	6.2	8.0	6.2	4.8	3.8	2.9			
	4+	4.9	6.3	7.9	10+	10+	10+	7.9	6.3	4.9			
(10) Tooth displacement score	Count teeth rotated about 45° or displaced about 2 mm.	2	.1	.1	.2	.3	.4	.3	.2	.1	.1	Is distocclusion and/or posterior crossbite max. to buccal  PRESENT YES NO Max. Expansion Syndrome Max. Collapse Syndrome	
		3	.2	.3	.4	.7	1.1	.7	.4	.3	.2		
		4	.3	.5	.9	1.2	1.9	1.2	.9	.5	.3		
	Count teeth rotated >45° or displaced more than 2mm x 2	5	.5	.8	1.2	1.9	3.0	1.9	1.2	.8	.5		
		6	.7	1.1	1.8	2.8	4.3	2.8	1.8	1.1	.7		
		7	1.0	1.5	2.4	3.9	5.9	3.9	2.4	1.5	1.0		
	Total (0, 1 no score)	8	1.3	1.9	3.1	4.9	7.7	4.9	3.1	1.9	1.3		
		9	1.7	2.5	4.1	6.2	9.7	6.2	4.1	2.5	1.7		
		9+	2.0	3.0	4.9	7.7	10+	7.7	4.9	3.0	2.0		
	CONSTANT			5.17	3.95	2.72	1.50	0.27	1.50	2.72	3.95		5.17
(8) Posterior Crossbite Count No. of teeth	MAX. TO BUCCAL	No.	0	1	2	3	4	5	6	7	8	more	
		Weight	0	.1	.6	1.3	2.2	3.5	5.0	6.9	9.0	10	
	MAX. TO LINGUAL	No.	0	1	2	3	4	5	6	more			
		Weight	0	.3	1.0	2.3	4.2	6.5	9.4	10			
SUM OF WEIGHTS IS TREATMENT PRIORITY INDEX													

Figure I. Calculating form for deriving the Treatment Priority Index.

5. Malaligned teeth.—A count is made of the number of teeth rotated about 45° or displaced about 2 mm. from a presumed ideal alignment. Next, a count is made of the number of teeth rotated more than 45° or displaced more than 2 mm. from the ideal. In the upper arch, anterior teeth are counted before posterior teeth. The same procedure is repeated for the lower teeth. The totals for each segment are marked in the appropriate space on the form.

#### Calculation of Treatment Priority Index

Figure I reproduces a form on which the examination data are entered to calculate the Treatment Priority Index. Directions for its use are as follows:

1. Observe the first molar relation and place a check mark in the column heading which applies.
2. On the left-hand margin circle the appropriate measurement for the horizontal incisor relation. If this measurement is 2-4 mm., it is considered normal with weight zero.
3. Also on the left-hand margin circle the appropriate score for vertical incisor relation and for tooth displacement. An upper incisor overbite from zero to two-thirds is considered normal with weight zero. Also, displacement scores of zero and one are discarded with weight zero.
4. Find the appropriate weights for the first three items at the junction of the row and column and enter them in the column on the right.
5. Transpose the constant for the designated column to the right.
6. Circle the appropriate scores for posterior crossbite and transpose the weights to the right-hand column.
7. Sum the right-hand column to obtain the Treatment Priority Index.

#### Training Examiners

Each of the 7,109 sample children who received dental examinations during 1963-65 was examined by one of five dentists. The dentists included two senior examiners, A and B, who trained and supervised the other examiners, C, D, and E.

Sample children were not assigned randomly or equally among the various examiners. At most survey locations children were examined by only one dentist—C, D, or E. At 14 of 40 locations, however, a small sub-sample was examined by either A or B or, as occurred at three locations, by both A and B. Thus the senior dentists examined relatively few sample children. The number and percent of children examined by each dentist were as follows:

Examiner	Number of sample children examined	Percent of sample children examined
All examiners -	7,109	100.0
A -----	467	6.6
B -----	394	5.5
C -----	3,200	45.0
D -----	2,188	30.8
E -----	860	12.1

Most examinations completed by the senior dentists resulted from a planned series of replicate examinations. As a rule, the findings of the senior dentists were included in the sample child's examination record, and the findings of the dentist with whom he was paired were kept separate. The primary aim of the replicate examinations was to correct any examiner divergence from the accepted examination procedures.

Throughout the replicate examinations, the senior dentist completed his examination first, while the other dentist was absent, and dictated his findings to a trained recorder. Then the other dentist completed his examination, and the senior dentist recorded these findings. Appreciable interexaminer differences as well as any procedure that diverged from the accepted one were discussed and, if indicated, either resolved or corrected while the sample child was still present. However, the findings originally recorded by the examiner were not altered.

To indicate the level of agreement on the TPI and its component measures, interexaminer differences are shown in table I. The direction of disagreement that occurred is shown by positive or negative numbers. A positive number indicates that a finding of a senior dentist was higher than that of the other dentist, while a negative number indicates the opposite.

The level of agreement between senior and other dentists on the TPI and its components was relatively high. Perfect agreement was recorded on 43 percent of the TPI examinations and about 72 percent of the TPI scores differed by no more than 1.0.

An even higher level of agreement was recorded for TPI component measures; perfect agreement ranged from a low of 50.7 percent for tooth displacement to a high of approximately 97 percent for buccal crossbite. All the component distributions had a high concentration of scores near zero, indicating close agreement. Eighty percent of the tooth displacement scores and all the openbite scores differed by no more than 1.0.

To some degree, the data indicate that the senior dentists tended to assign higher scores than the other dentists. All but one of the distributions in table I contain a greater percentage of positive scores than negative scores. For example, 27 percent of the upper anterior overjet scores are positive while only 14.9 percent are negative.

Table I. Percent distribution of interexaminer differences in the Treatment Priority Index (TPI) and its components on replicate dental examinations: Health Examination Survey, 1963-65

Difference in score (senior dentist minus other dentist)	TPI	Component score					
		Posterior crossbite		Upper anterior overjet <sup>1</sup>	Overbite	Openbite	Tooth displacement
		Lingual	Buccal				
Mean difference-----	0.23	0.08	0.0	0.09	0.05	0.13	0.21
Standard deviation of the difference-----	2.03	0.49	0.25	0.86	0.88	0.62	1.32
Number of replicate examinations-----	263	380	380	278	259	15	380
		Percent distribution					
All replicate examinations-----	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-6 or less-----	0.8	-	-	-	-	-	-
-5-----	1.5	-	-	0.4	0.8	-	0.3
-4-----	1.1	-	-	0.4	-	-	-
-3-----	3.0	-	-	0.7	0.4	-	2.9
-2-----	3.8	0.3	0.3	1.1	2.3	-	3.9
-1-----	16.0	2.1	1.6	13.3	13.1	13.3	11.6
0-----	43.4	91.2	96.5	57.1	57.6	60.0	50.7
1-----	12.2	3.7	1.3	24.8	23.9	26.7	18.2
2-----	7.2	1.6	-	1.8	1.9	-	7.9
3-----	4.9	0.8	0.3	0.4	-	-	2.4
4-----	1.1	0.3	-	-	-	-	1.3
5-----	2.3	-	-	-	-	-	0.5
6 or more-----	2.7	-	-	-	-	-	0.3

<sup>1</sup>Too few children with lower overjet measurement were included in the replicate examinations to permit accurate assessment of the interexaminer agreement for the component score.

## APPENDIX II

### DEMOGRAPHIC AND SOCIOECONOMIC TERMS

*Age.*—The age recorded for each child was the age at his last birthday on the date of examination. The age criterion for inclusion in the sample used in this survey was defined in terms of age at the time of the interview. Since the examination usually took place 2 to 4 weeks after the interview, some of those who were 11 years old at the time of interview became 12 years old by the time of examination. There were 72 such cases. In the adjustment and weighting procedures used to produce national estimates, these 72 were included in the 11-year-old group.

*Race.*—Race was recorded as "white," "Negro," or "other races." The last category included American Indians, Chinese, Japanese, and all races other than white or Negro. Mexican persons were included with "white" unless definitely known to be American Indian or of another race. Negroes and persons of mixed Negro and other parentage were recorded as "Negro."

*Family income.*—The income recorded was the total income received during the past 12 months by the head of the household and all other household members related to the head by blood, marriage, or adoption. This income was the gross cash income (excluding pay in kind) except in the case of a family with its own farm or business, in which case net income was recorded.

*Education of head of household.*—The highest grade completed in school was recorded. The only grades counted were those attended in a regular public or private school where persons were given formal education, whether during the day or at night, and whether attendance was full or part time. A "regular" school is one which advances a person toward an elementary or high

school diploma, or toward a college, university, or professional school degree. Education in vocational, trade, or business schools outside a regular school system was not counted in determining the highest grade of school completed.

*Geographic region.*—For purposes of stratification the United States was divided into four broad geographic regions of approximately equal population. These regions, which correspond closely to those used by the U.S. Bureau of the Census, were as follows:

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



## APPENDIX III

### STATISTICAL NOTES

#### The Survey Design

The sample design for the second cycle of the Health Examination Survey, similar to the one used for the first cycle, was that of a multistage, stratified probability sample of loose clusters of persons in land-based segments. Successive elements dealt with in the process of sampling were the primary sampling unit (PSU), census enumeration district (ED), segment, household, eligible child (EC), and, finally, the sample child (SC).

At the first stage, the nearly 2,000 PSU's into which the United States (including Hawaii and Alaska) had been divided and then grouped into 357 strata for use in the Current Population Survey and the Health Interview Survey were further grouped into 40 superstrata for use in Cycle II of the Health Examination Survey. The average size of each Cycle II stratum was 4.5 million persons, and all strata fell between the limits of 3.5 and 5.5 million. Grouping into 40 strata was done in a way that maximized homogeneity of the PSU's included in each stratum, particularly with regard to degree of urbanization, geographic proximity, and degree of industrialization. The 40 strata were classified into four broad geographic regions (each with 10 strata) of approximately equal population and cross-classified into four broad population density groups (each having 10 strata). Each of the 16 cells contained either two or three strata. A single stratum might include only one PSU, only part of a PSU (e.g., New York City, which represented two strata), or several score PSU's.

To take account of the possible effect that the rate of population change between the 1950 and 1960 censuses might have had on health, the 10 strata within each region were further classified into four classes ranging from those with no increase to those with the greatest relative increase. Each such class contained either two or three strata.

One PSU was then selected from each of the 40 strata. A controlled selection technique was used in which the probability of selection of a particular PSU was proportional to its 1960 population. In the controlled selection an attempt was also made to maximize the spread of the PSU's among the States. While not every one of the 64 cells in the 4x4x4 grid contributes a PSU to the sample of 40 PSU's, the con-

trolled selection technique ensured the sample's matching the marginal distributions in all three dimensions and being closely representative of all cross-classifications.

Generally, within a particular PSU, 20 ED's were selected with the probability of selection of a particular ED proportional to its population in the age group 5-9 years in the 1960 Census, which by 1963 roughly approximated the population in the target age group for Cycle II. A similar method was used for selecting one segment (a cluster of households) in each ED. Each of the resultant 20 segments was either a bounded area or a cluster of households (or addresses). All the children in the age range properly resident at the address visited were EC's. Operational considerations made it necessary to reduce the number of prospective examinees at any one location to a maximum of 200. The EC's to be excluded for this reason from the SC group were determined by systematic subsampling.

The total sample included 7,417 children from 25 different States in the age group 6-11 years, with approximately 1,000 at each of the single years of age.<sup>8</sup>

#### Reliability

Measurement processes employed in the survey were highly standardized and closely controlled. Of course this does not mean that the correspondence between the real world and the survey results is exact. 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 report on Cycle II<sup>1</sup> describes in detail the faithfulness with which the sampling design was carried out. It notes that of the 7,417 sample children the 7,119 who were examined—a response rate of 96 percent—gave evidence that they were a highly representative sample of children of this age in the noninstitutional population of the United States. The response levels for the various demographic subgroups—including those for age, sex, race, region, population density, parent's educational level, and family income—show no marked differentials. Hence it appears unlikely that



nonresponse could bias the findings much in these respects.

Data recorded for each sample child are inflated in the estimation process to characterize the larger universe of which the sample child is representative. The weights used in this inflation process are a product of the reciprocal of the probability of selecting the child, an adjustment for nonresponse cases, and a poststratified ratio adjustment which increases precision by bringing survey results into closer alignment with known U.S. population figures by race and sex within single years of age from 6-11.

In the second cycle of the Health Examination Survey, the sample was the result of three stages of selection—the single PSU from each stratum, the 20 segments from each sample PSU, and the sample children from the eligible children. The probability of selecting an individual child is the product of the probability of selection at each stage.

Since the strata are roughly equal in population size and a nearly equal number of sample children were examined in each of the sample PSU's, the sample design is essentially self-weighting with respect to the target population; that is, each child 6-11 years old had about the same probability of being drawn into the sample.

Only 10 examined sample children did not receive a dental examination. Thus dental findings were recorded for 7,109 children, who are classified in table II by age and sex. The estimated U.S. population aged 6-11 years by race, sex, and age is shown in table III.

By the end of the survey there were 2,014 sample children with incomplete occlusal records. Two hundred eighty-seven records had only one occlusal measure missing. When a sample child's record had only one occlusal measure missing, it was imputed. The imputed value was randomly selected from a pool of children's records which had the same or similar occlusal characteristics.

Table II. Number of examined sample children who received a dental examination, by sex and age: Health Examination Survey, 1963-65

Age	Number of boys	Number of girls
6-11 years-----	3,626	3,483
6 years-----	574	535
7 years-----	631	607
8 years-----	617	613
9 years-----	601	581
10 years-----	575	583
11 years-----	628	564

Table III. Estimated number of noninstitutionalized children, by race, sex, and age: United States, 1963-65

Age	Total <sup>1</sup>	White		Negro	
		Boys	Girls	Boys	Girls
Number in thousands					
6-11 years--	23,784	10,391	10,012	1,642	1,629
6 years-----	4,098	1,787	1,722	289	281
7 years-----	4,084	1,781	1,716	286	284
8 years-----	3,986	1,739	1,674	279	281
9 years-----	3,957	1,730	1,663	269	265
10 years-----	3,867	1,692	1,632	264	266
11 years----	3,792	1,662	1,605	255	253

<sup>1</sup>Includes data for "other races," which are not shown separately.

SOURCE: Adapted from data provided by the U.S. Bureau of the Census.

### Sampling and Measurement Error

In this report reference has been made to efforts to minimize bias and variability of measurement techniques. The probability design of the survey makes possible the calculation of sampling errors. The sampling error is used here to determine how imprecise the survey test results may be because they come from a sample rather than from the measurements 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 cases. Estimates of sampling error are obtained from the sample data and are themselves subject to sampling error which may be large 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 1-24. These estimates have been prepared by a replication technique which yields overall variability 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.

## Expected Values

In tables 14-16, the actual mean Treatment Priority Index per child is compared with expected values. The computation of expected values was as follows:

Suppose it is estimated that in a subgroup(s) there are  $N_i$  persons in the  $i$ th age group ( $i = 1, 2, \dots, 6$  sum of  $N_i = N$ ).

Suppose it is estimated that the mean TPI per person for the United States in the  $i$ th age-sex group is  $X_i$ . Then the expected mean TPI for the subgroup is

$$\frac{1}{N_s} \sum_i N_{si} X_i$$

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 who are in the region. This may or may not be true. The specified region may have higher values for younger children and lower values for older children than those found in other regions. In that case an average comparison would obliterate one or both of these differentials.

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.

## 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. When such numbers are shown, they have

been included to convey an impression of the overall story of the table.

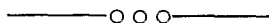
## Tests of Significance

Tests of significance for percent and mean statistics were performed in two ways. The first is to determine if the difference between two estimated means is equal to or greater than two times the standard error of the difference. The test assumes, in accordance with usual practice, that a 68-percent confidence interval ranges within one standard error of the tabulated statistics and that a 95-percent confidence interval ranges within two standard errors. An approximation of the standard error of the difference  $d = x - y$  of two statistics  $x$  and  $y$  is given by the formula  $S_d = (S_x^2 + S_y^2)^{1/2}$  where  $S_x$  and  $S_y$  are standard errors, respectively, of  $x$  and  $y$ .

For example, table 13 shows that the mean TPI is 3.5 for white boys aged 6 and 3.7 for white boys aged 11; the corresponding standard errors are 0.28 and 0.23, respectively. The formula yields a standard error of the difference of  $S_d = .3623$ . Since the observed difference ( $d = 0.2$ ) is less than twice the standard error of the difference, it can be concluded that the mean TPI for white boys aged 6 is not significantly lower than that for white boys aged 11.

The second test is to determine if the difference between the estimated actual and expected values is at least two times the standard error of the actual value. For example, for girls from families with less than \$3,000 yearly income, the difference between the actual and expected mean TPI scores is -0.2 (table 14), and the standard error of the actual value is 0.2. Since the difference is less than twice the standard error, it is statistically insignificant.

The criterion for significance among geographical regions was more stringent than that for other demographic characteristics. To determine whether the difference between estimated means for children in any two of the four geographic regions was significant, the difference was required to be at least 2.5 times the standard error.



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