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Refraction Status
Of Youths 12-17 Years

United States

Findings from the Health Examination Survey of 1966-70 on the degree of eye muscle imbalance, the strength and type of present glasses or contact lenses, and estimates of the best corrected acuity for youths 12-17 years by age, sex, race, region, and family income.

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REFRACTION STATUS OF YOUTHS 12-17 YEARS

Jean Roberts and David Slaby, *Division of Health Examination Statistics*

INTRODUCTION

Included in this report are findings on the degree of eye muscle imbalance, the strength and type of present glasses or contact lenses, and estimates of the best corrected visual acuity possible for youths 12-17 years in the noninstitutional population of the United States, as estimated from the Health Examination Survey findings of 1966-70. Differentials in these findings with respect to age, sex, race, geographic region, size of place of residence, and annual family income are also shown.

The Health Examination Survey, in which these data were collected, is a major program of the National Center for Health Statistics authorized by the 84th Congress under the National Health Survey Act of 1956 to provide for a continuing assessment of the health status of the population.

Three different types of programs are used in carrying out the intent of the National Health Survey.[1] The Health Interview Survey, which collects health information from samples of people by household interview, focuses primarily on the impact of illness and disability within various population groups. The Health Resources programs obtain health data as well as health resource and utilization information through surveys of hospitals, nursing homes, and other resident institutions and the entire range of personnel in the health occupations. The Health Examination Survey, on which the data in this report are based, collects health data by direct physical examination and various tests and measurements performed on samples of the population. The latter program provides the most efficient way yet devised for obtaining actual diagnostic data on the prevalence of medically defined illness in the general population. It is the only one of the National Center for Health Statistics programs designed to secure information on unrecognized or undiagnosed conditions as well as on a variety of physical, physiological, and psychological measures within the population. It also collects medical history, demographic, and socioeconomic data on the sample population under study with which the examination findings for these persons may be interrelated.

The Health Examination Survey is conducted as a series of separate programs, or cycles, each of which is limited to some specific segment of the U.S. population and to specific aspects of health. During the first cycle in 1960-62, the prevalence of certain chronic diseases and the distribution of various physical and physiological measures were determined among a defined adult population, as previously described.[2,3]

The target population for the second cycle in 1963-65 was the Nation's noninstitutionalized children 6-11 years of age. For this cycle the examination focused primarily on health factors related to growth and development as described in an earlier report.[4]

For the third cycle, on which the findings in this report are primarily based, a probability sample of the noninstitutionalized youths 12-17 years in the United States was selected and examined. As in the children's program, the study of youths was also designed to obtain basic measures of growth and development as

well as data on other health characteristics for this segment of the population. The questionnaires and examination content and procedures were similar to those in the children's program, so as to obtain comparable information for the entire continuum of childhood through adolescence, but were supplemented, as necessary, to obtain data specifically related to adolescent health. Included were a physical examination given by a pediatrician assisted by a nurse, an examination by a dentist, tests administered by a psychologist, and a variety of tests and measurements by laboratory X-ray technicians. The survey plan, sample design, examination content, and operation of this survey program have been described in an earlier report.[5]

Field data collection operation for the youths' cycle started in March 1966 and was completed in March 1970. Of the 7,514 youths selected in the sample for this program, 6,768 (90 percent) were examined. This national sample is representative, and the examined group closely so, of the 22.7 million noninstitutionalized youths aged 12-17 years in the United States with respect to age, sex, race, region, population size of place of residence, and rate of population change in size of place of residence from 1950 to 1960.

Examinations were carried out consecutively in 40 different locations throughout the United States in this survey program, as was done in the preceding program among children. During a single visit, each youth was given a standardized examination by the examining team in the mobile units specially designed for use in the survey. Prior to the examination, demographic and socioeconomic data on household members as well as medical history, behavioral, and related data on the youth to be examined were obtained from his parents. In addition, a Health Habits and History form was completed by the youth before he arrived for the examination, and a Health Behavior form was completed by him while in the examination center. Ancillary data were requested from the school attended by the youth, including his grade placement, teacher's ratings of his behavior and adjustment, and health problems known to his teacher. A birth certificate was obtained for each youth to verify his age and provide information related to his condition at birth.

Statistical notes on the sample design, reliability of the data, and sampling and measurement error are shown in appendix I. Definitions of the demographic and socioeconomic terms are in appendix II.

VISION EXAMINATION

The vision examination for youths was developed with the advice of Dr. J. Theodore Schwartz, ophthalmologist, now with the National Eye Institute, and Dr. Herbert A. Urweider, ophthalmologist, George Washington University School of Medicine. Included were tests to detect and classify color vision deficiencies, both monocular and binocular tests to determine the level of distance and near central visual acuity, tests of lateral phoria at distance and near, trial lens tests for myopia given at distance to those scoring less than 20/20 (Snellen) at distance, and lensometer measurements of the correction in the refractive lenses worn by the examinee. Except for color vision, the vision tests (including visual acuity and phoria measurements), were done for all examinees without correction. For those who had their glasses or contact lenses with them, the distance tests were also done with their usual correction. These tests were performed by the examining dentists who had been specially trained in their administration by Dr. Urweider. The dental examiners were selected to do this part of the examination because of operational considerations (space limitations in the mobile examination centers) and because it was felt his professional background would add to the quality of the way in which the test was administered.

The vision test battery for youths was expanded beyond that employed earlier for children. It also included tests for youths with their usual correction (glasses or contact lenses) and the trial lens test, which gave an estimate of the best correction possible for those with myopia, because this condition generally continues to progress throughout the growth period, including the stage of adolescence.

Each youth was also given an eye examination by the survey staff pediatrician. This included a careful, general inspection for evidence of abnormal conditions of the lids, conjunctivae, sclerae,

pupils, and irides; a cover test to detect the presence of tropia; an inspection of the conjugate gaze; and a determination of the focusing or dominant eye.

This report is limited to the findings from the vision test battery related to the degree of lateral eye muscle imbalance, the strength and type of the present correction in the youth's refractive lenses, the estimate of best correction and their relationship to the youth's visual acuity. The findings from the eye examination given by the survey pediatrician, which have been excluded from consideration here, will be contained in a subsequent report.

Testing Instruments and Tests

The same type of instrument as that employed in the children's study, the Master Ortho-Rater, was used in *phoria* and *visual acuity* testing of youth because of the need for data comparable with that from the earlier study as well as the similar need in both for uniformity in testing within available space and time limitations. The design of the instrument and their limitations with respect to visual acuity tests are described in the report *Visual Acuity of Youths 12-17 Years.*[6]

Phoria tests.—The degree of eye muscle imbalance (heterophoria) or misalignment of the visual axes in the lateral horizontal plane, which under conditions of normal binocular viewing is corrected by the fusional capacity of the eyes in latent but not manifest strabismus, was measured using binocular tests on two of the Ortho-Rater plates. For each plate, the eyes are disassociated (stimulus to fusion is lowered) by having each see a separate, nonfusable image. The left eye views a prominent vertical arrow pointed downward at the middle of three evenly spaced dots, while the right eye views a longer horizontal row of similarly spaced dots of size identical to those seen by the left eye. The dots seen by the right eye are spaced apart by an amount equivalent to 1 prism diopter ($^{\Delta}$) and are numbered consecutively from left to right, with only the odd numbers showing for ease in reading. The tests measure, in prism diopters, the separation between the "ideal" or neutral position of fusion and that position which the eyes take when fusion is artificially interrupted in the manner done with the survey instrument.[7] The range of phoria measurement on the plate for distance vision is from 0^{Δ} through 22^{Δ} and on the plate for near vision from 0^{Δ} through 34^{Δ}. With normal binocular viewing, the point of fusion of the arrow image and the dots would be at dot 11 on the distance plate and dot 13 on the near plate where there is no lateral imbalance. If the fusion point for the two images is to the left of the normal position on that test plate, the two eyes are converging (esophoria); but if the fusion point is to the right, the eyes are diverging (exophoria). The position of the fusion point indicates the degree of imbalance laterally. Thus the degree of horizontal or lateral phoria at distance (simulated 26 feet) was measured from 1 to 11 prism diopters of esophoria and from 1 to 11 prism diopters of exophoria. At near (simulated 13 inches) the degree lateral phoria was measured from 1 to 21 prism diopters of esophoria and from 1 to 13 prism diopters of exophoria.

The *binocular lateral phoria test* at distance and at near preceded the corresponding series of visual acuity tests for each youth. The tests were given both with and without correction in the order described previously for the acuity tests.[6] Each phoria test was repeated at least three times. The most consistently repeated response was recorded as the measure of the youth's phoria or eye muscle imbalance (appendix III).

Trial lens tests.—The *trial lens test for myopia*, used for youths who failed to read at the 20/20 level at distance with his right and/or left eye, consisted of seven lenses—one plano of zero power and six negative or concave spherical lenses graded in power of −1.00, −1.50, −2.00, −3.00, −4.00, and −5.00 diopters. The lenses were inserted in the slot provided on the Master Ortho-Rater in front of the eye under test. The right eye was tested first, then the left eye. For the eye under test, the series of lenses were presented in order of increasing strength, starting with the plano lens to prevent accommodation. The same test targets were used as in the regular visual acuity tests. The youth was asked to start reading the last row of letters he had successfully read without lenses. The examiner recorded the lowest power of the trial lens with which the youth was able to read at the 20/20 level with no more than the allowable number of

errors (set for the regular acuity tests). If unable to reach the 20/20 level, then the end point was taken as the best acuity level that could be reached with this strength of the trial lens. If no improvement was observed with the minus lens, this fact was recorded.

Lensometer measurements.—A Powerite II Lensometer was used by the examiner in determining the spherical and cylindrical power and the axis of deviation in the refractive lenses worn by the examinee. Clear lenses were measured through the green filter and dark lenses with the filter removed. A special attachment was used for measurements on contact lenses.

The measurements were carefully made starting with the power scale set on zero and the target lines in sharp focus. The lens was then clamped in the holder. The power wheel was rotated until the target lines were again in approximate focus and the lens centered for measuring. The power wheel was then rotated until the sphere power lines came into sharp focus. The power of the spherical correction in the lens from the power scale was recorded with the appropriate sign to the nearest hundredths of a diopter. The power wheel was again rotated until the cylindrical power lines came into sharp focus and the appropriate power was recorded to the nearest hundredths of a diopter. The degree of axis deviation between the spherical and cylindrical correction also shown at that time on the power wheel was recorded to the nearest degree.

Quality control.—The pretesting of the vision part of the examination for youths and the quality control measures used for these tests throughout the youth survey have been described previously.[6]

FINDINGS

Heterophoria

Nearly 2.7 million youths 12-17 years of age in the United States (12.0 percent) have a moderate to severe degree of eye muscle imbalance (heterophoria) in the lateral plane at distance when tested without correction, as estimated from findings in the Health Examination Survey of 1966-70 among the U.S. civilian, noninstitutional population (tables 1 and 3). Those youths with more than 5 prism diopters ($^{\Delta}$) of deviation from the normal fusion point at distance were considered to have moderate to severe heterophoria, consistent with the criteria most frequently recommended by practicing ophthalmologists and optometrists as the basis for referring children for further visual attention and care.[8,9]

The prevalence of this degree of eye muscle imbalance at distance is lower among U.S. youths than among U.S. children 6-11 years in the 1963-65 Health Examination Survey (14.6 percent). Over the entire 12-year age span, there is some indication of a decrease with age in the proportion having marked heterophoria, though the pattern is not consistent throughout and levels off at 13-17 years (figure 1). The deviation in the fusion point is substantially more likely to be inward (esophoria) than outward (exophoria). Among children, the ratio of esophoria to exophoria was about 9 to 1 compared with the 11-to-1 ratio among youths.

Girls 12-17 years are substantially more likely than are boys of that age to have marked heterophoria of either type, in contrast with the negligible sex difference (but in the same direction) in the proportion with this degree of imbalance among children 6-11 years (figure 2).

In tests of near vision, an estimated 3.7 million youths in this country (16.5 percent) were found to have a moderate to severe degree of eye muscle imbalance, inward or outward, when tested without corrective lenses in the present 1966-70 national study (tables 2 and 3). This rate is significantly higher than that for children 6-11 years in the 1963-65 study (13.3 percent). In near vision, deviations (from the normal fusion position) of 6 prism diopters or more esophoria and 10 prism diopters or more exophoria were classed as moderate to severe heterophoria, using the most frequently recommended criteria for referral for treatment.[8,9] In contrast to the findings at distance, the proportion with moderate to severe near heterophoria generally increased with age across the 12-year span, reflecting the generally consistent increase in near exophoria, which more than compensated for the decrease in near esophoria (figure 3). At 6 years of age, more than twice as many children had near esophoria than exophoria (10.2 percent compared with 4.2 percent). The

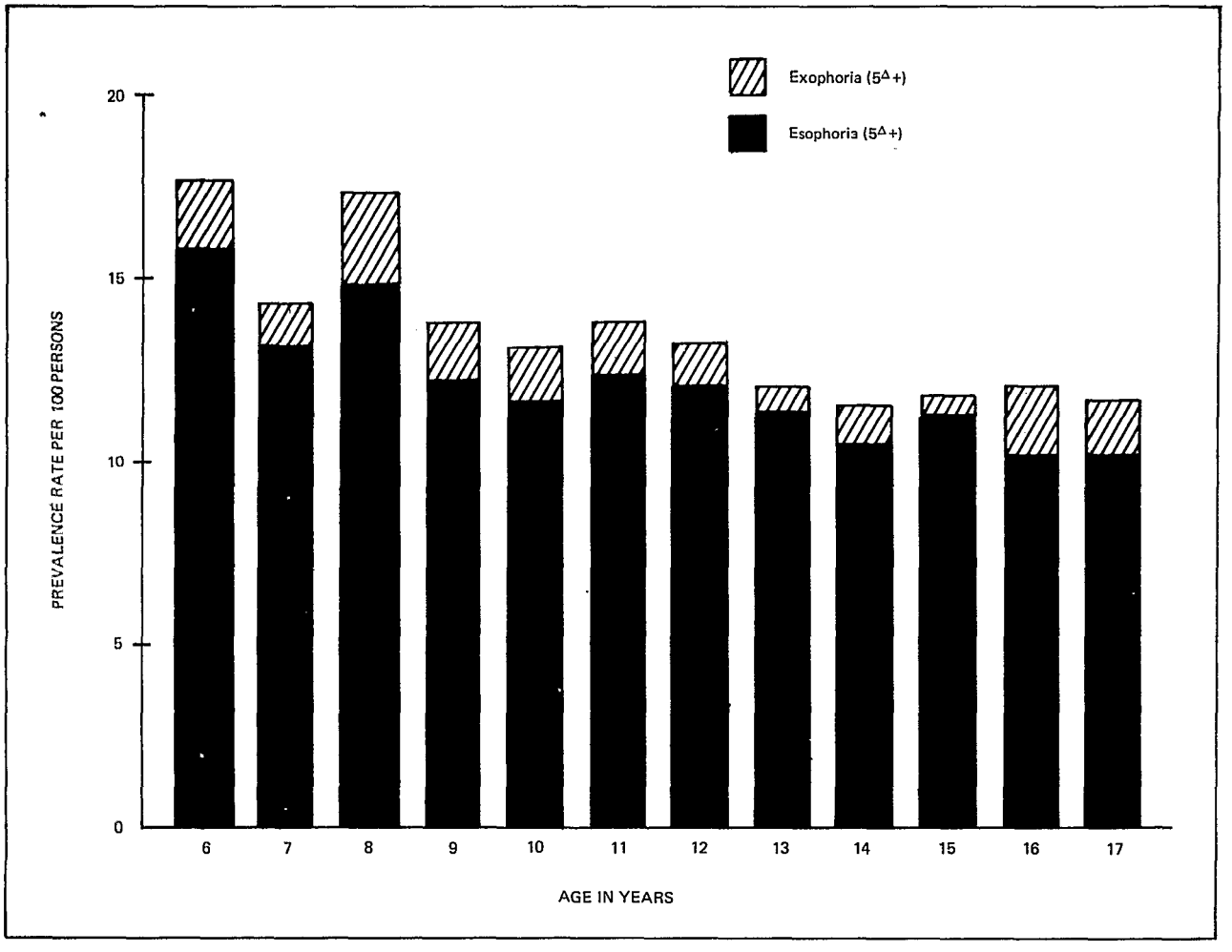

Figure 1. Prevalence rates among children and youths of significant esophoria and exophoria at distance without glasses (or contact lenses) by age: United States, 1963-70.

ratio gradually reversed with age until by 14-17 years, less than half as many youths had a marked near inward than outward deviation.

This pattern for near vision is similar among boys and girls. The proportion with marked near esophoria was slightly greater among boys than girls in the age groups 6-11 years and 12-17 years, while girls were slightly more likely than boys to have a marked exophoria (figure 4).

Phoria test findings with the youths' glasses were available for nearly 30 percent of the youths or for about 85 percent of the 34 percent who indicated they wore glasses or contact lenses. As would be expected, when tested without correction, the proportion of these youths with marked heterophoria was substantially greater than that of youths who did not wear glasses. At distance the prevalence rate of heterophoria was 20 percent for those who wore glasses compared with 12 percent for all youths. At near the contrast is even greater, nearly 40 percent compared with 16.5 percent (figure 5).

The effect of their glasses in reducing the degree of eye muscle imbalance for these youths is substantially greater at near than at distance. For youths who wore glasses, the proportion with moderate to severe near heterophoria is reduced from 40 percent in tests without correction to 28 percent in tests with correction, while at distance the proportion drops only from 20 to 16 percent, respectively (tables 4 and 5).

Although precise agreement cannot be expected between phoria test results in these

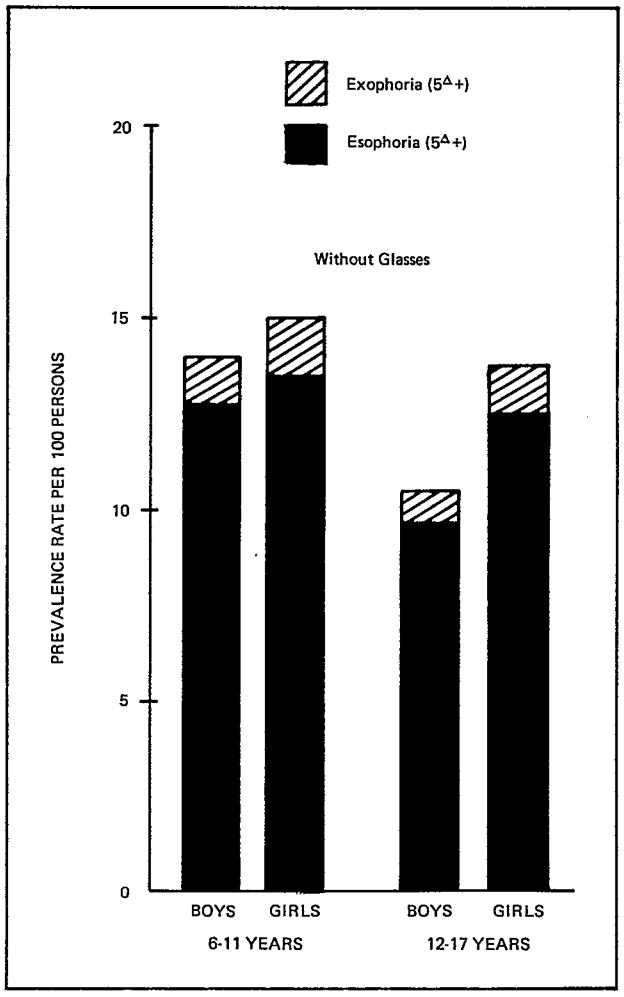

Figure 2. Prevalence rates among children 6-11 years and youths 12-17 years of significant esophoria and exophoria at distance without glasses (or contact lenses) by sex: United States, 1963-70.

surveys and those from a more thorough clinical examination, the Vision Test Validation Study done among visually normal and abnormal youths at one of the 1966-70 survey examination locations (Chicago in 1968)[10] indicates very close agreement of over 90 percent at distance and over 70 percent at near in the identification of essential orthophoria and in the detection of marked heterophoria.

Refraction Status

Among U.S. youths 12-17 years, an estimated 43 percent (9.8 million) are unable to see clearly enough to read at the 20/20 level at distance without correction (i.e., are unable to correctly identify letters with one or both eyes at a simulated 20-foot distance of a size that persons with "normal" acuity would be able to read at a 20-foot distance). The proportion is substantially greater among girls (48 percent) than among boys (39 percent); there is, however, no consistent trend with age for either (table 12). The difference between the defective acuity rates for boys and girls was at a minimum at 15 and 16 years (boys 5 and 7 percent less, respectively) and a maximum at 17 years (boys 14 percent less).

The medical histories obtained from the parents indicated that 34 percent (7.7 million) of youths 12-17 years of age in the civilian, noninstitutional population of this country wear corrective lenses—glasses or contact lenses.[6] Information regarding the refraction status for these youths is limited to the 85 percent who brought their glasses or contact lenses to the examination with them. The proportion who did so (28 percent of all youths) was significantly greater among girls (33 percent) than among boys (23 percent). A similar sex differential existed among all those who owned corrective lenses. Nearly 31 percent of those wearing corrective lenses at the time of the examination, or an estimated 2.4 million youths, failed to reach the 20/20 level with one or both eyes when wearing their own corrective lenses.

The prescription used in the youths' present glasses or contact lenses were determined by lensometer measurement during the survey examination for those youths who brought their glasses or contact lenses with them. The spherical and cylindrical power of the lenses and the degree of axis deviation of the cylinder as recorded are shown in tables 6-10 and figure 6. The actual spherical equivalence of the lens system in these glasses (as estimated here by the algebraic sum of spherical power and one-half the power of the cylindrical correction) is shown in table 11 and figure 6. No consistent age-related trend is evident for these youths in the power of the lens or lens system in their present glasses.

On the basis of the spherical correction only, 80 percent of the youths with glasses or contact lenses had a negative lens correction for myopia,

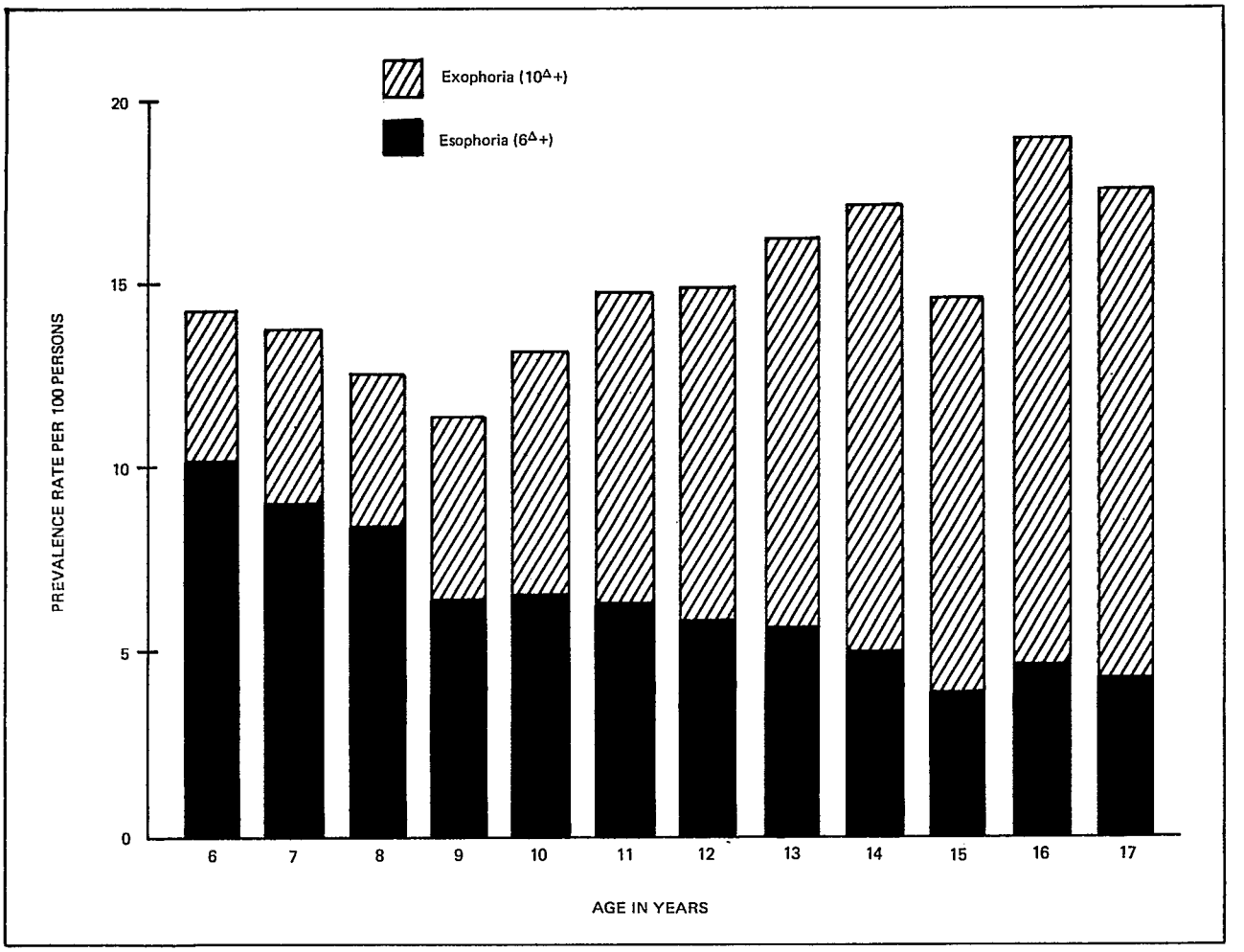

Figure 3. Prevalence rates among children and youths of significant esophoria and exophoria at near without glasses (or contact lenses) by age: United States, 1963-70.

16 percent had a positive correction for hyperopia, and 4 percent had no spherical correction. When the spherical equivalence of the total lens system is considered, 83 percent had a correction for myopia, 16 percent for hyperopia, and only about 1 percent had no measurable refraction in their glasses. The proportion of youths with a correction for myopia does show a substantial overall increase with age from 72 percent at 12 years to 87 percent at 17 years, while the proportion with a correction for hyperopia is reduced by more than half—decreasing with age from 27 percent at age 12 years to 12 percent at 16 and 17 years (figure 7).

Refraction Potential

All youths.—With the survey trial lens test for myopia, more than 6.0 million youths (61.4 percent) whose uncorrected monocular distance acuity was less than 20/20 could be corrected to the 20/20 level with the simple negative spherical lens of 5 diopters or less used in the trial test (table 12). The remaining 38.6 percent who could not reach that "normal" point with one of the trial lenses included an estimated 8 percent with more severe myopia requiring a negative lens power greater than 5 diopters, about 12 percent with some degree of myopia but requiring a complex lens system for astigmatism, and

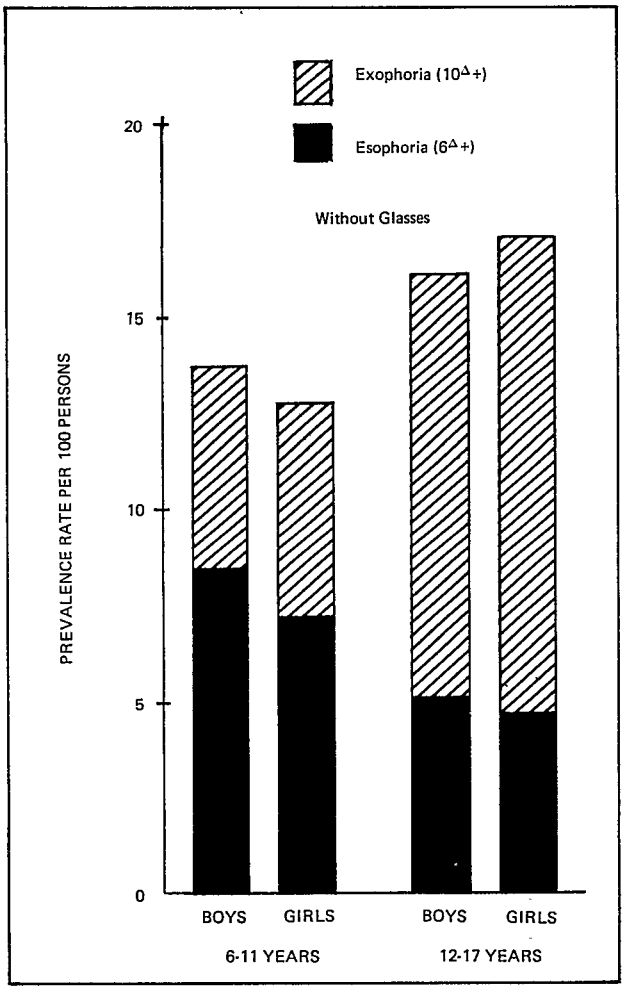

Figure 4. Prevalence rates among children 6-11 years and youths 12-17 years of significant esophoria and exophoria at near without glasses (or contact lenses) by sex: United States, 1963-70.

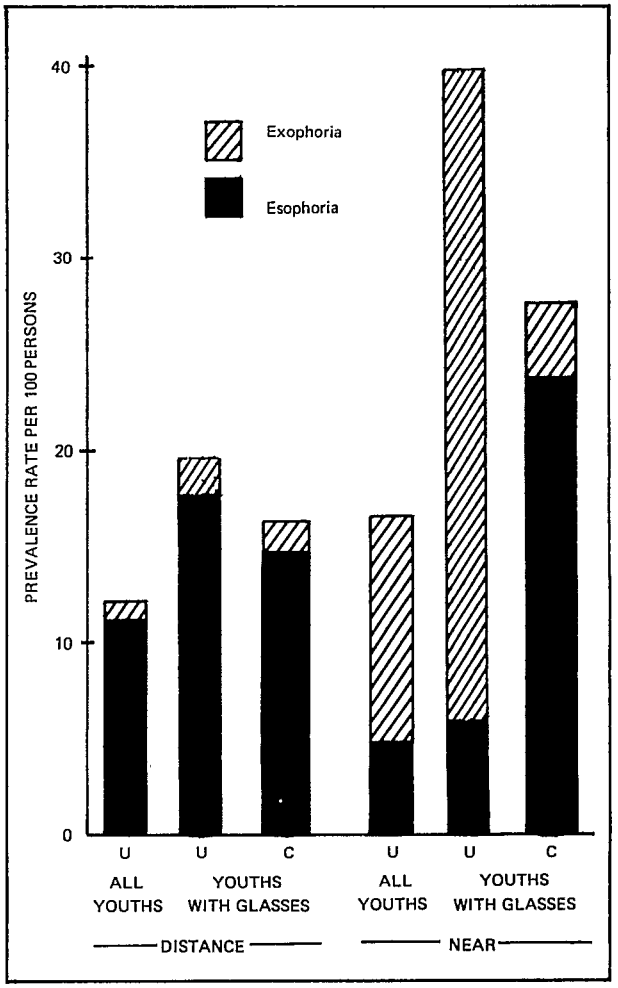

Figure 5. Prevalence rates among youths 12-17 years of significant esophoria and exophoria at distance and near for all youths without correction (U) and for youths with glasses with correction (C) and without (U): United States, 1966-70.

18 percent with astigmatism or other condition but no evidence of myopia (table 13). It should be kept in mind that this trial lens test gives only a rough estimate of the maximum correctability with a simple negative lens. It is not intended to infer here that this is the most comfortable or otherwise desirable level for these youths.

No consistent age-related trend was evident in the proportion correctable to 20/20 with the trial lens. The proportion varied between 60 and 62 percent across the age range 12-17 years.

More than one-third (34 percent) of the youths given the trial lens test reached their maximum correction with the 1-diopter (negative) lens (figure 8). Among this group, distance acuity for 87 percent was found correctable to 20/20 (figure 9). The remainder, presumably, would have required a complex lens if improvement to that point were possible for them.

The maximum correction was reached for an additional 36 percent of these youths (with uncorrected monocular acuity below 20/20) with one of the stronger trial lenses of -1.5, -2, -3, or -4 diopters—the proportion varying between 7 and 10 percent per lens. The proportion of this group correctable to 20/20 was slightly less, ranging from 71 percent at 4 diopters to 79 percent at 1.5 diopters.

Among the 11 percent requiring the strongest trial lens, 5 diopters, only about one-fourth (27

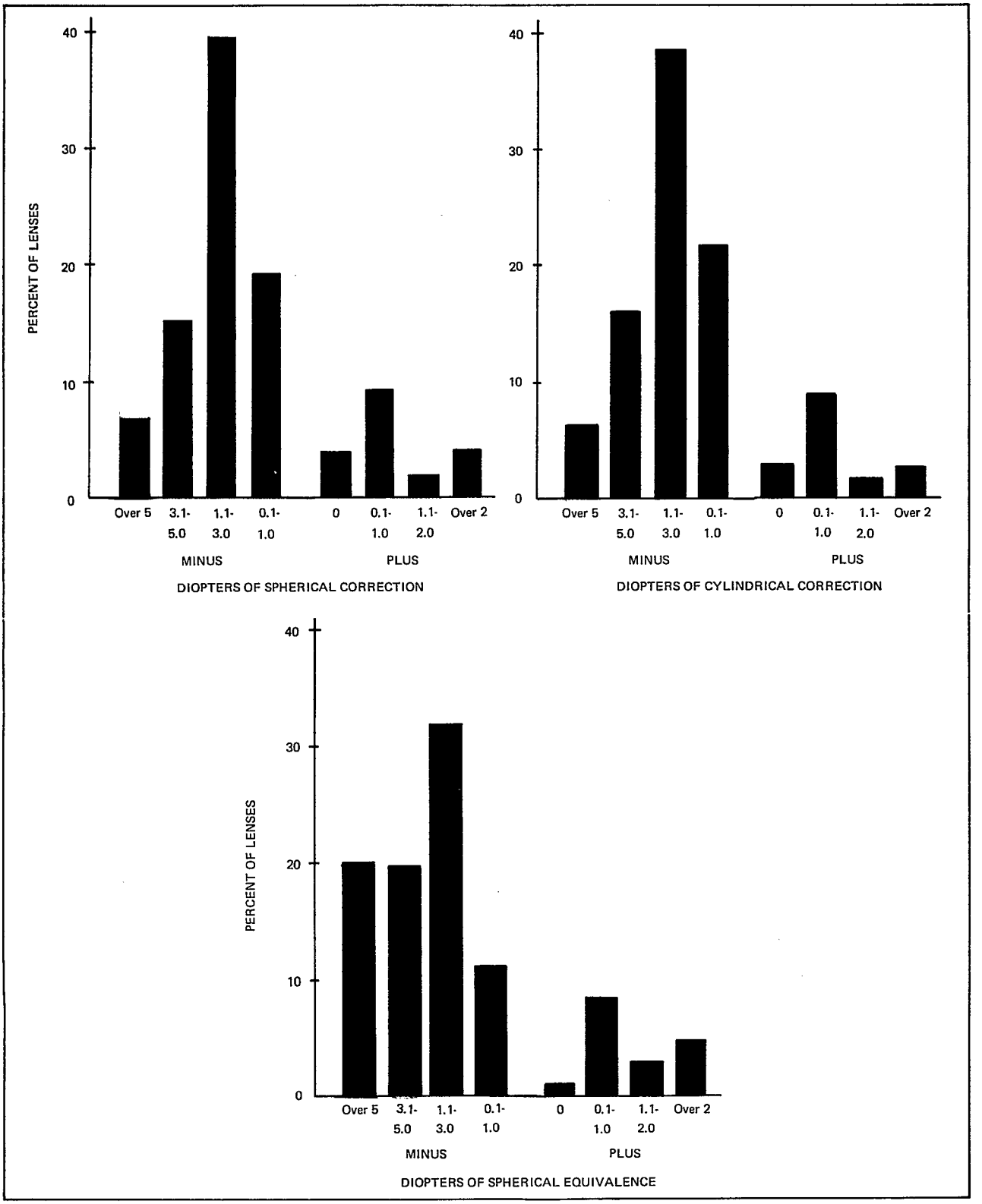

Figure 6. Proportion of youths with own glasses or contact lenses by the power of spherical and cylindrical correction and spherical equivalence in these glasses (or contact lenses): United States, 1966-70.

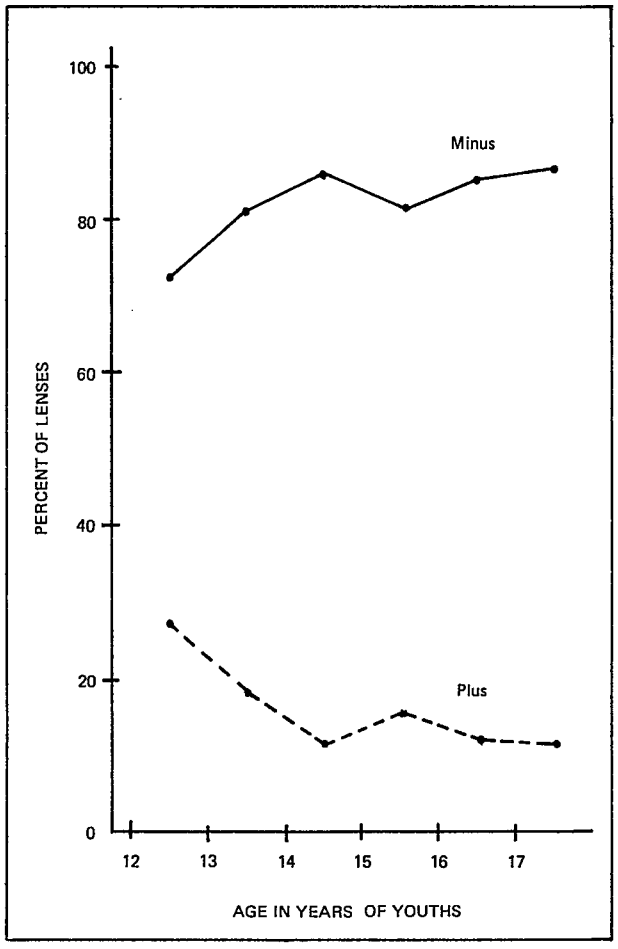

Figure 7. Percent of youths with minus lenses (for myopia) or plus lenses (for hyperopia) in their present glasses: United States, 1966-70.

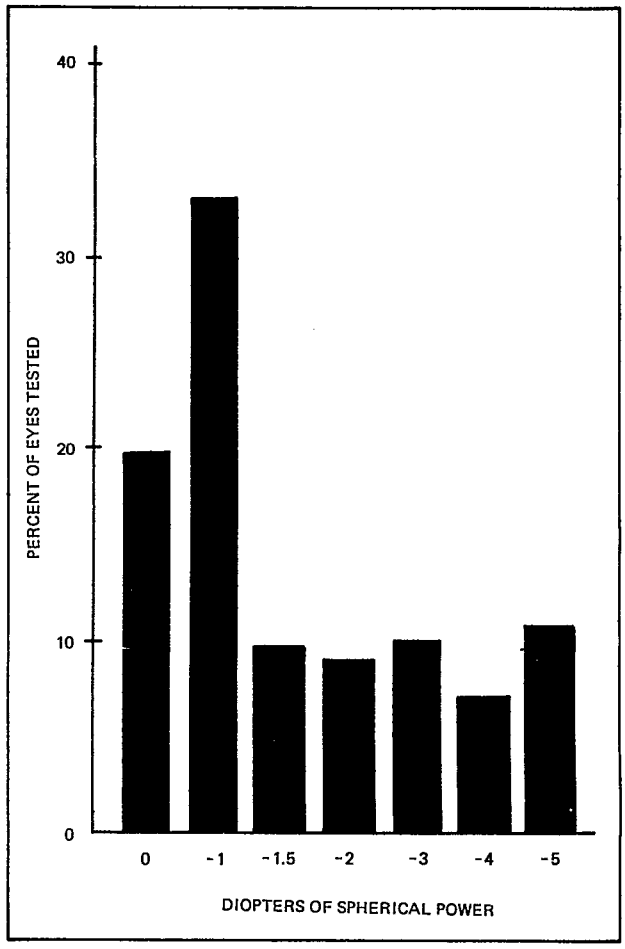

Figure 8. Percent of youths 12-17 years tested with trial lens (without glasses) by strength of lens needed for maximum correction: United States, 1966-70.

percent) could be improved to 20/20 with this simple lens.

One in five of these youths (19.7 percent) reached the maximum level in this test with the plano lens (0 diopters). The small proportion (9 percent) of this group improved to the 20/20 level with the plano lens presumably did so because the extra effort they may have exerted the second time was sufficient to compensate for the slight correction needed. The remaining 91 percent of these youths (18 percent of all youths with uncorrected acuity less than 20/20) would probably have required a complex or different type of lens for visual improvement.

Among all youths given the trial lens test, no consistent patterns by age or sex are evident with respect to the power required for maximum correction in the trial lens test for myopia.

The extent to which monocular acuity of youths could be improved with the power in the various trial lenses used is shown in table 13.

Figure 10 shows a comparison of the actual distribution of uncorrected (monocular) acuity in the youth population and the extent to which improvement in acuity would be possible if youths whose unaided acuity was less than 20/20 were to use corrective lenses of the power and type in the trial lens battery. With this correction, the proportion testing at least 20/20 would be increased from 57 percent to 83 percent, and the proportion testing 20/30 or better would be increased from 69 percent to nearly 93 percent.

The maximum strength of the trial lens needed for improvement to the 20/20 level or to the best level possible for those whose acuity

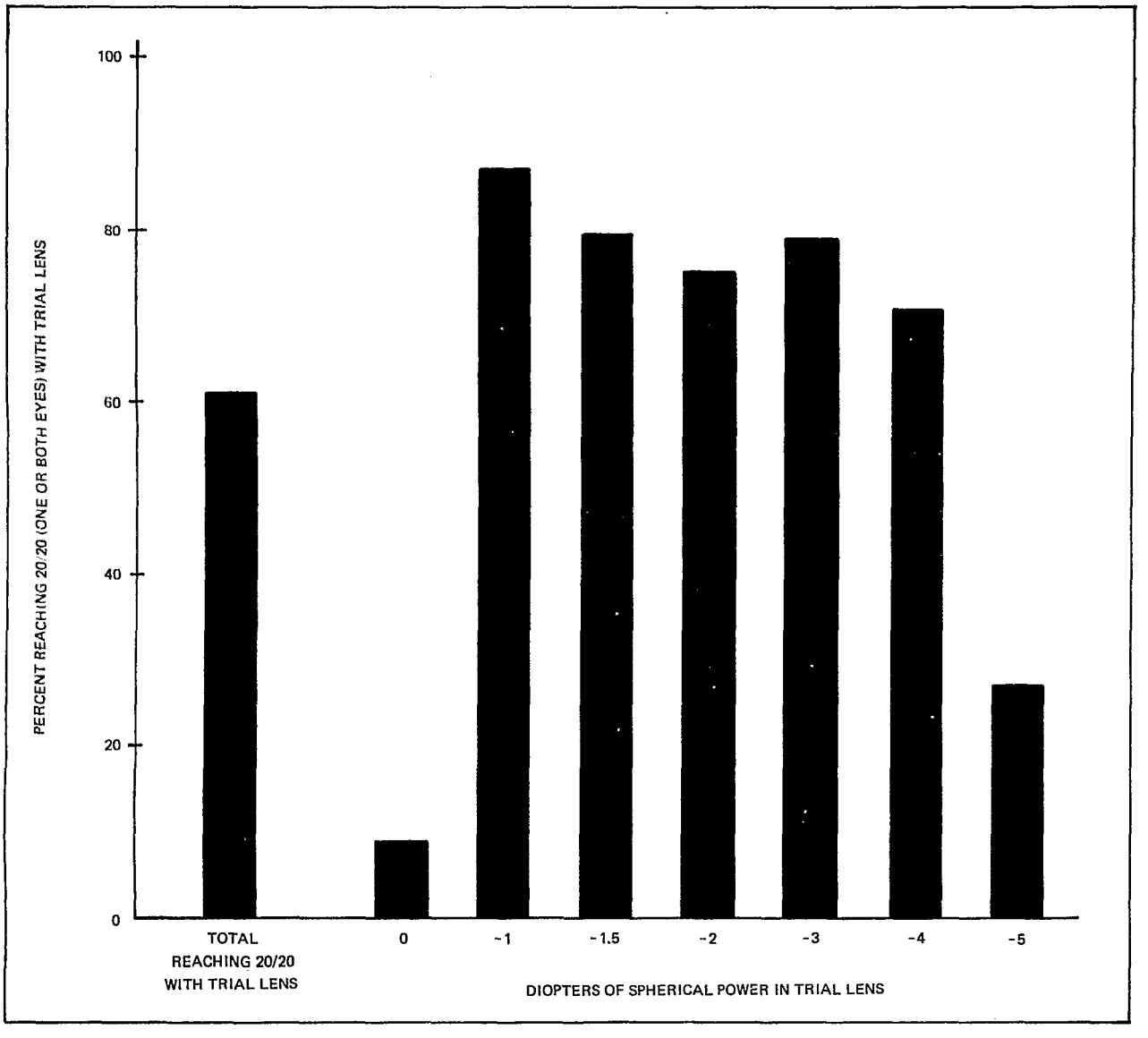

Figure 9. Percent of youths 12-17 years tested with trial lens whose acuity is increased to 20/20, by strength of trial lens required: United States, 1966-70.

could not be improved to that extent is similar for both eyes (table 15). For those with at least one eye corrected to 20/20 with the trial lens, 43 percent required the same power lens for each eye, and 68 percent required the power to differ by no more than one level. Among those whose acuity could not be corrected to 20/20, however, 73 percent of the youths required the same power of trial lens for maximum correction of the right and left eye, and 91 percent required the power to differ by no more than one level.

Youths with glasses.—Twenty-three percent of the youths tested with their own glasses or contact lenses did not reach the 20/20 level with them and were then given the trial lens test so that a rough estimate could be obtained of the extent to which their acuity with their own glasses could be increased with some additional negative spherical correction.

More than two-thirds (68 percent) of the youths with glasses tested as well or better with the trial lens than with their own glasses—26 percent reached the same acuity level, and 42

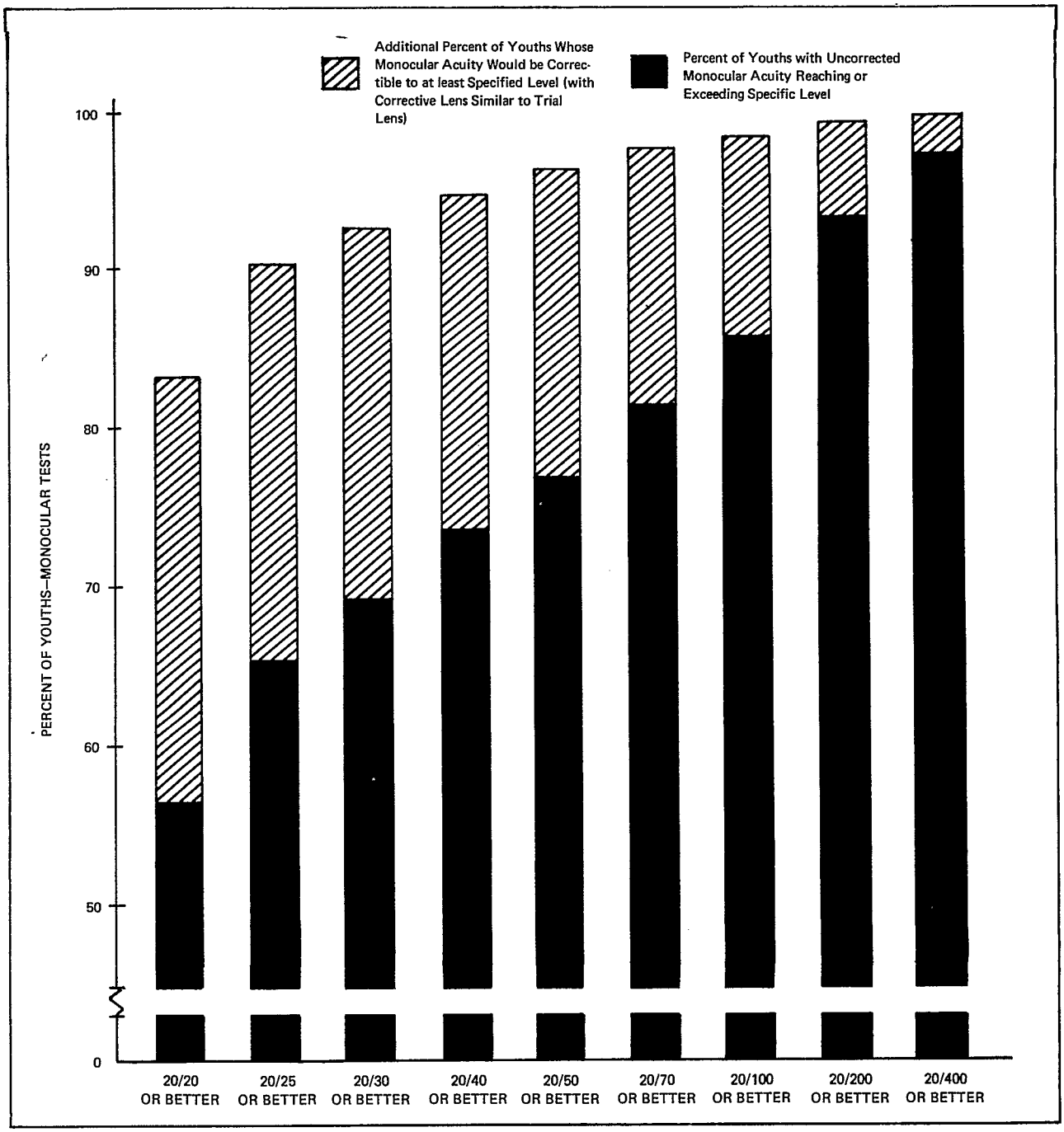

Figure 10. Percent of youths 12-17 years with uncorrected monocular acuity reaching or exceeding specified levels and additional maximum correction possible with lens similar to best trial lens: United States, 1966-70.

percent reached a higher level with the trial lens—while only 22 percent saw less well with the trial lens than with their own glasses (table 14).

More than half (56 percent) of the youths given the trial lens test while wearing their own glasses or contact lenses required a trial lens power of −1 diopter to reach their maximum

correction on this test (table 16 and figure 11). Nearly three-fifths (58 percent) of all youths who had failed at the 20/20 level with their present glasses or lenses had acuity improved to 20/20 with the addition of some power of the trial lenses. Of those tested with trial lenses of -1, -1.5, and -2 diopters, more than 80 percent were improved to the 20/20 level with this additional lens. The proportion was only slightly lower at 3 diopters.

The estimated extent of increase in acuity possible with some additional negative spherical power added to their present glasses or contact lenses is shown in figure 12. Here it is apparent that the proportion with at least 20/20 corrected acuity was increased from 68 to 86 percent, and the proportion testing 20/25 or better increased from 81 to 88 percent. The extent of improvement needed and made (in the trial test) is, as expected, substantially less than that for uncorrected acuity of all youths (figure 10).

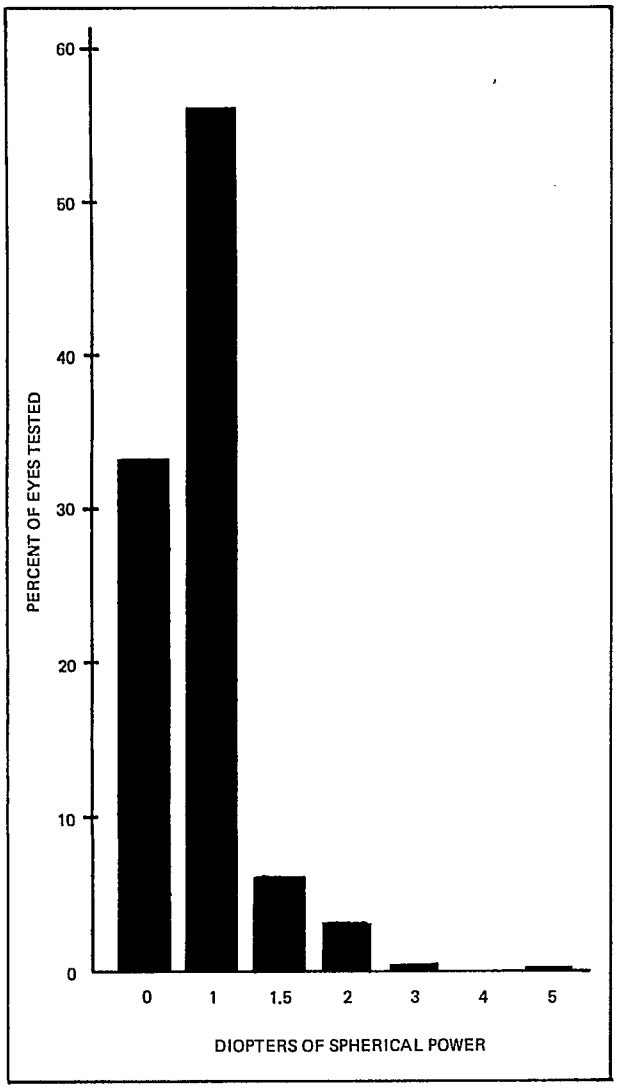

Figure 11. Percent of youths 12-17 years given trial lens test while wearing their glasses by strength of trial lens needed for maximum correction: United States, 1966-70.

A comparison of the spherical power and spherical equivalence of the youths present glasses with the spherical power of the trial lens used for maximum acuity with and without glasses is shown in tables 17-20. On tests without glasses, nearly two-fifths (39 percent) of the youths with a negative or zero correction in their present glasses or contact lenses had the same spherical equivalence as that in their best trial lens, and 18 percent required a trial lens one step (1 diopter or .5 diopter at 1-2D) stronger. For 28 percent of these youths, the trial lens was one step weaker than the spherical equivalence of their own glasses. Agreement with the spherical power of their own glasses or contact lenses (tables 18 and 20) is less good: for 32 percent the two were of the same order of magnitude, for 42 percent the trial lens was one step stronger, and for only 7 percent it was one step weaker than the spherical power in their own glasses or contact lenses.

Race, Region, and Income Differentials

Race.—The trial lens test results in this survey would indicate that among youths with unaided distance acuity less than 20/20 (43 percent of all youths) proportionately more white than Negro youths could have their monocular acuity increased to at least 20/20 with corrective lenses of -5 diopters or less—63 percent of white youths compared with 54 percent of Negro youths (table 21). However, no racial difference is evident in the proportion whose acuity remains as moderately to severely defective (20/70 or less) with this type and power of lens (8 percent of both racial groups).

Among those who failed at the 20/20 level with their own glasses (23 percent of the 28 percent who brought their glasses with them, or 6 percent of all youths), greater improvement

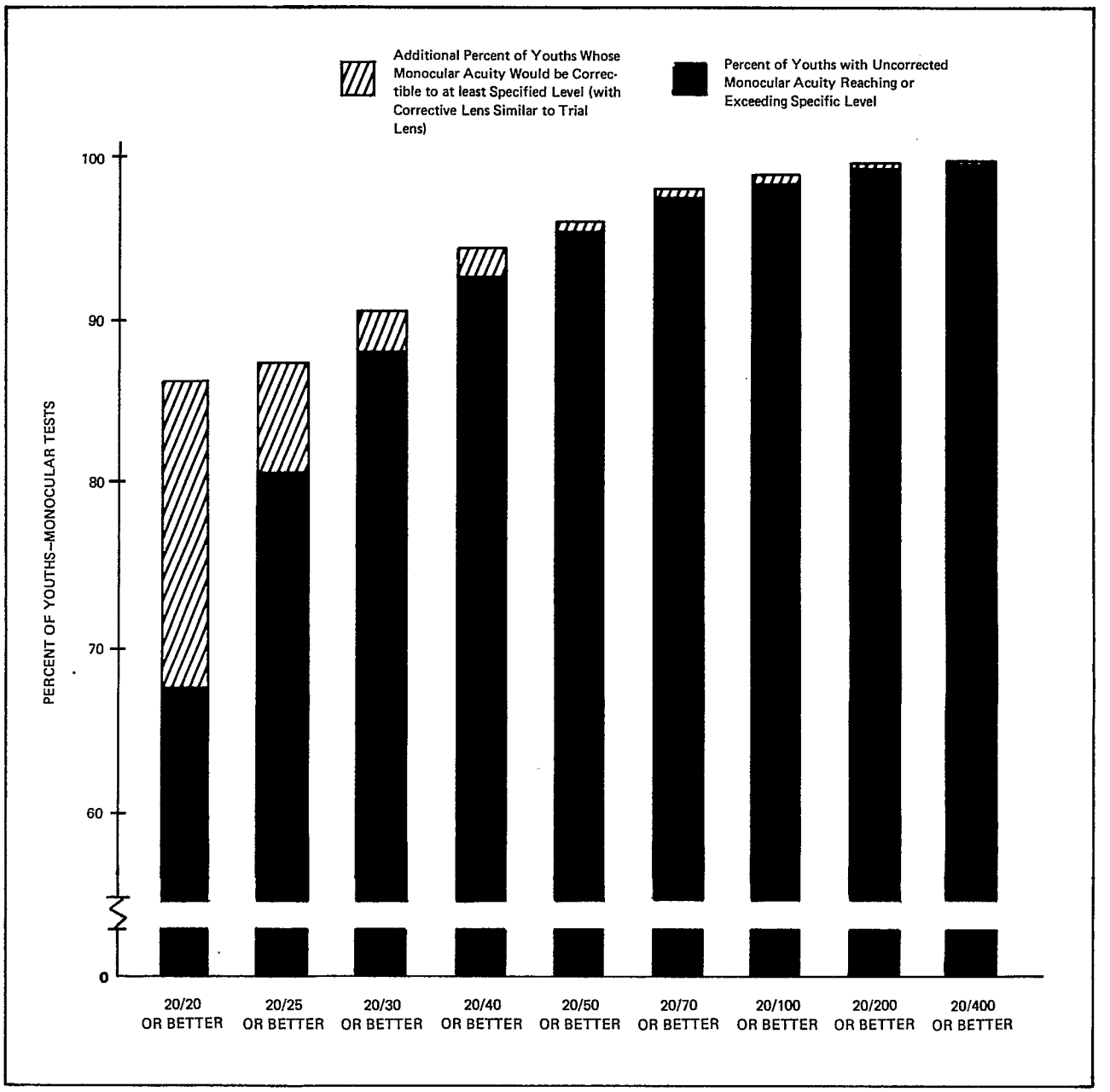

Figure 12. Percent of youths 12-17 years with monocular acuity with their own glasses reaching or exceeding specified levels and maximum correction possible with lens similar to best trial lens (with glasses): United States, 1966-70.

with the trial lens test was also shown for white than for Negro youths (table 22). Acuity was improved to the 20/20 level for 69 percent of the white youths compared with 56 percent of the Negro youths, while only 4 percent of the white youths and 7 percent of the Negro youths remained at 20/70 or less even with the additional lens.

Negro youths were slightly but not significantly less likely than white youths to have a marked degree of eye muscle imbalance with or without their own glasses or contact lenses (tables 23 and 24).

Region.—Significantly more improvement in acuity with the trial lens test was shown among youths in the Midwest and West than those in

the Northeast and South. Among youths whose unaided acuity was less than 20/20, 66 percent of those in the Midwest and 65 percent in the West compared with 58 percent in the Northeast and 54 percent in the South were improved to the 20/20 level with the trial lens (table 21).

There is a similar regional pattern in improvement of acuity with the trial lens among those who could not read at the 20/20 level with their own glasses (table 22). Improvement to the 20/20 level with the trial lens while wearing their own corrective lenses ranged from over 75 percent of youths in the West to 59 percent in the South. Because of the small proportion of youths in this group, only the extreme values are large enough to be considered statistically significant here.

With respect to significant heterophoria, youths living in the West tended to be less likely to have a marked degree of eye muscle imbalance in both their corrected and uncorrected vision than those from other regions of the country (tables 23 and 24).

Income.—There is a consistent positive association between the size of the family income and the extent of improvement in acuity on the trial lens test. The proportion of youths whose unaided acuity was brought up to the 20/20 level in the trial lens test increased from 57 percent among youths in families with less than $3,000 annual income to nearly 66 percent among those in families with annual income of $15,000 or more, with only a negligible setback at $10,000-$14,999. The proportion improved to the 20/20 level was significantly higher among youths in families with income of $7,000 or more than among those in families with annual income of less than $5,000.

The pattern of increase with income level in the proportion improved to the 20/20 level with the trial lens and the youths' own glasses is similar to the findings for all youths given this trial lens test.

Significantly more youths in families with annual income of $7,000 or more were improved to the 20/20 level than were those in families with income of less than $5,000 (72 percent compared with about 60 percent).

No really consistent relationship of significant heterophoria to size of family income is evident among U.S. youths (tables 23 and 24).

Children-Youth Comparison

In the 1966-70 Health Examination Survey among youths 12-17 years, the same sampling areas and housing units were utilized as in the previous 1963-65 Health Examination Survey among children 6-11 years. As a result, nearly one-third of the youths in the present study had also been examined in the children's survey. The time lapse between the two examinations ranged from 28 months to 5 years, with a median time lapse of 4 years. Since the uncorrected phoria and visual acuity tests were identical in both surveys, some longitudinal data on these measures are available for the estimated 7.4 million youths represented. Comparison of the findings at these two points in time will probably reflect the reliability of the testing as well as any change in condition of the children. Since the group reexamined is limited to those who remained in the same location during that period and were willing to be examined again, this subgroup cannot be considered typical of the total group of youths.

Heterophoria.—The prevalence of moderate to severe esophoria and exophoria at distance is nearly identical in both surveys for those youths who had also been examined in the children's survey: nearly 12 percent had esophoria of 5^{Δ} or more and about 1 percent had exophoria of 5^{Δ} or more in both examinations. However, while a highly significant relationship (positive correlation) exists between test results at the two points in time, some changes are evident. Considering the broad groupings of esophoria (5^{Δ} or more), essential orthophoria (less than 5^{Δ}), and exophoria (5^{Δ} or more), 86 percent had the same direction of deviation in conjugate gaze on both examinations. Six percent who were orthophoric as children tested in the esophoric range as youths, while for an additional 6 percent the shift was in the opposite direction (from esophoric to orthophoric). Only 1 percent who were rated as esophoric or orthophoric as children tested in the exophoric range when reexamined as youths (table 25).

At near the pattern is generally similar—84 percent had the same type of findings in both examinations, 10 percent shifted from esophoria or exophoria to a more normal position, and nearly 6 percent shifted from normal (ortho-

phoria) to a marked esophoria or exophoria (table 26).

Visual acuity.—The majority of youths who had been examined in the previous children's survey showed little change in their distance visual acuity between the two examinations. Sixty-five percent tested at least 20/20 at both points in time, while an additional 4 percent remained at the same level but below 20/20 (table 27).

For those whose acuity level changed over time, the tendency was about twice as likely to be a decrease as an increase. Twenty-one percent reached a lower acuity level when tested as youths than in the earlier examination.

The decrease in acuity for 10 percent of the youths was from at least 20/20 to less than 20/20, while that for 11 percent stayed below 20/20 but reached a lower level.

Among the 10 percent whose acuity improved, 6 percent who tested below 20/20 as children reached the 20/20 level as youths, and the remaining 4 percent showed some improvement but not to the 20/20 level.

SUMMARY

This report contains national estimates on the degree of eye muscle imbalance or heterophoria, the refraction status, and the refraction potential for visual acuity of noninstitutionalized youths 12-17 years of age in the United States as determined from findings of the Health Examination Survey of 1966-70.

For this survey, a probability sample of 7,514 youths was selected to represent the nearly 23 million noninstitutionalized youths age 12-17 years in this country at midsurvey point. Of these, 6,768 (90 percent) were examined. The examined group was closely representative of the target population from which the sample was drawn with respect to age, sex, race, region, population size of place of residence, and rate of population change in size of place of residence from 1950 to 1960.

The principal findings from this part of the examination are:

1. Nearly 12.0 percent (2.7 million) of the youths 12-17 years in the United States have a moderate to severe degree of eye muscle imbalance in the lateral plane at distance when tested without correction. This rate is significantly lower than the prevalence rate for this condition of nearly 15 percent among U.S. children 6-11 years in the 1963-65 national survey. In contrast with the negligible sex differences in the prevalence of this condition among children, girls 12-17 years are substantially more likely than are boys to have marked esophoria or exophoria.

2. At near, an estimated 3.7 million youths in this country (16.5 percent) were found to have a moderate to severe degree of eye muscle imbalance without correction or substantially more than the prevalence of this condition among children from the previous national survey.

3. Although precise agreement cannot be expected between the phoria test results in these surveys and those from a more thorough clinical examination, the small methodological study done among visually normal and visually abnormal youths in the survey who had been examined at one of the survey locations (Chicago) showed agreement of over 90 percent at distance and 70 percent at near in the identification of essential orthophoria (and level detection of marked heterophoria) between the two methods.

4. An estimated 43 percent (9.8 million) of the youths 12-17 years are unable to see clearly enough to read at the 20/20 level with one or both eyes at distance without corrective lenses, the proportion being substantially greater among girls (48 percent) than among boys (39 percent). Medical history information from the parent indicates that 34 percent of 7.7 million youths wear glasses or contact lenses.

Among the 85 percent who brought their glasses or contact lenses to the examination, 83 percent had a negative lens correction for myopia, 16 percent a positive lens correction for hyperopia, and about 1 percent no measurable refraction in their own lenses in lensometer determinations.

5. From the survey trial lens test for myopia, more than 6.0 million youths (61.4 percent) whose uncorrected monocular acuity was less than 20/20 could be corrected to the 20/20 level with the simple negative spherical lens of 5 diopters or less used in the trial lens test. Eight percent would have required a stronger correction, 12 percent showed some evidence of

myopia but would have required a complex lens system for astigmatism, and 18 percent showed evidence of astigmatism or other condition without myopia.

6. Nearly three-fifths (58 percent) of all youths whose acuity was below the 20/20 level with their present glasses or contact lenses had their corrected acuity improved to the 20/20 level with the addition of some power of the trial lenses used in this study (−1, −1.5, −2, −3, −4, −5 diopters).

7. The findings from this trial lens test give only a rough estimate of the maximum correctability with a simple negative lens. It is not intended to imply that the findings cited above (5 and 6) are either the most comfortable or otherwise desirable levels for these youths.

8. The extent of correctability of visual acuity as determined in the trial lens test is greater among white than among Negro youths, among youths in the West and Midwest than those in the Northeast and South, and among youths in higher income level families than those in families with annual income under $5,000.

Included here is a comparison of the findings among these youths at the time of this survey with those from their examination in the children's survey in 1963-65 for the nearly one-third of the youths who were examined in both.

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LIST OF DETAILED TABLES

Table 1. Percent distribution of youths by degree of distance lateral phoria for all youths without correction and for youths, who wore glasses, with their own glasses, by age: United States, 1966-70

Phoria scale	(Δ) Prism diopters of deviation	All youths without correction						Youths with own glasses					
		12 years	13 years	14 years	15 years	16 years	17 years	12 years	13 years	14 years	15 years	16 years	17 years
		Percent distribution											
Total		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Esophoria													
0	11+	1.5	1.4	0.8	1.6	1.3	1.0	2.1	2.0	0.5	2.2	2.4	2.1
1	10	0.6	1.2	0.9	0.5	0.5	0.8	1.8	0.6	0.9	2.1	3.2	0.9
2	9	1.1	1.0	1.2	0.8	0.8	0.9	1.7	1.3	1.2	0.6	0.5	1.5
3	8	2.1	1.5	1.5	1.6	1.5	1.7	3.2	2.2	1.7	2.5	1.2	3.8
4	7	0.6	1.3	1.3	1.0	1.2	0.8	1.4	3.0	1.3	1.7	3.0	1.7
5	6	3.1	2.8	2.7	2.9	2.0	3.0	1.6	3.0	2.9	3.6	2.0	2.5
6	5	3.1	2.2	2.1	2.9	2.9	2.0	3.0	3.0	5.5	3.8	3.5	4.6
7	4	7.0	8.4	8.3	7.2	8.8	6.8	6.6	8.3	9.2	7.6	7.0	8.7
8	3	7.8	8.4	9.4	7.8	7.6	8.2	9.0	10.7	9.6	8.7	9.6	9.6
9	2	27.1	28.8	30.2	30.1	28.0	30.7	25.0	24.5	28.6	25.1	23.9	24.7
10	1	18.9	16.9	15.9	19.6	19.4	19.3	18.2	17.6	17.5	16.3	14.9	14.8
Orthophoria													
11	0	17.5	16.5	17.2	16.4	16.1	16.2	14.8	14.7	13.0	17.1	15.4	14.2
Exophoria													
12	1	4.9	5.7	4.9	3.8	5.0	3.9	7.6	4.3	3.4	3.6	5.6	4.6
13	2	2.8	2.0	1.8	2.0	2.0	2.3	1.2	1.8	2.4	2.5	3.2	0.8
14	3	0.4	0.8	0.5	0.7	0.3	0.8	0.3	0.2	1.0	0.8	1.6	0.7
15	4	0.3	0.5	0.3	0.6	0.8	0.2	1.2	0.4	0.2	0.7	0.5	1.4
16	5	0.1	0.2	0.1	-	0.3	0.4	-	-	-	-	0.3	-
17	6	0.5	-	0.1	-	0.1	-	0.3	0.6	-	-	0.4	1.1
18	7	0.1	-	-	-	0.1	0.2	0.4	0.2	-	-	-	-
19	8	-	-	0.2	0.2	0.2	0.3	-	1.1	-	0.3	-	-
20	9	0.2	-	-	0.1	0.1	0.3	-	-	-	-	0.3	0.8
21	10	-	0.3	0.1	-	0.7	-	0.3	-	0.8	-	-	0.4
22	11+	0.3	0.1	0.5	0.2	0.3	0.2	0.3	0.5	0.3	0.8	1.5	1.1

Table 2. Percent distribution of youths by degree of near lateral phoria for all youths without correction and for youths, who wore glasses, with their own glasses, by age: United States, 1966-70

Phoria scale	(Δ) Prism diopters of deviation	All youths without correction						Youths with own glasses					
		12 years	13 years	14 years	15 years	16 years	17 years	12 years	13 years	14 years	15 years	16 years	17 years
		Percent distribution											
Total		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Esophoria													
0	13+	1.1	1.4	0.7	1.2	1.1	0.7	1.7	2.7	0.5	1.2	2.5	2.5
1	12	0.5	0.3	0.2	0.3	0.3	0.5	2.8	2.1	3.8	2.8	6.2	3.4
2	11	0.6	0.7	0.4	0.1	0.4	0.4	4.1	2.9	1.5	2.6	1.7	2.8
3	10	0.7	0.3	0.5	0.6	0.4	0.2	3.2	3.0	2.8	2.5	1.9	4.1
4	9	0.1	0.1	0.2	0.1	0.5	0.2	0.3	1.6	1.5	2.0	1.7	0.6
5	8	0.7	0.5	0.8	0.2	0.3	1.0	2.6	2.8	5.8	6.1	2.0	3.5
6	7	0.5	0.1	0.7	0.1	0.3	0.5	3.2	1.5	5.5	3.6	1.6	3.7
7	6	1.7	2.2	1.5	1.3	1.3	0.8	5.2	5.9	6.5	3.8	6.1	3.8
8	5	1.1	0.7	1.1	1.1	1.4	1.1	2.5	5.6	5.0	2.3	4.2	3.7
9	4	2.6	3.4	3.4	3.0	2.4	3.0	9.1	4.0	6.7	3.4	7.6	6.8
10	3	2.3	2.8	3.3	2.1	2.6	2.9	5.0	3.6	4.7	5.4	6.0	7.5
11	2	7.8	6.2	6.5	8.2	6.0	6.9	7.9	9.8	6.6	9.3	7.7	8.0
12	1	7.6	5.3	4.8	7.0	5.8	6.0	4.0	3.9	6.2	6.6	7.3	6.5
Orthophoria													
13	0	12.2	11.5	12.6	12.2	11.6	11.7	10.8	11.8	11.1	13.4	8.0	7.9
Exophoria													
14	1	6.3	7.1	6.5	5.8	7.4	6.1	3.8	8.4	4.7	5.8	2.8	4.7
15	2	13.0	11.7	11.1	11.5	10.3	10.6	7.2	6.2	5.1	6.4	6.5	4.5
16	3	4.9	7.6	6.3	6.4	4.5	6.1	5.9	3.6	3.4	3.3	3.4	3.2
17	4	9.8	8.9	9.2	8.5	9.2	9.8	6.2	5.1	5.2	6.8	4.0	5.1
18	5	3.1	3.7	3.8	3.6	4.8	4.0	1.8	2.4	2.4	1.0	3.2	3.3
19	6	6.6	5.5	7.0	6.7	7.3	5.1	3.6	5.3	4.4	3.9	3.0	3.9
20	7	2.2	2.5	1.9	2.8	2.7	2.7	1.4	1.6	1.6	1.2	3.2	2.0
21	8	4.1	5.2	4.2	4.3	2.9	4.7	2.6	1.5	2.8	2.7	2.9	2.1
22	9	1.5	1.7	1.2	2.2	2.1	1.7	1.2	0.4	-	0.9	1.9	0.7
23	10	3.0	2.3	3.7	2.6	2.7	3.1	0.8	0.9	0.9	0.6	1.1	2.0
24	11	1.0	1.3	1.2	0.5	0.9	1.8	1.0	0.7	-	0.3	0.2	0.3
25	12	1.1	2.2	1.9	1.6	2.3	1.4	0.3	1.1	0.2	0.5	1.5	0.7
26	13	0.5	0.6	0.7	0.5	1.4	0.6	-	-	-	-	-	1.1
27	14	0.8	1.1	1.1	1.3	1.4	1.7	0.8	0.9	-	0.5	-	-
28	15	0.7	0.4	0.9	0.9	0.9	0.7	-	-	0.5	0.3	0.3	-
29	16	0.8	1.3	1.7	1.5	2.4	1.7	-	0.2	0.3	-	1.0	0.8
30	17	0.5	0.2	0.3	0.6	0.8	0.9	0.3	0.5	0.3	0.3	0.2	-
31	18	0.3	0.6	0.3	0.7	0.8	0.3	0.3	-	-	0.2	-	-
32	19	0.1	-	-	0.1	-	0.1	-	-	-	-	-	-
33	20	-	-	-	-	-	-	-	-	-	-	-	-
34	21+	0.2	0.6	0.3	0.4	0.8	1.0	0.4	-	-	0.3	0.3	0.8

Table 3. Percent and number of youths with significant distance and near heterophoria for all youths without correction and for youths, who wore glasses, with their own glasses, by age and sex, showing standard errors for total percentages: United States, 1966-70

Age and sex	Lateral phoria—distance						Lateral phoria—near					
	Without correction			With own glasses			Without correction			With own glasses		
	Esophoria (5^{Δ}+)	Normal (0-4^{Δ})	Exophoria (5^{Δ}+)	Esophoria (5^{Δ}+)	Normal (0-4^{Δ})	Exophoria (5^{Δ}+)	Esophoria (6^{Δ}+)	Normal 5^{Δ} left 9^{Δ} right	Exophoria (10^{Δ}+)	Esophoria (6^{Δ}+)	Normal 5^{Δ} left 9^{Δ} right	Exophoria (10^{Δ}+)
Both sexes	Percent of youths											
Total, 12-17 years ..	11.0	88.0	1.0	15.6	82.4	2.0	4.9	83.5	11.6	24.4	71.6	4.0
12 years	12.2	86.7	1.1	14.8	83.9	1.3	5.8	85.1	9.1	23.0	73.1	3.9
13 years	11.5	88.0	0.5	15.2	82.3	2.5	5.8	83.6	10.6	22.5	73.1	4.4
14 years	10.5	88.5	1.0	14.0	84.9	1.1	5.0	82.8	12.2	27.9	69.8	2.3
15 years	11.4	88.2	0.4	16.4	82.5	1.1	3.8	85.5	10.7	24.6	72.4	3.0
16 years	10.1	88.2	1.7	15.9	81.6	2.5	4.5	81.2	14.3	23.8	71.7	4.5
17 years	10.3	88.3	1.4	17.0	79.6	3.4	4.3	82.5	13.2	24.5	69.8	5.7
Boys												
Total, 12-17 years ..	9.7	89.5	0.8	13.6	85.2	1.2	5.2	83.9	10.9	26.6	69.7	3.7
12 years	10.4	89.2	0.4	11.5	88.5	-	5.6	85.7	8.7	24.5	71.8	3.7
13 years	9.6	90.1	0.3	13.1	85.5	1.4	6.9	85.1	8.0	27.0	70.1	2.9
14 years	10.0	88.7	1.3	13.6	85.0	1.4	5.4	83.9	10.7	31.2	65.9	2.9
15 years	11.6	87.9	0.5	13.7	84.5	1.8	3.6	83.4	13.0	24.6	70.6	4.8
16 years	8.4	90.3	1.3	17.0	82.6	0.4	4.2	82.3	13.5	29.8	66.7	3.5
17 years	7.9	90.9	1.2	12.5	85.3	2.2	5.2	82.9	11.9	23.0	72.6	4.4
Girls												
Total, 12-17 years ..	12.5	86.3	1.2	17.0	80.4	2.6	4.6	83.0	12.4	22.9	72.9	4.2
12 years	14.0	84.2	1.8	17.7	79.8	2.5	6.1	84.4	9.5	21.8	74.1	4.1
13 years	13.6	85.6	0.8	16.4	80.5	3.1	4.6	82.2	13.2	19.8	75.0	5.2
14 years	11.1	88.3	0.6	14.3	84.8	0.9	4.6	81.7	13.7	25.9	72.2	1.9
15 years	11.2	88.4	0.4	18.7	80.7	0.6	4.1	87.5	8.4	24.6	73.9	1.5
16 years	11.9	85.9	2.2	15.1	81.0	3.9	4.8	80.0	15.2	19.6	75.1	5.3
17 years	12.9	85.5	1.6	20.0	75.8	4.2	3.4	82.0	14.6	25.4	68.0	6.6
	Standard error											
Both sexes	0.52	0.52	0.15	0.79	0.86	0.48	0.26	0.64	0.66	1.52	1.36	0.44
Boys	0.57	0.57	0.12	1.38	1.48	0.49	0.31	0.66	0.57	1.95	1.83	0.57
Girls	0.64	0.68	0.27	0.76	0.98	0.62	0.49	1.10	1.07	1.49	1.40	0.69
Both sexes	Number in thousands											
Total, 12-17 years ..	2,175	17,329	198	980	5,163	126	1,605	18,132	2,523	1,540	4,520	253
12 years	436	3,115	39	141	796	12	227	3,304	354	220	698	37
13 years	405	3,090	19	149	806	24	220	3,187	402	221	718	43
14 years	348	2,917	31	138	833	11	183	3,031	447	281	702	23
15 years	371	2,883	15	173	865	11	137	3,076	386	259	761	31
16 years	308	2,691	53	185	954	29	154	2,785	492	279	839	53
17 years	307	2,633	41	195	909	39	144	2,750	442	281	801	66
Boys												
Total, 12-17 years ..	992	9,140	83	352	2,200	31	573	9,268	1,201	689	1,807	97
12 years	193	1,652	8	51	393	-	111	1,711	174	109	320	16
13 years	178	1,661	6	47	309	5	135	1,657	156	97	253	11
14 years	172	1,518	22	51	316	5	100	1,536	197	120	254	11
15 years	193	1,471	8	64	395	8	65	1,520	236	114	328	22
16 years	134	1,434	21	83	403	2	74	1,443	237	145	326	17
17 years	122	1,406	18	56	384	10	89	1,400	202	103	325	19
Girls												
Total, 12-17 years ..	1,183	8,189	115	627	2,964	96	492	8,864	1,322	851	2,713	156
12 years	243	1,463	31	90	404	12	116	1,592	180	111	378	21
13 years	227	1,430	13	101	498	19	85	1,530	246	123	465	32
14 years	177	1,400	9	87	516	5	83	1,496	250	161	448	12
15 years	178	1,413	6	109	470	3	73	1,555	150	144	433	9
16 years	174	1,257	32	102	550	27	80	1,342	255	134	513	36
17 years	185	1,227	23	138	526	29	56	1,350	240	178	476	46

Table 4. Percent and number of youths 12-17 years of age who wore glasses by direction and severity of distance heterophoria with and without their own glasses, and with standard errors for selected percentages: United States, 1966-70

Direction of phoria with own glasses	Total	Direction of phoria without own glasses				
		Esophoria		Orthophoria	Exophoria	
		11Δ+	5-10Δ	≤4Δ	5-10Δ	11Δ+
	Percent of youths					
Total	100.0	3.3	14.6	80.3	1.2	0.6
Esophoria:						
11Δ+	2.1	1.9	0.1	-	-	0.1
5-10Δ	12.5	0.3	6.4	5.7	0.1	-
Orthophoria:						
≤4Δ	83.9	1.1	8.0	74.0	0.7	0.1
Exophoria:						
5-10Δ	0.8	-	-	0.4	0.3	0.1
11Δ+	0.7	-	0.1	0.2	0.1	0.3
	Standard error					
Total	---	0.65	1.02	1.10	0.30	0.24
	Number of youths in thousands					
Total	3,702	662		2,971	68	
Esophoria (5Δ+)	540	321		209	9	
Orthophoria (≤4Δ)	3,106	337		2,739	31	
Exophoria (5Δ+)	56	4		23	29	

Table 5. Percent and number of youths 12-17 years of age who wore glasses by direction and severity of near heterophoria with and without their own glasses with standard errors for selected percentages: United States, 1966-70

Direction of phoria with own glasses	Total	Direction of phoria without own glasses				
		Esophoria		Orthophoria	Exophoria	
		$13^{\Delta}+$	$6\text{-}12^{\Delta}$	$5^{\Delta}E\text{-}9^{\Delta}X$	$10\text{-}20^{\Delta}$	$21^{\Delta}+$
	Percent of youths					
Total	100.0	2.0	3.6	60.2	32.9	1.3
Esophoria:						
$13^{\Delta}+$	1.8	0.9	0.2	0.3	0.3	0.1
$6\text{-}12^{\Delta}$	22.1	0.7	1.8	13.6	5.8	0.2
Orthophoria:						
$5^{\Delta}E\text{-}9^{\Delta}X$	72.4	0.4	1.6	45.8	24.1	0.5
Exophoria:						
$10\text{-}20^{\Delta}$	3.5	-	-	0.5	2.7	0.3
$21^{\Delta}+$	0.2	-	-	-	-	0.2
	Standard error					
Total	---	0.39	0.42	1.30	1.42	0.24
	Number of youths in thousands					
Total	5,599	314		3,369	1,916	
Esophoria	1,339	204		776	359	
Orthophoria	4,053	110		2,564	1,379	
Exophoria	207	-		29	178	

Table 6. Percent distribution of the lenses in the glasses or contact lenses of youths by the spherical power of the lens for each eye and at each year of age for youths, with selected standard errors: United States, 1966-70

Spherical power of lens as recorded in diopters (D)	Monocular tests							12-17 years		Standard error	
	12-17 years	12 years	13 years	14 years	15 years	16 years	17 years	Right eye	Left eye	Right eye	Left eye
	Percent distribution of lenses tested									Percent	
Total tested	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	---	---
Minus											
5.1 D or more	6.4	5.1	4.6	8.1	5.3	7.7	7.9	6.6	6.3	0.67	0.70
4.1-5.0 D	5.8	2.6	6.4	7.6	4.7	7.8	5.8	5.8	5.9	0.70	0.71
3.1-4.0 D	9.4	5.2	7.5	14.1	7.8	11.4	10.0	9.7	9.3	0.68	0.67
2.1-3.0 D	16.7	13.7	16.9	13.5	18.9	17.9	17.7	16.9	16.3	0.98	0.97
1.6-2.0 D	11.2	11.8	10.2	12.1	10.5	13.1	9.4	11.2	11.3	0.92	0.92
1.1-1.5 D	11.7	10.6	13.5	10.3	12.0	9.6	13.3	11.4	11.8	0.75	0.80
0.6-1.0 D	10.6	10.3	11.6	11.1	12.9	7.4	10.8	11.0	10.3	0.62	0.72
0.1-0.5 D	8.4	9.6	7.4	8.5	8.2	7.0	9.6	7.9	8.9	0.84	0.66
0.0 D	4.0	4.2	3.6	2.4	5.5	5.2	3.0	3.7	4.2	0.49	0.48
Plus											
0.1-0.5 D	6.3	11.8	7.1	5.2	5.0	4.4	5.3	6.7	5.9	0.67	0.71
0.6-1.0 D	3.0	5.1	2.6	2.2	3.2	3.4	1.6	2.7	3.3	0.47	0.46
1.1-2.0 D	2.8	3.8	4.2	0.7	2.2	1.9	3.6	2.7	2.8	0.26	0.27
2.1 D or more	3.7	6.2	4.4	4.2	3.8	3.2	2.0	3.7	3.7	0.49	0.49

Table 7. Percent distribution of the lenses in the glasses or contact lenses of youths by the cylindrical power of the lens for each eye and at each year of age for youths, with selected standard errors: United States, 1966-70

Cylindrical power of lens as recorded in diopters (D)	Monocular tests							12-17 years		Standard error	
	12-17 years	12 years	13 years	14 years	15 years	16 years	17 years	Right eye	Left eye	Right eye	Left eye
	Percent distribution of lenses tested									Percent	
Total tested	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	---	---
Minus											
5.1 D or more	6.6	4.8	4.6	7.0	6.8	6.9	8.8	6.4	6.7	0.70	0.72
4.1-5.0 D	6.0	2.0	5.6	8.2	4.9	8.3	5.9	6.7	5.2	0.67	0.62
3.1-4.0 D	10.4	7.0	8.4	14.5	8.4	13.8	10.0	10.2	10.6	0.92	1.01
2.1-3.0 D	15.6	12.7	16.5	12.6	16.8	17.4	16.7	15.0	16.3	1.02	1.04
1.6-2.0 D	10.6	10.6	10.0	12.6	12.7	10.0	8.2	11.1	10.1	0.98	0.77
1.1-1.5 D	11.8	12.1	14.7	11.8	9.3	9.6	13.5	11.4	12.2	0.84	0.91
0.6-1.0 D	11.6	12.4	12.8	10.0	14.0	9.8	10.8	12.0	11.2	0.52	0.75
0.1-0.5 D	10.4	11.0	9.6	10.3	9.2	10.4	11.3	10.2	10.5	0.92	1.01
0.0 D	3.2	4.8	3.2	3.3	3.4	2.6	2.6	2.9	3.6	0.46	0.56
Plus											
0.1-0.5 D	5.8	10.8	6.2	4.0	6.1	4.2	4.6	6.2	5.5	0.57	0.69
0.6-1.0 D	2.8	3.9	2.4	2.2	3.4	2.6	2.7	2.8	2.9	0.52	0.40
1.1-2.0 D	2.2	3.8	3.2	0.6	1.2	1.6	2.9	2.3	2.2	0.45	0.42
2.1 D or more	3.0	4.1	2.8	2.9	3.8	2.8	2.0	2.8	3.0	0.46	0.50

Table 8. Percent distribution of the lenses in the glasses or contact lenses of youths by the degree of axis deviation of the cylinder in the lenses for each eye and at each year of age of youths, with standard errors: United States, 1966-70

Axis deviation in degrees	Monocular tests							12-17 years	
	12-17 years	12 years	13 years	14 years	15 years	16 years	17 years	Right eye	Left eye
	Percent distribution of lenses tested								
Total tested	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
None	43.0	42.6	42.7	43.2	44.1	41.8	44.1	42.2	43.9
1°-45°	19.4	20.1	22.7	16.8	18.6	19.1	19.0	20.8	17.9
46°-90°	4.8	4.2	5.2	2.8	6.4	4.8	5.2	4.2	5.4
91°-135°	6.2	6.1	4.0	6.8	5.2	6.8	8.0	7.0	5.5
136°-180°	26.6	27.0	25.4	30.4	25.7	27.5	23.7	25.8	27.3
	Standard error in percent								
None	2.40	4.02	4.06	3.38	3.04	3.00	3.77	2.36	2.44
1°-45°	1.08	2.64	2.05	1.92	2.04	2.48	2.32	1.46	0.69
46°-90°	0.84	1.10	1.16	1.15	1.30	1.62	1.26	0.73	0.94
91°-135°	1.12	1.72	1.34	1.64	1.42	1.70	1.73	1.28	0.96
136°-180°	2.20	4.11	3.58	3.46	3.32	3.10	2.41	2.32	2.09

Table 9. Percent of lenses in the glasses or contact lenses of youths 12-17 years of age by spherical and cylindrical power of lens: United States, 1966-70

Spherical power of lens as recorded in diopters (D)	All lenses	Cylindrical power of lens (D)												
		Minus									Plus			
		5.1 D or more	4.1-5.0 D	3.1-4.0 D	2.1-3.0 D	1.6-2.0 D	1.1-1.5 D	0.6-1.0 D	0.1-0.5 D	0.0 D	0.1-0.5 D	0.6-1.0 D	1.1-2.0 D	2.1 D or more
	Percent of lenses tested													
All lenses	100.0	6.5	6.0	10.4	15.5	10.5	11.8	11.9	10.5	3.2	5.8	2.7	2.3	2.9
Minus														
5.1 D or more	6.5	5.4	1.0	0.1	0.0	-	-	-	-	-	-	-	-	-
4.1-5.0 D	5.9	0.8	3.7	1.4	-	-	-	-	-	-	-	-	-	-
3.1-4.0 D	9.3	0.0	1.0	6.7	1.4	0.2	-	-	0.0	-	-	-	-	-
2.1-3.0 D	16.7	0.1	0.2	1.9	11.8	1.8	0.6	0.2	-	0.1	-	0.0	0.0	0.0
1.6-2.0 D	11.0	0.1	0.0	0.3	1.4	6.5	2.3	0.4	0.0	0.0	0.0	0.0	-	0.0
1.1-1.5 D	11.5	0.1	0.1	0.0	0.2	1.3	7.0	2.0	0.7	0.0	0.0	-	0.1	-
0.6-1.0 D	10.6	0.0	-	0.0	0.2	0.3	1.2	6.9	1.5	0.2	0.2	0.0	0.1	0.0
0.1-0.5 D	8.4	-	-	0.0	0.2	0.0	0.3	1.2	5.4	0.6	0.5	0.1	0.1	-
0.0 D	4.0	-	-	0.0	0.0	0.3	0.1	0.5	1.3	0.9	0.6	0.2	0.1	0.0
Plus														
0.1-0.5 D	6.3	-	-	-	0.2	0.0	0.1	0.2	1.0	0.8	3.2	0.6	0.2	0.0
0.6-1.0 D	3.2	-	-	0.0	0.1	0.1	-	0.1	0.2	0.4	1.0	1.2	0.1	0.0
1.1-2.0 D	2.9	-	-	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.5	1.0	0.4
2.1 D or more	3.7	0.0	-	0.0	-	0.0	0.0	0.2	0.2	0.0	0.1	0.1	0.6	2.5

Table 10. Percent distribution of lenses in the glasses and contact lenses of youths by the power of the lens for each eye and at each year of age for youths, with selected standard errors: United States, 1966-70

Power[1] of lens in diopters (D)	Monocular tests							12-17 years		Standard error	
	12-17 years	12 years	13 years	14 years	15 years	16 years	17 years	Right eye	Left eye	Right eye	Left eye
	Percent distribution of lenses tested									Percent	
Total tested	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	---	---
Minus											
7.6 D or more	15.0	8.8	12.2	18.7	13.1	19.6	15.9	15.2	14.8	0.70	0.72
5.1-7.5 D	15.1	10.2	13.0	17.5	12.9	18.2	18.5	15.2	15.1	0.72	0.73
4.1-5.0 D	8.3	7.1	9.5	8.2	10.6	8.2	6.3	8.1	8.5	0.60	0.60
3.1-4.0 D	11.3	11.8	11.0	11.8	13.2	11.9	8.3	12.0	10.6	0.65	0.66
2.1-3.0 D	12.0	11.7	15.4	10.2	10.1	9.0	16.0	11.6	12.3	0.66	0.65
1.6-2.0 D	6.4	7.7	6.6	6.2	8.0	4.8	5.6	6.3	6.6	0.58	0.65
1.1-1.5 D	4.6	4.0	5.4	4.9	5.8	4.0	4.0	4.9	4.4	0.54	0.53
0.6-1.0 D	6.3	8.0	4.2	6.8	5.0	6.2	7.4	6.0	6.6	0.69	0.49
0.1-0.5 D	3.5	2.3	3.8	2.2	3.3	4.2	4.6	3.3	3.7	0.42	0.65
0.0 D	2.1	4.4	1.7	1.8	1.9	1.7	1.2	2.2	2.0	0.51	0.29
Plus											
0.1-0.5 D	2.9	2.7	3.7	3.0	3.5	2.3	2.3	2.8	3.0	0.45	0.47
0.6-1.0 D	3.7	7.7	3.7	2.3	4.0	1.8	3.2	3.9	3.5	0.62	0.53
1.1-2.0 D	3.4	5.9	3.9	2.5	2.9	3.6	2.2	3.3	3.5	0.46	0.45
2.1 D or more	5.4	7.7	5.9	3.9	5.7	4.5	4.5	5.2	5.4	0.53	0.52

[1] Algebraic sum of spherical and cylindrical power in lens.

Table 11. Percent distribution of lenses in the glasses and contact lenses of youths by the spherical equivalence of the lens for each eye and at each year of age for youths, with selected standard errors: United States, 1966-70

Spherical equivalence of lens[1] in diopters (D)	Monocular tests							12-17 years		Standard error	
	12-17 years	12 years	13 years	14 years	15 years	16 years	17 years	Right eye	Left eye	Right eye	Left eye
	Percent distribution of lenses tested									Percent	
Total tested	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	---	---
Minus											
10.1 D or more	2.0	2.5	1.1	1.8	1.8	1.9	2.7	2.1	1.9	0.37	0.20
7.6-10.0 D	5.0	2.7	3.6	6.3	4.4	6.0	6.0	4.9	5.0	0.51	0.50
5.1-7.5 D	13.0	6.2	11.9	18.4	10.4	17.1	12.4	12.8	12.9	0.76	0.77
4.1-5.0 D	9.0	5.6	6.8	9.2	9.0	11.2	11.7	9.4	8.7	0.57	0.72
3.1-4.0 D	10.4	10.7	12.2	8.5	12.1	10.6	8.5	10.3	10.6	0.58	0.59
2.1-3.0 D	15.5	15.1	16.1	16.8	15.6	15.0	14.6	15.6	15.4	0.82	0.81
1.6-2.0 D	7.8	7.2	10.0	5.2	7.3	6.2	10.8	8.0	7.7	0.64	0.77
1.1-1.5 D	8.6	8.4	8.8	9.2	11.1	7.0	7.6	9.0	8.3	0.56	0.70
0.6-1.0 D	7.4	10.7	6.0	7.9	7.6	5.2	7.4	6.9	7.9	0.69	0.66
0.1-0.5 D	4.0	3.0	4.0	3.0	3.2	5.2	5.2	3.7	4.4	0.48	0.62
0.0 D	1.2	1.4	1.4	1.2	1.4	1.6	0.7	1.1	1.4	0.32	0.21
Plus											
0.1-0.5 D	3.8	5.4	3.6	3.2	4.6	2.7	3.5	4.0	3.5	0.48	0.57
0.6-1.0 D	4.2	8.6	5.0	2.8	3.7	2.9	2.8	4.2	4.1	0.52	0.50
1.1-1.5 D	2.1	3.7	2.4	1.4	2.0	2.6	0.7	2.2	2.0	0.38	0.38
1.6-2.0 D	1.1	1.4	1.8	0.2	0.7	1.0	1.8	1.0	1.2	0.30	0.21
2.1 D or more	4.9	7.4	5.3	4.9	5.1	3.8	3.6	4.8	5.0	0.63	0.65

[1] Algebraic sum of spherical and one-half of cylindrical power in lens.

Table 12. Percent of youths with uncorrected monocular acuity below 20/20 reaching the 20/20 level with the trial lens test by the strength of the trial lens required for each eye and for both eyes by the age and sex of the youths: United States, 1966-70

Eye tested, age, and sex	Percent of youths with uncorrected acuity less than 20/20	Proportion reaching 20/20 of all youths given trial lens test	Maximum strength of trial lens used						
			0 D	1 D	1.5 D	2 D	3 D	4 D	5 D
One or both eyes			Percent reaching 20/20 with trial lens						
Both sexes, 12-17 years	43.4	61.4	8.6	86.8	79.4	75.0	78.9	71.1	26.6
12 years	43.8	60.4	7.5	87.6	78.2	80.1	74.1	60.0	32.8
13 years	44.2	62.2	6.4	86.5	74.5	77.4	82.8	75.0	29.2
14 years	41.6	60.9	8.8	88.2	75.7	62.4	82.7	74.6	27.4
15 years	43.9	61.4	10.6	84.6	82.6	80.4	77.0	63.8	22.6
16 years	43.6	62.1	9.2	86.8	82.0	74.2	79.2	76.0	28.7
17 years	43.2	61.6	10.6	87.0	83.7	73.4	77.4	76.4	19.8
Boys, 12-17 years	38.6	62.2	6.6	86.3	81.9	76.1	82.9	71.3	28.2
12 years	39.3	62.4	4.0	87.5	75.6	76.8	79.0	67.0	37.1
13 years	38.8	64.7	6.8	87.2	74.3	79.8	82.0	72.5	36.2
14 years	36.7	58.8	12.2	83.6	80.3	75.2	96.6	74.3	25.2
15 years	41.4	62.0	4.6	85.3	83.4	78.0	81.9	68.9	28.8
16 years	40.0	64.4	6.6	87.2	85.0	76.0	82.5	75.4	33.2
17 years	36.2	60.6	6.0	86.2	97.2	70.5	78.0	69.1	17.8
Girls, 12-17 years	48.2	60.7	10.2	87.2	77.3	74.0	76.1	70.9	25.4
12 years	48.5	58.6	10.0	87.8	81.0	85.8	70.6	52.1	29.8
13 years	49.8	60.2	6.0	85.8	74.5	77.8	56.6	74.8	25.2
14 years	46.8	62.4	4.9	92.3	71.0	54.4	76.7	74.9	30.0
15 years	46.6	61.0	15.9	83.6	83.4	84.2	72.4	53.3	17.0
16 years	47.2	60.1	11.8	86.4	79.0	71.6	76.3	76.3	26.2
17 years	50.2	62.4	14.0	87.6	75.3	75.4	76.6	81.3	21.4
Both sexes, 12-17 years									
Right eye	42.4	62.5	7.4	86.6	80.3	76.4	80.5	72.7	26.4
Left eye	44.3	60.3	9.9	86.9	78.6	73.6	77.3	69.5	26.8
Both sexes, 12-17 years			Percent of tests with trial lens						
One or both eyes	---	100.0	19.6	34.0	9.6	9.2	10.1	6.9	10.6
Right eye	---	100.0	18.2	35.0	9.5	9.8	9.4	7.3	10.8
Left eye	---	100.0	21.0	33.0	9.6	8.5	10.8	6.5	10.5

Table 13. Percent of youths 12-17 years of age given trial lens test without glasses by strength of trial lens used and maximum acuity reached on trial lens test, for each eye and for one or both eyes: United States, 1966-70

Test and trial lens power in diopters (D)	Total youths with uncorrected acuity less than 20/20	Acuity level reached with trial lens									
		20/20 or better	20/25	20/30	20/40	20/50	20/70	20/100	20/200	20/400	Less than 20/400
One or both eyes	Percent										
Total	100.0	61.4	16.1	5.6	5.4	3.0	3.1	1.4	2.5	1.1	0.4
0 D	19.7	1.7	7.4	2.3	3.0	1.2	1.4	0.6	1.2	0.6	0.3
1 D	34.0	29.5	2.9	0.9	0.4	0.1	0.2	0.0	0.0	-	-
1.5 D	9.6	7.6	1.0	0.4	0.4	0.1	0.1	0.0	0.0	0.0	-
2 D	9.0	6.9	1.0	0.6	0.2	0.2	0.0	0.0	0.1	0.0	-
3 D	10.0	8.0	1.2	0.4	0.2	0.2	0.0	0.0	0.0	-	-
4 D	7.0	4.9	0.9	0.2	0.2	0.2	0.2	0.1	0.2	0.1	-
5 D	10.7	2.8	1.7	0.8	1.0	1.0	1.2	0.7	1.0	0.4	0.1
Right eye											
Total	100.0	62.5	16.0	4.6	4.9	3.2	3.2	1.4	2.7	1.1	0.4
0 D	18.2	1.3	7.1	1.9	2.6	1.2	1.4	0.6	1.3	0.5	0.3
1 D	35.0	30.4	3.1	0.8	0.3	0.1	0.3	-	0.0	-	-
1.5 D	9.5	7.6	1.0	0.3	0.3	0.2	0.1	0.0	-	-	-
2 D	9.8	7.5	1.1	0.5	0.3	0.2	0.0	0.0	0.1	0.1	-
3 D	9.4	7.6	1.2	0.2	0.2	0.2	-	0.0	-	-	-
4 D	7.3	5.3	0.7	0.2	0.2	0.2	0.2	0.2	0.2	0.1	-
5 D	10.8	2.8	1.8	0.7	1.0	1.1	1.2	0.6	1.1	0.4	0.1
Left eye											
Total	100.0	60.3	15.9	6.4	6.2	2.8	3.1	1.6	2.1	1.1	0.5
0 D	21.1	2.1	7.6	2.7	3.5	1.2	1.3	0.7	1.0	0.6	0.4
1 D	33.0	28.7	2.5	1.0	0.4	0.1	0.2	0.1	-	-	-
1.5 D	9.7	7.6	0.9	0.5	0.5	0.0	0.1	-	0.0	0.1	-
2 D	8.4	6.3	1.0	0.6	0.2	0.1	0.1	0.0	0.1	-	-
3 D	10.7	8.3	1.2	0.6	0.3	0.2	0.1	0.0	0.0	-	-
4 D	6.6	4.5	1.1	0.2	0.2	0.2	0.2	-	0.1	0.1	-
5 D	10.5	2.8	1.6	0.8	1.1	1.0	1.1	0.8	0.9	0.3	0.1

Table 14. Percent distribution of youths by maximum monocular acuity on trial lens test (without own glasses) for youth at each acuity level reached with their own glasses: United States, 1966-70

Acuity with own glasses, one or both eyes	Total	Acuity on trial lens test without own glasses									
		20/20	20/25	20/30	20/40	20/50	20/70	20/100	20/200	20/400	Less than 20/400
	Percent distribution										
Total	100.0	60.3	12.8	5.4	5.6	3.6	4.3	2.4	3.4	1.6	0.6
20/12	100.0	86.4	8.3	0.8	2.0	0.8	0.9	-	0.8	-	-
20/15	100.0	80.3	7.4	3.6	2.0	1.4	1.9	1.6	1.4	0.2	0.2
20/17	100.0	73.9	9.4	3.8	2.9	2.2	3.9	0.8	2.0	0.9	0.2
20/20	100.0	61.7	14.0	5.6	5.6	3.2	3.2	2.7	2.0	1.8	0.2
20/25	100.0	47.5	22.4	7.2	8.0	3.2	4.4	3.3	3.4	0.6	-
20/30	100.0	40.7	16.7	8.5	8.5	9.0	6.0	2.2	5.5	2.4	0.5
20/40	100.0	32.5	11.0	10.6	12.6	8.8	9.7	4.2	8.4	2.2	-
20/50	100.0	41.4	11.8	5.0	11.9	6.6	10.6	2.4	9.2	1.1	-
20/70	100.0	25.9	8.2	6.2	10.2	4.2	14.8	8.8	15.5	3.8	2.4
20/100	100.0	24.2	10.5	9.0	11.0	13.5	7.5	8.5	2.6	9.6	3.6
20/200	100.0	21.9	8.8	10.2	6.5	2.8	9.0	-	19.1	8.7	13.0
20/400	100.0	12.2	-	-	-	-	-	-	19.4	41.2	27.2
Less than 20/400	100.0	-	-	-	-	-	7.7	-	7.2	32.5	52.6

Table 15. Percent of youths 12-17 years of age with acuity level increased to 20/20 in at least one eye and of youths not increased to 20/20 in either eye by strength of trial lens used for maximum acuity in each eye: United States, 1966-70

Left eye: trial lens power in diopters (D)	Number in thousands	Percent of all youths	Total	Right eye: trial lens power in diopters (D)							
				0 D	1 D	1.5 D	2 D	3 D	4 D	5 D	Not tested[1]
Acuity increased to at least 20/20 in one eye with a trial lens:			Percent of youths								
Total	7,719	34.0	100.0	4.3	39.6	10.2	10.2	9.9	7.4	5.1	13.3
0 D			6.0	0.8	2.6	0.6	0.2	-	0.1	0.0	1.7
1 D			38.7	1.8	22.3	2.8	1.5	0.4	0.0	0.1	9.8
1.5 D			11.1	0.3	4.4	3.0	1.8	0.4	0.1	-	1.1
2 D			9.2	0.2	1.2	2.0	3.8	1.3	0.1	0.1	0.5
3 D			12.1	0.3	0.4	0.6	2.5	6.2	1.6	0.4	0.1
4 D			6.8	0.1	0.2	0.0	0.2	1.4	3.8	1.0	0.1
5 D			5.1	-	-	-	0.1	0.0	1.5	3.5	0.0
Not tested[1]			11.0	0.8	8.5	1.2	0.1	0.2	0.2	0.0	---
Less than 20/20 acuity in both eyes with a trial lens:											
Total	2,430	10.7	100.0	39.4	12.0	5.0	6.4	5.6	5.2	26.4	---
0 D			41.8	33.5	4.5	1.1	1.6	0.2	0.1	0.8	---
1 D			10.3	3.2	6.0	0.9	0.1	0.1	-	-	---
1.5 D			4.2	0.7	0.9	1.6	0.7	0.3	-	-	---
2 D			5.7	0.8	0.3	1.2	2.7	0.5	0.1	0.1	---
3 D			5.9	0.3	0.2	0.1	0.6	3.2	1.4	0.1	---
4 D			5.5	0.3	0.1	0.1	0.7	0.9	2.1	1.3	---
5 D			26.6	0.6	-	-	-	0.4	1.5	24.1	---

[1] The acuity in this eye was 20/20 or better and the trial lens test was not performed.

Table 16. Percent of youths 12-17 years of age given trial lens test with their own glasses by strength of trial lens used and maximum acuity reached on trial lens test for each eye and for one or both eyes: United States, 1966-70

Test and trial lens power in diopters (D)	Total youths with corrected acuity less than 20/20	Acuity level reached with trial lens									
		20/20 or better	20/25	20/30	20/40	20/50	20/70	20/100	20/200	20/400	Less than 20/400
	Percent of youths										
One or both eyes											
Total	100.0	57.9	20.8	8.0	6.2	2.2	1.6	0.6	1.2	0.9	0.6
0 D	33.8	0.9	15.0	6.2	4.8	2.1	1.6	0.6	1.2	0.8	0.6
1 D	56.1	48.8	4.6	1.5	1.1	0.1	-	-	-	-	-
1.5 D	6.9	5.6	0.7	0.3	0.3	-	-	-	-	-	-
2 D	2.7	2.3	0.4	0.0	-	-	-	-	-	-	-
3 D	0.4	0.3	0.1	-	-	-	-	-	-	-	-
4 D	-	-	-	-	-	-	-	-	-	-	-
5 D	0.1	-	-	-	-	-	-	-	-	0.1	-
Right eye											
Total	100.0	59.2	20.2	8.1	4.9	2.7	1.4	0.7	0.8	1.4	0.6
0 D	32.7	0.5	14.7	6.5	3.9	2.4	1.4	0.7	0.8	1.2	0.6
1 D	58.8	51.6	4.8	1.5	0.6	0.3	-	-	-	-	-
1.5 D	6.3	5.5	0.3	0.1	0.4	-	-	-	-	-	-
2 D	1.5	1.1	0.4	-	-	-	-	-	-	-	-
3 D	0.5	0.5	-	-	-	-	-	-	-	-	-
4 D	-	-	-	-	-	-	-	-	-	-	-
5 D	0.2	-	-	-	-	-	-	-	-	0.2	-
Left eye											
Total	100.0	56.6	21.3	8.0	7.5	1.8	1.7	0.6	1.5	0.4	0.6
0 D	34.8	1.3	15.2	6.0	5.7	1.8	1.7	0.6	1.5	0.4	0.6
1 D	53.4	45.9	4.4	1.5	1.6	-	-	-	-	-	-
1.5 D	7.5	5.8	1.1	0.4	0.2	-	-	-	-	-	-
2 D	3.9	3.4	0.4	0.1	-	-	-	-	-	-	-
3 D	0.4	0.2	0.2	-	-	-	-	-	-	-	-
4 D	-	-	-	-	-	-	-	-	-	-	-
5 D	-	-	-	-	-	-	-	-	-	-	-

Table 17. Number and percent distribution of trial lens strength for maximum acuity among youths 12-17 years of age (without own glasses) at specified levels of spherical power in youths' own glasses or contact lenses: United States, 1966-70

Sphere power in present glasses (in diopters)	Total	Trial lens strength in diopters (D)—tests without glasses						
		0 D	−1 D	−1.5 D	−2 D	−3 D	−4 D	−5 D
	Number of eyes in thousands							
Total	11,339	1,559	2,276	1,037	1,421	1,774	1,283	1,989
−5.1 D or more	529	75	11	-	9	14	46	374
−4.1 D through −5.0 D	467	20	-	-	6	4	23	414
−3.1 D through −4.0 D	886	16	2	-	8	21	169	670
−2.1 D through −3.0 D	1,404	31	9	12	21	318	631	382
−1.6 D through −2.0 D	2,270	42	63	137	557	1,035	341	95
−1.1 D through −1.5 D	1,487	43	334	346	466	254	38	6
−0.1 D through −1.0 D	1,487	64	725	359	227	88	12	12
0.0 D	2,103	686	1,083	171	101	37	10	15
+0.1 D through +1.0 D	134	108	16	2	5	3	-	-
+1.1 D through +2.0 D	326	263	27	7	21	-	4	4
+2.1 D or more	246	211	6	3	-	-	9	17
	Percent distribution							
Total	100.0	13.7	20.1	9.1	12.5	15.6	11.3	17.5
−5.1 D or more	100.0	14.2	2.1	-	1.7	2.6	8.7	70.7
−4.1 D through −5.0 D	100.0	4.3	-	-	1.3	0.9	4.9	88.6
−3.1 D through −4.0 D	100.0	1.8	0.2	-	0.9	2.4	19.1	75.6
−2.1 D through −3.0 D	100.0	2.2	0.6	0.9	1.5	22.6	44.9	27.3
−1.6 D through −2.0 D	100.0	1.9	2.8	6.0	24.5	45.6	15.0	4.2
−1.1 D through −1.5 D	100.0	2.9	22.5	23.3	31.3	17.1	2.6	0.3
−0.1 D through −1.0 D	100.0	4.3	48.8	24.1	15.3	5.9	0.8	0.8
0.0 D	100.0	32.6	51.5	8.1	4.8	1.8	0.5	0.7
+0.1 D through +1.0 D	100.0	80.7	11.9	1.5	3.7	2.2	-	-
+1.1 D through +2.0 D	100.0	80.8	8.3	2.1	6.4	-	1.2	1.2
+2.1 D or more	100.0	85.8	2.4	1.2	-	-	3.7	6.9

Table 18. Number and percent distribution of trial lens strength for maximum acuity among youths 12-17 years of age (with own glasses) at specified levels of spherical power in youths' own glasses or contact lenses: United States, 1966-70

Sphere power in present glasses (in diopters)	Total	Trial lens strength in diopters (D)—tests with own glasses						
		0 D	−1 D	−1.5 D	−2 D	−3 D	−4 D	−5 D
	Number of eyes in thousands							
Total	2,992	1,022	1,669	202	81	12	-	6
−5.1 D or more	199	103	79	14	3	-	-	-
−4.1 D through −5.0 D	88	32	41	9	6	-	-	-
−3.1 D through −4.0 D	190	43	141	6	-	-	-	-
−2.1 D through −3.0 D	318	61	226	19	12	-	-	-
−1.6 D through −2.0 D	519	132	327	45	9	6	-	-
−1.1 D through −1.5 D	246	54	185	7	-	-	-	-
−0.1 D through −1.0 D	318	76	210	11	19	2	-	-
0.0 D	692	271	353	45	17	-	-	6
+0.1 D through +1.0 D	117	57	33	24	3	-	-	-
+1.1 D through +2.0 D	179	103	54	9	9	4	-	-
+2.1 D or more	126	90	20	13	3	-	-	-
	Percent distribution							
Total	100.0	34.2	55.7	6.8	2.7	0.4	-	0.2
−5.1 D or more	100.0	51.8	39.7	7.0	1.5	-	-	-
−4.1 D through −5.0 D	100.0	36.4	46.6	10.2	6.8	-	-	-
−3.1 D through −4.0 D	100.0	22.6	74.2	3.2	-	-	-	-
−2.1 D through −3.0 D	100.0	19.2	71.0	6.0	3.8	-	-	-
−1.6 D through −2.0 D	100.0	25.4	63.0	8.7	1.7	1.2	-	-
−1.1 D through −1.5 D	100.0	22.0	75.2	2.8	-	-	-	-
−0.1 D through −1.0 D	100.0	23.9	66.0	3.5	6.0	0.6	-	-
0.0 D	100.0	39.1	51.0	6.5	2.5	-	-	0.9
+0.1 D through +1.0 D	100.0	48.7	28.2	20.5	2.6	-	-	-
+1.1 D through +2.0 D	100.0	57.6	30.2	5.0	5.0	2.2	-	-
+2.1 D or more	100.0	71.4	15.9	10.3	2.4	-	-	-

Table 19. Number and percent distribution of trial lens strength for maximum acuity among youths 12-17 years of age (without own glasses) at specified levels of spherical equivalence in youths' own glasses or contact lenses: United States, 1966-70

Sphere equivalence in present glasses (in diopters)	Total	Trial lens strength in diopters (D)—tests without glasses						
		0 D	−1 D	−1.5 D	−2 D	−3 D	−4 D	−5 D
	Number of eyes in thousands							
Total	11,090	1,442	2,172	1,029	1,409	1,770	1,279	1,989
−5.1 D or more	1,794	114	13	-	23	33	190	1,422
−4.1 D through −5.0 D	802	17	6	9	13	81	371	305
−3.1 D through −4.0 D	1,166	18	8	10	37	464	467	163
−2.1 D through −3.0 D	1,593	23	35	103	455	753	177	47
−1.6 D through −2.0 D	1,811	42	383	431	578	323	46	9
−1.1 D through −1.5 D	1,248	50	614	297	185	80	9	12
−0.1 D through −1.0 D	615	58	413	81	50	10	3	-
0.0 D	1,326	539	626	82	44	24	3	9
+0.1 D through +1.0 D	145	104	37	4	-	-	-	-
+1.1 D through +2.0 D	237	189	17	9	15	3	-	4
+2.1 D or more	353	288	21	3	11	-	13	18
	Percent distribution							
Total	100.0	13.0	19.6	9.3	12.7	16.0	11.5	17.9
−5.1 D or more	100.0	6.4	0.7	-	1.3	1.8	10.6	79.2
−4.1 D through −5.0 D	100.0	2.1	0.7	1.1	1.6	10.1	46.3	38.1
−3.1 D through −4.0 D	100.0	1.5	0.7	0.9	3.2	39.8	40.0	13.9
−2.1 D through −3.0 D	100.0	1.4	2.2	6.5	28.6	47.2	11.1	3.0
−1.6 D through −2.0 D	100.0	2.3	21.1	23.8	32.0	17.8	2.5	0.5
−1.1 D through −1.5 D	100.0	4.0	49.3	23.8	14.8	6.4	0.7	1.0
−0.1 D through −1.0 D	100.0	9.4	67.2	13.2	8.1	1.6	0.5	-
0.0 D	100.0	40.6	47.2	6.2	3.3	1.8	0.2	0.7
+0.1 D through +1.0 D	100.0	71.7	25.5	2.8	-	-	-	-
+1.1 D through +2.0 D	100.0	79.7	7.2	3.8	6.3	1.3	-	1.7
+2.1 D or more	100.0	81.4	5.9	0.8	3.1	-	3.7	5.1

Table 20. Number and percent distribution of trial lens strength for maximum acuity among youths 12-17 years of age (with own glasses) at specified levels of spherical equivalence in youths' own glasses or contact lenses: United States, 1966-70

Sphere equivalence in present glasses (in diopters)	Total	Trial lens strength in diopters (D)—tests with glasses						
		0 D	−1 D	−1.5 D	−2 D	−3 D	−4 D	−5 D
	Number of eyes in thousands							
Total	2,930	990	1,642	202	81	12	-	3
−5.1 D or more	470	200	231	29	10	-	-	-
−4.1 D through −5.0 D	190	31	143	16	-	-	-	-
−3.1 D through −4.0 D	261	56	185	5	12	3	-	-
−2.1 D through −3.0 D	375	90	242	34	9	-	-	-
−1.6 D through −2.0 D	310	59	232	19	-	-	-	-
−1.1 D through −1.5 D	283	81	179	8	15	-	-	-
−0.1 D through −1.0 D	150	51	80	10	4	5	-	-
0.0 D	482	186	237	38	18	-	-	3
+0.1 D through +1.0 D	70	47	18	5	-	-	-	-
+1.1 D through +2.0 D	159	63	58	23	11	4	-	-
+2.1 D or more	180	126	37	15	2	-	-	-
	Percent distribution							
Total	100.0	33.8	56.0	6.9	2.8	0.4	-	0.1
−5.1 D or more	100.0	42.6	49.1	6.2	2.1	-	-	-
−4.1 D through −5.0 D	100.0	16.3	75.3	8.4	-	-	-	-
−3.1 D through −4.0 D	100.0	21.5	70.8	1.9	4.6	1.2	-	-
−2.1 D through −3.0 D	100.0	24.0	64.5	9.1	2.4	-	-	-
−1.6 D through −2.0 D	100.0	19.0	74.9	6.1	-	-	-	-
−1.1 D through −1.5 D	100.0	28.6	63.3	2.8	5.3	-	-	-
−0.1 D through −1.0 D	100.0	34.0	53.3	6.7	2.7	3.3	-	-
0.0 D	100.0	38.6	49.2	7.9	3.7	-	-	0.6
+0.1 D through +1.0 D	100.0	67.2	25.7	7.1	-	-	-	-
+1.1 D through +2.0 D	100.0	39.6	36.5	14.5	6.9	2.5	-	-
+2.1 D or more	100.0	70.0	20.6	8.3	1.1	-	-	-

Table 21. Percent of youths 12-17 years of age (with uncorrected monocular acuity less than 20/20) reaching specified maximum acuity levels for each eye and one or both eyes on the trial lens test without their glasses by race, region, and annual family income, showing selected standard errors: United States, 1966-70

Race, region, and income	Youths with one or both eye acuity below 20/20	Acuity level reached with trial lens without own glasses									Either eye	
		One or both eyes			Right eye			Left eye				
		20/20 or better	20/25-20/50	20/70 or poorer	20/20 or better	20/25-20/50	20/70 or poorer	20/20 or better	20/25-20/50	20/70 or poorer	20/20 or better	20/70 or poorer
	Percent among youths with uncorrected acuity below 20/20										Standard error	
Youths 12-17 years . .	43.4	61.4	30.0	8.6	62.5	28.7	8.8	60.3	31.3	8.4	1.36	0.65
Race												
White	43.6	62.6	29.0	8.4	64.0	27.4	8.6	61.2	30.6	8.2	1.38	0.66
Negro	41.1	54.4	37.4	8.2	53.9	37.9	8.2	55.0	36.9	8.1	1.56	0.95
Region												
Northeast	45.1	58.0	32.0	10.0	60.8	29.5	9.7	55.2	34.4	10.4	2.68	2.50
Midwest	48.0	66.0	25.7	8.3	66.3	25.6	8.1	65.6	25.9	8.5	1.92	1.42
South	37.8	54.4	35.9	9.7	55.3	34.3	10.4	53.5	37.5	9.0	1.82	0.95
West	42.2	64.8	28.6	6.6	65.3	27.3	7.4	64.2	30.0	5.8	4.04	2.67
Income												
Under $3,000	40.1	57.4	34.7	7.9	58.0	34.4	7.6	56.8	35.0	8.2	1.95	1.17
$3,000-$4,999	44.0	57.6	32.6	9.8	57.1	32.5	10.4	58.1	32.6	9.3	1.68	1.52
$5,000-$6,999	42.5	60.9	30.2	8.9	61.3	29.6	9.1	60.4	30.9	8.7	1.96	1.32
$7,000-$9,999	43.0	64.9	26.6	8.5	67.5	24.1	8.4	62.3	29.1	8.6	1.28	0.80
$10,000-$14,999	48.0	62.4	29.4	8.2	64.3	27.6	8.1	60.6	31.2	8.2	2.01	1.23
$15,000 and over	43.8	65.6	26.6	7.8	65.4	25.9	8.7	65.9	27.2	6.9	2.50	1.36

Table 22. Percent of youths 12-17 years of age reaching specified maximum acuity levels for each eye and one or both eyes on the trial lens test with their own glasses by race, region, and annual family income: United States, 1966-70

Race, region, and income	Youths with one or both eye acuity below 20/20	Acuity level reached with trial lens while wearing own glasses									Either eye	
		One or both eyes			Right eye			Left eye				
		20/20 or better	20/25-20/50	20/70 or poorer	20/20 or better	20/25-20/50	20/70 or poorer	20/20 or better	20/25-20/50	20/70 or poorer	20/20 or better	20/70 or poorer
		Percent among youths with acuity with own glasses below 20/20									Standard error	
Youths 12-17 years . .	31.2	68.8	27.1	4.1	69.9	26.3	3.8	67.8	27.8	4.4	1.63	0.78
Race												
White	30.9	69.2	26.9	3.9	70.2	26.2	3.6	68.2	27.6	4.2	1.66	0.79
Negro	43.8	56.2	36.4	7.4	54.5	39.0	6.5	58.0	33.8	8.2	1.87	11.40
Region												
Northeast	33.2	66.2	29.4	4.4	66.6	29.2	4.2	65.8	29.6	4.6	3.22	3.00
Midwest	21.9	69.2	26.6	4.2	69.2	27.0	3.8	69.1	26.3	4.6	2.30	1.70
South	39.4	59.2	35.0	5.8	59.1	36.1	4.8	59.2	33.9	6.9	2.18	1.14
West	24.8	75.6	22.0	2.4	78.7	18.8	2.5	72.5	25.2	2.3	4.85	3.20
Income												
Under $3,000	39.6	60.0	32.8	7.2	61.4	31.2	7.4	58.6	34.5	6.9	2.34	1.40
$3,000-$4,999	41.2	58.7	36.6	4.7	59.0	36.8	4.2	58.5	36.3	5.2	2.02	1.82
$5,000-$6,999	35.0	64.0	32.0	4.0	66.0	30.2	3.8	61.9	33.9	4.2	2.35	1.58
$7,000-$9,999	28.2	72.1	23.8	4.1	72.6	23.6	3.8	71.7	23.9	4.4	1.54	0.96
$10,000-$14,999	29.3	72.3	23.8	3.9	73.6	23.0	3.4	70.9	24.7	4.4	2.41	1.48
$15,000 and over	28.5	71.6	26.2	2.2	71.6	26.2	2.2	71.5	26.3	2.2	3.00	1.63

Table 23. Percent of youths 12-17 years of age with significant distance heterophoria with and without their own glasses by race, region, and annual family income: United States, 1966-70

Item	Total	Esophoria (5^{Δ}+)	Normal range (0-4^{Δ})	Exophoria (5^{Δ}+)	Esophoria (5^{Δ}+)	Normal range (0-4^{Δ})	Exophoria (5^{Δ}+)
		Percent			Standard error		
Youths: uncorrected distance							
Race:							
White	100.0	11.2	87.7	1.1	0.56	0.54	0.17
Negro	100.0	9.9	89.8	0.3	1.60	1.57	0.17
Other	100.0	17.6	82.4	-	12.14	12.14	-
Region:							
Northeast	100.0	11.6	87.2	1.2	0.91	0.65	0.51
Midwest	100.0	11.5	87.4	1.1	1.71	1.62	0.21
South	100.0	12.5	86.6	0.9	1.00	1.05	0.21
West	100.0	8.6	90.5	0.9	1.11	1.19	0.21
Income:							
Less than $5,000	100.0	12.8	86.2	1.0	1.20	1.21	0.23
$5,000-$9,999	100.0	10.5	88.6	0.9	0.74	0.77	0.20
$10,000 and over	100.0	10.8	88.3	0.9	0.80	0.64	0.26
Unknown	100.0	8.3	89.9	1.8	1.94	1.95	0.60
Youths: corrected distance							
Race:							
White	100.0	15.5	82.4	2.1	0.88	0.96	0.54
Negro	100.0	16.8	82.4	0.8	2.38	2.24	0.76
Other	100.0	17.8	82.2	-	13.54	13.54	-
Region:							
Northeast	100.0	12.5	85.3	2.2	1.74	1.36	1.08
Midwest	100.0	17.3	80.2	2.5	2.15	2.23	1.02
South	100.0	19.0	79.8	1.2	2.24	2.65	0.48
West	100.0	14.1	84.2	1.7	2.02	2.28	0.81
Income:							
Less than $5,000	100.0	17.9	80.7	1.4	2.07	2.11	0.69
$5,000-$9,999	100.0	14.8	83.2	2.0	1.02	1.27	0.70
$10,000 and over	100.0	16.1	81.5	2.4	1.04	1.27	0.85
Unknown	100.0	10.7	88.0	1.3	2.87	2.79	0.97

Table 24. Percent of youths 12-17 years of age with significant near heterophoria with and without their own glasses by race, region, and annual family income: United States, 1966-70

Item	Total	Esophoria (6^{Δ}+)	Normal range 5^{Δ} left-9^{Δ} right	Exophoria (10^{Δ}+)	Esophoria (6^{Δ}+)	Normal range 5^{Δ} left-9^{Δ} right	Exophoria (10^{Δ}+)
Youths: uncorrected near		Percent			Standard error		
Race:							
White	100.0	4.9	82.7	12.4	0.26	0.70	0.76
Negro	100.0	5.3	88.8	5.9	0.81	1.05	0.54
Other	100.0	-	75.7	24.3	-	8.37	8.37
Region:							
Northeast	100.0	5.1	82.2	12.7	0.72	1.81	1.75
Midwest	100.0	4.4	80.9	14.7	0.45	1.19	1.16
South	100.0	5.7	87.2	7.1	0.32	0.84	0.96
West	100.0	4.5	84.1	11.4	0.72	1.41	1.39
Income:							
Less than $5,000	100.0	5.6	86.3	8.1	0.67	1.01	0.83
$5,000-$9,999	100.0	4.8	83.4	11.8	0.37	0.67	0.79
$10,000 and over	100.0	4.8	80.7	14.5	0.49	1.11	1.00
Unknown	100.0	3.3	85.7	11.0	1.07	1.72	1.94
Youths: corrected near							
Race:							
White	100.0	24.5	71.4	4.1	1.60	1.44	0.46
Negro	100.0	25.4	71.4	3.2	3.22	3.45	1.36
Other	100.0	11.1	88.9	-	8.35	8.35	-
Region:							
Northeast	100.0	23.3	71.6	5.1	2.64	1.88	1.12
Midwest	100.0	26.4	68.9	4.7	3.10	2.89	1.10
South	100.0	21.2	75.4	3.4	2.60	2.23	0.63
West	100.0	24.8	72.8	2.4	4.42	4.18	0.51
Income:							
Less than $5,000	100.0	22.7	72.5	4.8	2.47	2.47	0.99
$5,000-$9,999	100.0	25.7	69.8	4.5	1.90	1.80	0.54
$10,000 and over	100.0	23.7	73.2	3.1	1.89	1.90	0.94
Unknown	100.0	24.9	70.8	4.3	4.18	4.41	1.99

Table 25. Percent and number of youths 12-17 years of age by direction of significant distance heterophoria in youths' and children's examination for those examined in both surveys: United States, 1963-70

Direction of phoria among youths 12-17 years	Direction of phoria among children 6-11 years			
	Total	Esophoria	Orthophoria	Exophoria
	Percent			
Total	100.0	11.7	87.6	0.7
Esophoria (5^{Δ}+)	11.5	5.4	6.0	0.1
Orthophoria ($\leq 4^{\Delta}$)	87.3	6.1	80.8	0.4
Exophoria (5^{Δ}+)	1.2	0.2	0.8	0.2
	Standard error			
Total	---	0.69	0.96	0.10
	Number in thousands			
Total	6,103	713	5,348	42
Esophoria (5^{Δ}+)	698	326	369	3
Orthophoria ($\leq 4^{\Delta}$)	5,330	372	4,930	28
Exophoria (5^{Δ}+)	75	15	49	11

Table 26. Percent and number of youths 12-17 years of age by direction of significant near heterophoria in youths' and children's examinations for those examined in both surveys: United States, 1963-70

Direction of phoria among youths 12-17 years	Direction of phoria among children 6-11 years			
	Total	Esophoria	Orthophoria	Exophoria
	Percent			
Total	100.0	5.5	83.3	11.2
Esophoria (6^{Δ}+)	6.5	2.6	3.5	0.4
Orthophoria (5^{Δ}E-9^{Δ}X)	88.0	2.9	77.6	7.5
Exophoria (10^{Δ}+)	5.5	-	2.2	3.3
	Standard error			
Total	---	0.50	0.94	0.69
	Number in thousands			
Total	6,687	366	5,569	752
Esophoria (6^{Δ}+)	431	175	233	24
Orthophoria (5^{Δ}E-9^{Δ}X)	5,886	191	5,192	503
Exophoria (10^{Δ}+)	369	-	145	225

Table 27. Percent and number of youths 12-17 years of age by uncorrected binocular distance acuity in the youths' and children's examinations for those examined in both surveys: United States, 1963-70

Youths (1966-70): acuity	Total	Children (1963-65): acuity												
		20/12	20/15	20/17	20/20	20/25	20/30	20/40	20/50	20/70	20/100	20/200	20/400	20/400+
	Percent													
Total	100.0	3.6	25.2	25.1	21.9	8.0	2.5	3.6	1.5	2.7	2.0	2.6	1.2	0.1
20/12	15.3	2.4	8.5	3.7	0.5	0.2	-	-	-	-	-	-	-	-
20/15	32.7	0.7	11.1	11.8	7.4	1.4	0.1	0.2	-	-	-	0.0	-	-
20/17	13.6	0.2	2.4	4.1	5.3	1.4	0.2	0.0	0.0	0.0	-	0.0	-	-
20/20	9.6	0.0	1.3	2.1	4.0	1.6	0.4	0.2	-	0.0	0.0	-	-	-
20/25	4.9	-	0.5	1.0	1.2	1.0	0.4	0.6	0.1	0.1	-	-	-	-
20/30	2.3	0.1	0.3	0.7	0.7	0.2	0.0	0.3	0.0	0.0	0.0	-	-	-
20/40	2.7	-	0.3	0.3	0.9	0.2	0.2	0.5	0.2	0.1	-	-	-	-
20/50	3.3	0.0	0.4	0.5	0.4	0.4	0.2	0.5	0.2	0.5	0.2	0.0	-	-
20/70	4.8	0.1	0.2	0.7	0.8	0.7	0.5	0.5	0.3	0.5	0.3	0.2	-	-
20/100	2.7	-	0.1	0.1	0.4	0.3	0.2	0.2	0.4	0.5	0.2	0.2	0.1	-
20/200	4.8	0.1	0.1	0.1	0.3	0.3	0.1	0.5	0.2	0.9	0.9	0.9	0.4	-
20/400	2.5	-	-	-	-	0.1	0.2	0.1	0.1	0.1	0.4	1.0	0.5	-
20/400+	0.8	-	-	-	-	0.2	-	-	0.0	-	0.0	0.3	0.2	0.1
	Standard error													
Total		0.41	1.25	0.92	0.80	0.53	0.46	0.44	0.23	0.40	0.36	0.56	0.35	0.08
	Number in thousands													
Total	6,975	236	1,763	1,751	1,522	555	180	240	105	198	142	195	79	9

APPENDIX I
STATISTICAL NOTES

Survey Design

The sample design for the first three programs (or Cycles I-III) of the Health Examination Survey has been essentially similar in that each has been a multistage, stratified probability sample of clusters of households in land-based segments. The successive elements for this sample design are the primary sampling unit (PSU), census enumeration district (ED), segment (a cluster of households), eligible persons, and finally the sample person.

The 40 sample areas and the segments utilized in the design of Cycle III were the same as those in Cycle II.[5] Previous reports describe in detail the sample design used for Cycle II and in addition discuss the problems and considerations given to other types of sampling frames, cluster versus random sampling, and whether or not to control the selection of siblings.[4]

Requirements and limitations placed on the design for Cycle III, similar to those for children in Cycle II, were that:

1. The target population be defined as the civilian noninstitutional population of the United States, including Alaska and Hawaii, between the ages of 12 and 17 years, with the special exclusion of youths residing on reservation lands of the American Indians. The latter exclusion was due to operational problems encountered on these lands in Cycle I.
2. The time period of data collection be limited to about 3 years for each cycle, and the length of the individual examination within the specially constructed mobile examination center be between 2 and 3 hours.
3. Ancillary data be collected on specially designed household, medical history, and school questionnaires and from birth certificate copies.
4. Examination objectives be primarily related to factors of physical and intellectual growth and development.
5. The sample be sufficiently large to yield reliable findings within broad geographic regions and population density groups, as well as age, sex, and limited socioeconomic groups for the total sample.

The sample was drawn jointly with the U.S. Bureau of the Census starting with the 1960 Decennial Census list of addresses and the nearly 1,900 PSU's into which the entire United States was divided. Each PSU is either a standard metropolitan statistical area (SMSA), a county, or a group of two or three contiguous counties. These PSU's were grouped into 40 strata, each stratum having an average size of about 4.5 million persons, in such a manner as to maximize the degree of homogeneity within strata with regard to the population size of the PSU's, degree of urbanization, geographic proximity, and degree of industrialization. The 40 strata were then classified into four broad geographic regions of 10 strata each and then within each region, cross-classified by four population-density classes and classes of rate of population change from 1950 to 1960. Using a modified Goodman-Kish controlled-selection technique, one PSU was drawn from each of the 40 strata.

Further stages of sampling within PSU's required first the selection of ED's, which are small, well-defined areas of about 250 housing units into which the entire Nation was divided for the 1960 population census. Each ED was assigned a "measure of size" equal to the rounded whole number resulting from a "division by nine" of the number of children, aged 5-9 years, in the ED at the time of the 1960 census. A sample of 20 ED's in the sample PSU

was selected by systematic sampling with each ED having a probability of selection proportional to the population of children 5-9 years at the time of the 1960 census date. A further random selection by size of segments (smaller clusters of housing units) within each ED was then made.

Because of the 3-year time interval between Cycle II and Cycle III, the Cycle III frame had to be supplemented for new construction and to compensate for segments in which housing was partially or totally demolished to make room for highway construction or urban redevelopment.

Advanced planning for the examinations at the various locations or stands provided for about 17 days of examinations, which limited the number of examinees per location to approximately 200. When the number of eligible youths in the sample drawn for a particular location exceeded this number, subsampling was done by deleting from the master list of eligible youths (ordered by segment, household order within segment, and age within household) every nth name on the list starting with the yth name, y being a number between 1 and n selected randomly, and n being the extent of oversampling in the original draw.

In Cycle III, as in Cycle II, twins who were deleted in the sample selection were also scheduled for examination, time permitting, as were youth deleted from the Cycle III sample who had been examined in Cycle II. The sample was selected in Cycle III, as it had been for the children in Cycle II, so as to contain the correct proportion of youths from families having only one eligible youth, two eligible youths, and so on to be representative of the total target population. However, since households were one of the elements in the sample frame, the number of related youths in the resultant sample is greater than would come from a design that sampled youths 12-17 years without regard to household. The resultant estimated mean measurements or rates should be unbiased, but their sampling variability will be somewhat greater than those from more costly, time-consuming systematic sample design in which every kth youth would be selected.

The total probability sample for Cycle III included 7,514 youths representative of the approximately 22.7 million noninstitutionalized U.S. youths 12-17 years. The sample contained youths from 25 different States and approximately 1,000 in each single year of age.

The response rate in Cycle III was 90 percent, with 6,768 youth examined out of the total sample. These examinees were closely representative of those in the samples as well as the population from which the samples were drawn with respect to age, sex, race, region, population density, and population growth in area of residence. Hence it appears unlikely that nonresponse could bias the findings appreciably.

Measures used to control the quality of the data from these surveys have been cited previously;[4-6] those additional measures specifically related to the particular examinations, tests, or measurements are outlined in the analytic reports describing and presenting the respective initial findings.

Reliability

While measurement processes in the surveys were carefully standardized and closely controlled, the correspondence between the real world and survey results cannot be expected to be exact. Survey data 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 III[5] describes in detail the faithfulness with which the sampling design was carried out.

Data recorded for each sample youth are inflated in the estimation process to characterize the larger universe of which the sample youth is representative. The weights used in this inflation process are a product of the reciprocal of the probability of selecting the youth, an adjustment for nonresponse cases, and a poststratified ratio adjustment that increases precision by bringing survey results into closer alignment with known U.S. population figures by color and sex within single years of age 12 through 17 years for the youths' survey.

In the third cycle of the Health Examination Survey (as for the children in Cycle II), the samples were the result of three principal stages of selection—the single PSU from each stratum, the 20 segments from each sample PSU, and the

sample youths from the eligible persons. The probability of selecting an individual youth 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 youths 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 youth 12 through 17 years had about the same probability of being drawn into the respective samples.

The adjustment upward for nonresponse is intended to minimize the impact of nonresponse on final estimates by imputing to nonrespondents the characteristics of "similar" respondents. Here "similar" respondents were judged to be examined youths in a sample PSU having the same age (in years) and sex as youths not examined in that sample PSU.

The poststratified ratio adjustment used in the third cycle achieved most of the gains in precision that would have been attained if the sample had been drawn from a population stratified by age, color, and sex. The adjustment makes the final sample estimates of population agree exactly with independent controls prepared by the Bureau of the Census for the U.S. noninstitutional population as of March 9, 1968 (approximate midsurvey point for Cycle III), by color and sex for each single year of age 12-17 years. The weights of every responding sample youth in each of the 24 age, color, and sex classes is adjusted upward or downward so that the weighted total within the class equals the independent population control for each survey.

In addition to youths not examined at all, there were some whose examination was incomplete in one procedure or another. The extent of missing data for the part of the examination relevant to this report is shown in tables I and II.

Sampling and Measurement Error

In the present 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 that 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) thousands of statistics are coming from the survey, 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 included in the detailed tables. These estimates have been prepared by a replication technique that 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.

In accordance with usual practice, the interval estimate for any statistic may be considered the range within 1 standard error of the tabulated statistic, with 68 percent confidence; or the range within 2 standard errors of the tabulated statistic, with 95 percent confidence. The latter is used as the level of significance in this report.

An approximation of the standard error of a 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 the sampling errors, respectively, of x and y. Of course, where the two groups or measures are positively or negatively correlated, this will give an overestimate

Table I. Number of examinees and extent of missing uncorrected distance phoria tests: Health Examination Survey, 1966-70

Age and sex	Total	Multiple entries	Arrow or number not usable	Examination not done
	Number of youths			
Both sexes				
Total, 12-17 years	6,768	3	865	46
Boys				
Total, 12-17 years	3,545	-	390	28
12 years	643	-	59	4
13 years	626	-	56	6
14 years	618	-	68	4
15 years	613	-	75	6
16 years	556	-	73	4
17 years	489	-	59	4
Girls				
Total, 12-17 years	3,223	3	475	18
12 years	547	-	62	5
13 years	582	-	79	3
14 years	586	1	88	3
15 years	503	1	69	5
16 years	536	-	94	1
17 years	469	1	83	1

or underestimate, respectively, of the actual standard error.

Small Numbers

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

Table II. Number of examinees and extent of missing data for right and left sphere and cylinder among those who wore corrective lenses: Health Examination Survey, 1966-70

Age and sex	Total with lenses	Right missing		Left missing	
		Sphere	Cylinder	Sphere	Cylinder
	Number of youths				
Both sexes					
Total, 12-17 years	1,869	98	143	100	157
Boys					
Total, 12-17 years	806	40	62	44	70
12 years	141	9	13	9	17
13 years	120	3	4	4	4
14 years	117	5	15	5	14
15 years	150	10	11	6	10
16 years	154	8	10	11	16
17 years	124	5	9	9	9
Girls					
Total, 12-17 years	1,063	58	81	56	87
12 years	137	10	10	6	11
13 years	183	10	16	9	20
14 years	183	8	18	7	16
15 years	169	13	15	15	16
16 years	203	14	13	13	14
17 years	188	3	9	6	10

APPENDIX II
DEMOGRAPHIC AND SOCIOECONOMIC TERMS

Age.—The age recorded for each youth was the age at 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 time of interview. Since the examination usually took place 2 to 4 weeks after the interview, some of those who were 17 years old at the time of interview became 18 years old by the time of examination. There were 23 such cases. In the adjustment and weighting procedures used to produce national estimates, these 23 were included in the 17-year group.

Race.—Race was recorded as "white," "Negro," or "other." "Other" 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 other nonwhite race. Negroes and persons of mixed Negro and other parentage were recorded as "Negro."

Geographic region.—For purposes of stratification, the United States was divided into four 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:

Region	*States included*
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

Family income.—The income recorded was the total income of the past 12 months received 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 their own farm or business, in which case net income was recorded.

APPENDIX III

RECORDING FORMS

HEALTH EXAMINATION SURVEY—III

DISTANCE VISION—WITHOUT CORRECTION

VISION TESTS

Check tests given first. ☐ Far ☐ Near (Odd numbers distance first; even numbers near first)

DIAL

1. BINOCULAR LATERAL PHORIA—DISTANCE (Check number nearest arrow)

☐ Left of 1 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 / ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 / ☐ 17 ☐ 18 ☐ 19 ☐ 20 ☐ 21

☐ Right of 21 ☐ Arrow or number not visible. Code _____

2. MONOCULAR DISTANCE—SMALL*

Line	Right eye	Score (Check)	Left eye	Score
5	VHDNS OZKRC	___50	CDZNO KSRVH	___50
6	DVZNC SRHKO	___40	CNRKH ZVSDO	___40
7	KNZCO SRDHV	___30	DVHCK OZNSR	___30
8	KNDRS ZVCOH	___25	CDKRO SZVNH	___25
9	VZCHD KNRSO	___20	CVHSZ ORKDN	___20
10	KZSVN HCRDO	___17	DNVHS OKRCZ	___17
11	RCSNV KDHOZ	___15	ZHODC SVNKR	___15
12	ROKHZ NSCVD	___12	KHOZD CSNVR	___12

3. MONOCULAR DISTANCE—LARGE* *(Omit if score on Dial 2)*

Line	Right eye	Score	Left eye	Score
1	SDK	___400	VNC	___400
2	RCSZO	___200	OZNKS	___200
2	KNHDV		DRHCV	
3	HNZOS KRCVD	___100	RZOHC KSNDV	___100
4	ZHODC SVNKR	___ 70	RKNCZ HSDVO	___ 70

CODE _____ CODE _____

TRIAL LENS FOR MYOPIA (Score in lines 1–8, Plates 2, 3—OMIT IF CONTACT LENSES ARE WORN.)

Right eye	☐	☐	☐	☐	☐	☐	☐	☐	SCORE _____
	0	**1**	**1.5**	**2**	**3**	**4**	**5**	**N.A.**	
Left eye	☐	☐	☐	☐	☐	☐	☐	☐	SCORE _____

3A. BINOCULAR DISTANCE—SMALL*

Line	Score
5	OSDNH VKZCR ___ 50
6	RHZCD OSVKN ___ 40
7	SVNHO KCRDZ ___ 30
8	RHSCK OZDVN ___ 25
9	OZRVN HSCKD ___ 20
10	DRHVN ZSKCO ___ 17
11	OSKCV RZHDN ___ 15
12	SKHDN OCVRZ ___ 12

4A. BINOCULAR DISTANCE—LARGE* *(Omit if score on Dial 3A)*

Line	Score
1	KDS ___400
2	ZSKCO ___200
2	VRHDN
3	ZNSKH VDRCO ___100
4	OZCRH NSKDV ___ 70

Code _____

*Diagonal line through each letter missed; horizontal line through sections of line not attempted and through top full line not attempted.

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SAMPLE NO. (1–5)

NEAR VISION—WITHOUT CORRECTION

6. BINOCULAR LATERAL PHORIA—NEAR (Check number nearest arrow)

☐ Left of 1 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 / ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14

☐ 15 ☐ 16 ☐ 17 ☐ 18 / ☐ 19 ☐ 20 ☐ 21 ☐ 22 ☐ 23 ☐ 24 ☐ 25 ☐ 26 ☐ 27 ☐ 28 ☐ 29

☐ 30 ☐ 31 ☐ 32 ☐ 33 ☐ Right of 33 CODE _____

7. MONOCULAR NEAR—SMALL*

Line	Right eye	Score (Check)	Left eye	Score
5	CVRZS DKHNO	___ 50	ZKCRV OHSDN	___ 50
6	VZKCO HRSDN	___ 40	SDKVO ZRHNC	___ 40
7	HSZKN OVCDR	___ 30	DHZRV SOKNC	___ 30
8	OVRHS CNDZK	___ 25	DKOSN RVZCH	___ 25
9	ZHCOR VDNSK	___ 20	RKZVD OSNCH	___ 20
10	RHCVN SDKZO	___ 17	OKSRN DHVCZ	___ 17
11	CNZSR OHKDV	___ 15	VRCHN OZKSD	___ 15
12	OSCNH VRSKZ	___ 12	ROHKS VDNCZ	___ 12

8. MONOCULAR NEAR—LARGE* *(Omit if score on Dial 7)*

Line	Right eye	Score	Left eye	Score
1	NCV	___ 400	DSK	___ 400
2	HNRCD	___ 200	CRSZO	___ 200
2	VOSZK		NDVHK	
3	NDOCV RSZKH	___ 100	OKZHS NCVRD	___ 100
4	VRCNZ OSDHK	___ 70	RCOVN DHKSZ	___ 70

CODE _____ CODE _____

9. BINOCULAR NEAR—SMALL*

Line		Score
5	OCVKR ZNSDH	___ 50
6	ZHOCV NDRKS	___ 40
7	SDOVK HRNZC	___ 30
8	DNHKO ZSRVC	___ 25
9	DSVKH ZNOCR	___ 20
10	NZHKO RCVDS	___ 17
11	SNCZO RKVHD	___ 15
12	DHNVO SCZKR	___ 12

NS5. BINOCULAR NEAR—LARGE* *(Omit if score on Dial 9)*

Line		Score
1	NVC	___ 400
2	CZHSN	___ 200
2	DKORV	
3	KSDVO NHZCR	___ 100
4	VZOCS HRNKD	___ 70

CODE _____

*Diagonal line through each letter missed; horizontal line through sections of line not attempted and through top full line not attempted.

NEAR VISION—WITH CORRECTION

6. BINOCULAR LATERAL PHORIA—NEAR (Check number nearest arrow)

☐ Left of 1 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 / ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14

☐ 15 ☐ 16 ☐ 17 ☐ 18 / ☐ 19 ☐ 20 ☐ 21 ☐ 22 ☐ 23 ☐ 24 ☐ 25 ☐ 26 ☐ 27 ☐ 28 ☐ 29

☐ 30 ☐ 31 ☐ 32 ☐ 33 ☐ Right of 33 ☐ **Arrow or number not visible** CODE _____

DISTANCE VISION—WITH CORRECTION

CORRECTED VISION
1 ☐ With glasses
2 ☐ With contact lenses

VISION TESTS
DIAL

1. BINOCULAR LATERAL PHORIA—DISTANCE (Check number nearest arrow)

☐ Left of 1 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 / ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 / ☐ 17 ☐ 18 ☐ 19 ☐ 20 ☐ 21

☐ Right of 21 ☐ Arrow or number not visible. Code _____

5A. MONOCULAR DISTANCE—SMALL*

Line	Right eye	Score (Check)	Left eye	Score
5	KDZNV SHROC	___50	CRNDO SVZHK	___50
6	VKRNZ CODHS	___40	ZVCOH DRSNK	___40
7	HSDRZ NCVOK	___30	ZKHSO VCDRN	___30
8	ZOVCS NRKDH	___25	HNVZS CKRDU	___25
9	RHSDK ONCVZ	___20	RHCVN ODSZK	___20
10	KNRZD OHVCS	___17	KRNHC OSDVZ	___17
11	KZODR HNSCV	___15	SCHZD VKNRO	___15
12	RVNSZ KCDOH	___12	CNDZK OHRVS	___12

3A. BINOCULAR DISTANCE—SMALL*

Line		Score
5	OSDNH VKZCR	___50
6	RHZCD OSVKN	___40
7	SVNHO KCRDZ	___30
8	RHSCK OZDVN	___25
9	OZRVN HSCKD	___20
10	DRHVN ZSKCO	___17
11	OSKCV RZHDN	___15
12	SKHDN OCVRZ	___12

3. MONOCULAR DISTANCE—LARGE* *(Omit if Score on Dial 5A)*

Line	Right eye	Score	Left eye	Score
1	SDK	___400	VNC	___400
2 / 2	RCSZO / KNHDV	___200	OZNKS / DRHCV	___200
3	HNZOS KRCVD	___100	RZOHC KSNDV	___100
4	ZHODC SVNKR	___70	RKNCZ HSDVO	___70

CODE _____ CODE _____

4A. BINOCULAR DISTANCE—LARGE* *(Omit if score on Dial 3A)*

Line		Score
1	KDS	___400
2 / 2	ZSKCO / VRHDN	___200
3	ZNSKH VDRCO	___100
4	OZCRH NSKDV	___70

CODE _____

LENSOMETER READINGS

EYE LENS	± FIRST READING	± SECOND READING	AXIS
Right			
Left			

*Diagonal line through each letter missed; horizontal line through sections of line not attempted and through top full line not attempted.

TRIAL LENS TEST FOR MYOPIA (Score in lines 1–8, plates 5A, 3)

Right eye	☐	☐	☐	☐	☐	☐	☐	☐	SCORE _____
	0	1	1.5	2	3	4	5	N.A.	
Left eye	☐	☐	☐	☐	☐	☐	☐	☐	SCORE _____

VISION—LANDOLT RING TESTS

DISTANCE* (at 10 feet)

WITHOUT CORRECTION

LINE (Code)	RIGHT EYE	LEFT EYE	BINOCULAR
1	200 ☐	200 ☐	200 ☐
2	100 ☐	100 ☐	100 ☐
3	71.4 ☐	71.4 ☐	71.4 ☐
4	50 ☐	50 ☐	50 ☐
5	39.3 ☐	39.3 ☐	39.3 ☐
6	28.6 ☐	28.6 ☐	28.6 ☐
7	25 ☐	25 ☐	25 ☐
8	21.4 ☐	21.4 ☐	21.4 ☐
8	17.9 ☐	17.9 ☐	17.9 ☐
10	14.3 ☐	14.3 ☐	14.3 ☐
11	10.7 ☐	10.7 ☐	10.7 ☐
CODE	_____	_____	_____

WITH CORRECTION

1 ☐ With Glasses
2 ☐ With Contact Lenses

LINE (Code)	RIGHT EYE	LEFT EYE	BINOCULAR
1	200 ☐	200 ☐	200 ☐
2	100 ☐	100 ☐	100 ☐
3	71.4 ☐	71.4 ☐	71.4 ☐
4	50 ☐	50 ☐	50 ☐
5	39.3 ☐	39.3 ☐	39.3 ☐
6	28.6 ☐	28.6 ☐	28.6 ☐
7	25 ☐	25 ☐	25 ☐
8	21.4 ☐	21.4 ☐	21.4 ☐
9	17.9 ☐	17.9 ☐	17.9 ☐
10	14.3 ☐	14.3 ☐	14.3 ☐
11	10.7 ☐	10.7 ☐	10.7 ☐
CODE	_____	_____	_____

TRIAL LENS TEST FOR MYOPIA—without correction (Score in lines 1–8 Monocular Distance—Omit if contact lenses are worn)

Right eye	☐	☐	☐	☐	☐	☐	☐	☐	SCORE _____
	0	**1**	**1.5**	**2**	**3**	**4**	**5**	**N.A.**	
Left eye	☐	☐	☐	☐	☐	☐	☐	☐	SCORE _____

NEAR* (at 14 inches)

LINE (Code)	RIGHT EYE	LEFT EYE	BINOCULAR
1	200 ☐	200 ☐	200 ☐
2	160 ☐	160 ☐	160 ☐
3	125 ☐	125 ☐	125 ☐
4	100 ☐	100 ☐	100 ☐
5	80 ☐	80 ☐	80 ☐
6	60 ☐	60 ☐	60 ☐
7	50 ☐	50 ☐	50 ☐
8	40 ☐	40 ☐	40 ☐
9	30 ☐	30 ☐	30 ☐
10	25 ☐	25 ☐	25 ☐
11	20 ☐	20 ☐	20 ☐
CODE	_____	_____	_____

Check acuity level reached.

TRIAL LENS TEST FOR MYOPIA—with correction (Score in Lines 1–8, Monocular Distance)

Right eye	☐	☐	☐	☐	☐
	0	**1**	**1.5**	**2**	**3**
Left eye	☐	☐	☐	☐	☐

Right eye	☐	☐	☐	SCORE _____
	4	**5**	**N.A.**	
Left eye	☐	☐	☐	SCORE _____

LENSOMETER READINGS (glasses, contact lenses)

EYE LENS	±FIRST READING	±SECOND READING	AXIS
Right			
Left			

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