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Author(s): Linda N. Edwards and Michael Grossman
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Income and Race Differences in Children's Health in the Mid-1960s

LINDA N. EDWARDS, PH.D.,* AND MICHAEL GROSSMAN, PH.D.†

This article explores income and race differences in eight measures of the health of children ages 6 through 11 as assessed in the early 1960s. It is shown that both income and race differences in health are much less pronounced than they are in infant mortality and birth weight data. Significant differences are found in the health status of black and white children and of children from high- and low-income families, but these are primarily differences with respect to parent-reported (rather than physician-reported) health criteria and they by no means overwhelmingly favor the white or high-income children. These findings underscore the importance of treating children's health status as multidimensional. In addition, these findings will serve as a bench mark for studies of children's health using data for a more recent period.

RECENT REVIEWS of children's health in the United States have stressed the differences between black and white children and between children in high- and low-income families.[1,2] These studies cite mortality rates for both infants and older children that are over 50 per cent higher for blacks than for whites. They also point out that low birth weight (a good negative indicator of whether an infant will survive his first year and of his successful future development) is more prevalent among black and poor families.

The income and race comparisons in children's health status cited above, as well as those cited elsewhere, rely primarily on measures that relate to the first year of the child's life. This results largely from the unavailability of comprehensive measures of morbidity for older children. Publication of data from Cycles II and III of the Health Examination Survey, however, makes it possible to study explicitly the health of older children. In this paper we use data from Cycle II, which covers children aged 6 through 11 years in the 1963-65 period, to explore income and race differences in eight measures of children's health.

The Cycle II children were examined in the mid-1960s. Nevertheless, their records are still an important resource for analysis. These children comprise the only large representative sample of U.S. children taken from the recent past for which such a rich array of health and family background data are available. Undoubtedly, there have been changes in the health status of children in this age-group during the intervening 15 years, especially as a result of government health programs targeted at the poor, so that the relative status of black and poor children may have changed. But

* Department of Economics, Queens College and Graduate School, of the City University of New York and National Bureau of Economic Research, New York, New York.

† Department of Economics Graduate School, of the City University of New York and National Bureau of Economic Research, New York, New York.

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Reprint requests: Michael Grossman, National Bureau of Economic Research, 269 Mercer Street, 8th Floor, New York, New York 10003.

even so, analysis of the data from 1963 to 1965 will provide a benchmark against which to measure that change as future samples become available.

We report two kinds of results. First, we show that when health measures from mid-childhood are the subject of analysis, both income and race differences are much less pronounced than they are in infant mortality data. Indeed, for one of our most comprehensive health measures—the examining doctor's assessment of whether or not the child has any "significant acquired abnormalities"—there are no statistically significant differences either by income or by race. Second, the differences that we do find do not uniformly favor children from white or higher-income families.

Measuring Health in the Cycle II Sample

Cycle II of the Health Examination Survey, conducted by the National Center for Health Statistics (NCHS), is an exceptional source of information about a national sample of 7,119 noninstitutionalized children aged 6 to 11 years in the 1963-65 period. The data comprise medical and developmental histories of each child provided by the parent, information on family socioeconomic characteristics, birth certificate information and a school report with data on school performance and classroom behavior provided by teachers or other school officials. Most important, there are objective measures of health from physical examinations administered by the Public Health Service. Together, the data provide an unusually detailed picture of the health of children in this cohort.

A full description of the sample, the sampling technique and the data collection is presented in NCHS.[3] An exceptional strength of this sample is its high response rate of 96 per cent with nonwhites having a slightly higher response rate than did whites (0.982 versus 0.956). (See NCHS,[3] Table 4.) The one deficiency of the sample, from the point of view of studying children's health, is the exclusion of children in institutions. To the extent that these children are more likely to have serious and disabling physical conditions, the reported incidence of certain conditions will be lower in our sample than in the entire population of children. In addition, if the probability of the institutionalization of a child with a given condition depends on income and race, our results will incorporate unknown biases. The number of institutionalized children is small, however, at about four-tenths of a per cent of all children aged 5 through 13 years. This is the proportion of 5–13 year olds living in "group quarters" in 1970 according to the U.S. Bureau of the Census,[4] Tables 52 and 205. The corresponding percentages by race are 0.38 per cent for whites and 0.7 per cent for blacks.

Given the unusual detail and diversity of the health data in the Cycle II survey, the choice of health status measures is not dictated solely by data availability, but rather is an issue that must be faced directly. The problem of defining and measuring children's (and adults') health is very much an unresolved one, even among professionals in the area of public health.[5,6] The economist's approach is to define health as a form of human capital that determines the amount of time available for consumption and for work in the home and labor market.[7] With this type of definition, an appropriate measure of health status over some time period would be the proportion of one's potential time that is actually available for the usual consumption, maintenance and work activities. Similarly, the complementary measure of ill health would be that proportion of one's potential time lost as a consequence of imperfect functioning. Such disability may be relatively easy to measure when dealing with adults who are members of the labor force (a good approximation is days lost from work because of illness), but it is not easy to measure for other adults or for children. Therefore, in economists' studies of adults' health, the occurrence of particular physical conditions and the individual's own assessment of his health status have been used as supplementary health measures.[8]

We use the same type of restricted, morbidity-oriented, definition of children's health, focusing on the child's physical health rather than his overall well-being, and similar types of measures including disability, physical conditions, and parental assessment of health status. Even some of these measures, however, may not always be appropriate for children, because certain childhood diseases and acute conditions that prevent children from carrying out their normal activities may not reflect their health capital or "permanent" health. A useful distinction to make here is between permanent health which is one's prospect for life preservation and normal lifetime functioning, and "transitory" health, which is short-run deviations from one's normal state of health. It is the child's permanent health status that we wish to study, and we attempt to choose health measures that are indicators of that permanent health status.

Of course, there is a positive relationship between permanent and transitory health status, in the sense that a child with low health capital is more likely to contract some acute conditions and to have them for a more extended time period. For example, Birch and Gussow[9] discuss how a child's nutrition (which is clearly a determinant of permanent health status) and his likelihood of sustaining an acute condition are intimately related. Similarly, Starfield[10] reports that some acute problems may have a high likelihood of permanence in some population subgroups.

In some situations a single overall index of permanent health might be desired to help one describe parsimoniously the health status of a population, for example, or allocate public funds. Infant mortality statistics frequently are used in this way. Health, however, is clearly a multidimensional concept. Consequently, we use a set of health measures rather than a single index. Analysis of a set of component measures also avoids the essentially arbitrary weighting of the various dimensions of health implied by a health index.‡ Finally, such analysis allows for the possibility that the various aspects of children's health are differentially related to family income and race.

The actual choice of components of children's health status to be examined has been guided by the child health literature,[11–19] as well as by discussions with public health specialists and pediatricians. In addition, we have tried to take advantage of the diversity of the data by including measures derived not only from the physician's examination but also from the parent's report and the school report. The latter two types of measures, of course, are subjective, in that they depend on the perceptions of the parent or teacher. The final set of measures we study, listed and described below, will not satisfy everyone. But some exclusions result from unavailability (anemia and corrected distance vision, for example) or extremely low prevalence (poor hearing and injuries due to accidents), rather than deliberate choice.

1. The presence of one or more "significant acquired abnormalities" on physical examination of the child, represented by the dichotomous variable ABNORMALITY. These abnormalities include heart disease; neurological, muscular or joint conditions; and other major diseases.‖

2. The child's visual acuity, represented by the dichotomous variable VISION. VI-

‡ In earlier work some attempts were made to condense the health information with the use of principal component analysis. The analysis yielded almost as many equally weighted components as there were initial health measures.

‖ In defining ABNORMALITY, we exclude abnormalities resulting from accidents or injuries, because these may be more likely to reflect transitory rather than permanent health variations. The proportion of children in the full sample that had abnormalities due to accidents or injuries (but no other type of abnormality) is 2 per cent. Note that congenital abnormalities are not studied, because they generally relate to events that occur prior to birth (the prenatal period is not investigated in this paper).

SION indicates whether the child has abnormal distance vision. All children were examined only without their eyeglasses; their uncorrected binocular distance vision was defined as abnormal if it was worse than 20/30.[20] It also would have been desirable to investigate corrected distance vision, but the Cycle II data do not include the information necessary to do so.

3. The child's blood pressure, represented by BLOODP. BLOODP is a dichotomous variable which indicates if the child's diastolic blood pressure exceeds the 95th percentile for his or her age and sex.

4. The child's periodontal index, represented by PERI. The periodontal index is described as follows:[21] "Every tooth in the mouth . . . is scored according to the presence or absence of manifest signs of periodontal disease. When a portion of the free gingiva is inflamed, a score of 1 is recorded. When completely circumscribed by inflammation, teeth are scored 2. Teeth with frank peridontal pockets are scored 6 when their masticatory function is unimpaired and 8 when it is impaired. The arithemetic average of all scores is the individual's [periodontal index], which ranges from a low of 0.0 (no inflammation or periodontal pockets) to a high of 8.0 (all teeth with pockets and impaired function)."[21] PERI is a good overall indicator of oral health as well as a correlate of nutrition.[22] Since the periodontal index is known to differ systematically by age and sex, PERI is standardized by age and sex (PERI is measured as the difference between the child's actual periodontal index and the average value of that index for his or her age-sex group divided by the standard deviation of the index for that age-sex group). Higher values of PERI denote poorer values of oral health.

The periodontal index, however, suffers from the defect that it is subject to intrarater and inter-rater variability. We have experimented with a somewhat more objective measure of oral health, the number of decayed permanent and primary teeth adjusted for age and sex, and have obtained results similar to those for the periodontal index. We chose to report on the periodontal index rather than on the prevalence of decay because we judged that the former is more likely to reflect underlying nutritional and health habits and less likely to simply indicate the receipt of recent dental care.

5. The parent's assessment of the child's overall current health, represented by ASSESS. ASSESS is a dichotomous variable indicating whether the parent views the child's health as either "poor," "fair" or "good" as opposed to "very good." This particular dichotomy was chosen because there were very few children rated in the "poor" and "fair" categories (5.0 per cent) whereas a large number of parents felt it pertinent to distinguish between "good" and "very good."

It is interesting to note that although this is a subjective measure, the NCHS[23] reports that it is positively related to the physician's overall assessment of the child's health. That is, children who are given a lower health rating by one of their parents are more likely than average to be rated by the physician as having a "significant abnormality."

6. Whether or not the parent reports that the child has hay fever, asthma or "other allergies," represented by the dichotomous variable ALLERGY.

7. The parent's assessment of the child's level of tension, represented by the dichotomous variable TENSION. TENSION indicates if a child is rated by his or her parent as "high strung" or "moderately tense," as opposed to "moderately relaxed" or "unusually calm and relaxed." This dichotomy, again, was partially dictated by the data; very few of the children were rated in the "high strung" category.

8. Excessive absence from school for health reasons during the past 6 months, represented by the dichotomous variable ABSENT. This variable is taken from information provided by the child's teacher or a school administrator.

As is implied in the above definitions, all of these variables are negative correlates of good health. Note that four of the variables are taken from the physical examination (ABNORMALITY, VISION, BLOODP AND PERI), three are taken from the medical history form completed by the parent (ASSESS, ALLERGY and TENSION) and one is taken from the school form (ABSENT). Note also that variables taken from the physical examination are subject to inter-rater variability in that physicians and dentists may differ in the way they interpret the results of an examination.[24,25] This means that both objective health variables (those obtained from the physical examination) and subjective health variables (those obtained from the parent) are subject to measurement errors. But measurement errors in the subjective variables are likely to be correlated with income and race (see below), while measurement errors in the objective variables are unlikely to be correlated with race and income. This follows because white and black children and children from different income classes were examined by physicians and dentists with similar qualifications.

Race and Income Differences in Health Status in the Cycle II Sample

Table 1 presents the mean levels of these eight health measures for our entire working sample, as well as by family income and by race. The two family income classes are under \$5,000 per annum and \$5,000 or more per annum. This income cutoff is selected because it approximately identifies the lowest quartile of the income distribution for the Cycle II sample. For purposes of comparison, Table 1 also includes statistics on infant mortality and the prevalence of low birth weight for the same income and race classes.

The working sample used in Table 1, as well as in all subsequent calculations, includes only 4,777 of the 7,119 observations, because, first, we restricted our analysis to children who either lived with both of their parents or with their mothers only (no stepparents, foster parents, grandparents, etc.). We did so to guarantee that the family background variables used in the next section reflect the actual environment of the child.§ We also excluded those children for whom there were missing data for any of the health measures or socioeconomic variables used in the next section.‖ A comparison of the means of the eight health measures computed from our working sample with corresponding means for the entire Cycle II sample reveals very little difference between them in most cases (Table 2).¶ Table 2 also reveals that the entire Cycle II sample contains slightly higher proportions of black children and children from low-income families than the working sample. These differences are not, however, large enough to suggest that the results of our analysis would be altered if the entire sample had been utilized.

Looking now at Table 1, we present not only the race and income differences in the health measures, but also the standard normal statistics required for testing whether or not observed race and income differences could have arisen by chance.# These "z" statistics are computed in two ways. The first way assumes that the Cycle II data were generated by a simple random sampling procedure, while the second makes an adjustment to allow for the actual multi-stage cluster sampling design used to collect the Cycle II data.

Computing sample standard errors for this type of sample is complicated and requires information about the location of each sample observation. At the time of

§ Only 1 per cent of the children lived with their fathers only. The 72 children who turned 12 years old before the completion of the survey were also excluded.

‖ There is no school form for approximately 500 children in the Cycle II data set. Since excessive absence due to illness is the only variable taken from the school form, children without the school form are eliminated from our working sample only when school absenteeism is examined.

¶ All means and standard deviations discussed here and in the rest of the paper were computed from the unweighted data. Follow-up calculations with the weighted data altered the means only slightly (typically in the third decimal place only).

For the dichotomous health measure the appropriate statistical test uses the binomial distribution. With samples as large as this one, however, the binomial distribution is well approximated by the normal distribution. For the continuous health measures, the "t" distribution is needed. But again, for large samples, the "t" distribution is well approximated by the normal distribution.

TABLE 1. Mean Values of Health Measures* in Cycle II Sample by Family Income and Race, and Infant Mortality and Birth Weight by Family Income and Race

Cycle II Health Measure	Cycle II Working Sample (n = 4777)	Blacks (n = 581)	Whites (n = 4196)	"z" Statistic for Black-White Difference	Adjusted "z" Statistic for Black-White Difference	Income < $5,000/yr (n = 1645)	Income ⩾ $5,000/yr (n = 3132)	"z" Statistic for Low-High Income Difference	Adjusted "z" Statistic for Low-High Income Difference
ASSESS	0.4706	0.6127	0.4509	7.36	4.09	0.5939	0.4058	12.58	6.99
VISION	0.1160	0.1136	0.1163	0.20	0.11	0.0954	0.1268	3.21	1.78
BLOODP	0.0557	0.0671	0.0541	1.28	0.71	0.0614	0.0527	1.25	0.87
ALLERGY	0.1478	0.0878	0.1561	4.35	2.42	0.1015	0.1721	6.56	3.65
TENSION	0.4593	0.3373	0.4762	6.32	3.51	0.4304	0.4745	2.90	1.61
ABNORMALITY	0.0373	0.0430	0.0365	0.78	0.43	0.0389	0.0364	0.44	0.24
PERI†	−0.0392	−0.0736	0.0344	1.19	0.66	0.0711	−0.0971	7.48	4.16
ABSENT‡	0.0445	0.0422	0.0449	0.28	0.16	0.0483	0.0426	0.87	0.48
Other Health Measures	Total Population 1963-65	Black Population 1963-65	White Population 1963-65	Population With Income < $5,000/yr. 1963–65	Populaltion With Income ⩾ $5,000/yr. 1963-65				
Infant mortality§	23.0	39.5	20.8	28.4	18.1				
Per cent of births with weight < 2,500 grams	7.87	14.01	7.01	8.89	7.05				

* Health measures defined in text.

† The mean of this variable is not zero, because standardization was done using the means and standard deviations for the entire Cycle II sample rather than for our working subsample.

‡ Means derived from subsample of working sample for which a school report was available (n = 4,333 rather than 4,777).

§ Deaths per 1,000 live legitimate births.[26]

this analysis such information was not provided by the Health Examination Survey (HES), in order to preserve the confidentiality of the Cycle II data. We obtain an approximation of the true standard errors for the Cycle II sample by adapting the results of a Monte Carlo study of data from the Cycle I HES survey (which utilizes the same sample design as Cycle II) reported by McCarthy.[27] McCarthy finds that the true standard error of sample means in the Cycle I data is, on the average, 1.8 times the value computed under the assumption that the data came from a simple random sample. He also estimates that the true standard error of regression coefficients computed from the Cycle I data is, on the average, 1.35 times the standard error computed under the assumption of simple random sampling. These two adjustment factors are applied to the estimates in an effort to control for the effects of the Cycle II sample design.

Statistically significant race differences (at the 5 per cent level, which is used throughout this paper) are reported for only three of the eight health measures: ASSESS, ALLERGY and TENSION. Black parents assess their children to be in poorer overall current health than do white parents. At the same time, black parents are less likely than white parents to report that their children are extremely tense or are afflicted with allergies. These three health measures are all subjective, since they are based on the parents' report. For the more objective measures, no race differences are statistically significant. The reported differences do suggest, however, that the black children in the sample are more likely to have physical abnormalities and high blood pressure than the white children. The data also suggest that black children are less likely to have periodontal disease and poor vision. In addition, black children are less likely than white children to be absent from school because of illness.

To summarize, race comparisons of children's health based on these eight measures clearly yield a much less uniform impression than is drawn from inspection of data on infant mortality and low birth weight. Rather than exhibiting the dramatically large health deficits of black infants, older black children do not appear to have a consistently different health profile than their white counterparts. Moreover, those differences that are statistically significant only pertain to subjective measures. This divergence between the relative health profile of blacks in infancy and in mid-childhood is not simply a result of differences in data sources or differences between sample data and population data. Data for the Cycle II children regarding their infancy (birth weight, the incidence of congenital abnormalities and the parents' retrospective assessment of the infant's health) indicate that even the black children in the Cycle II sample had significantly poorer health in infancy than did the white children in the sample.

Income differences in these health measures are of the same order of magnitude as are the race differences, only

TABLE 2. Percentage of Black Children, Percentage of Children from Low-Income (< \$5,000/yr) Families, and Mean Values of Health Measures in Cycle II Total and Working Samples*

Cycle II Measure	Total Sample	Working Sample
Percentage of black children	13.9	12.2
Percentage of children from low-income families	37.1	34.4
Health Measures		
ASSESS	0.4790	0.4706
VISION	0.0950	0.1160
BLOODP	0.0510	0.0557
ALLERGY	0.1580	0.1478
TENSION	0.4560	0.4593
ABNORMALITY	0.0420	0.0373
PERI	0.0000	−0.0392
ABSENT	0.0440	0.0445

* In computing the percentage or mean of a given measure in the total sample, observations with missing data for that measure alone are deleted.

three being statistically significant.**[28] Two of these place children from higher income families in better health (the parents' overall assessment and the periodontal index), while the allergies measure places them in worse health. These income-related differences are independent of race and are evident in the white sample as well (Table 3). It is notable that for the doctor's overall assessment of significant abnormalities there is no significant income difference.

Data for the period 1971-72 from Cycle I of the Health and Nutrition Examination Survey, however, give a somewhat different result regarding income differences in visual acuity when children are examined with their "usual correction"[29] In particular, a smaller proportion of low-income children had usual distance vision in the better eye of 20/20 or better, compared with high-income children; and a larger proportion of low-income children had usual distance vision of 20/50 or worse. It should be noted, however, that these relationships are not uniform over the three income classes studied. A larger proportion of low-income (less than $5,000) children had vision of 20/20 or better, compared with middle-income ($5,000–9,999) children. A larger proportion of high-income ($10,000 and over) children had vision of 20/50 or worse, compared with low-income children. Moreover, tabulations for the classification 20/30 or worse are not shown.

What conclusions can be drawn from this simple comparison of means between the black–white and low-income/high-income subsamples? First, neither race nor income differences are pronounced. Second, those variables for which there are significant race and income differences are, for the most part, subjective measures. Finally, and most notably, we report that for the overall evaluation of the child's health by the Public Health Service physician (ABNORMALITY), there are no significant differences either by race or by income class.

Our results with respect to race and income differences in the parent's assessment of the child's overall health are similar to those reported by the NCHS,[23] in spite of our use of a smaller sample. Our results, with respect to significant acquired abnormalities, differ from those of the NCHS. Both analyses indicate fewer abnormalities in white children, compared with black children, and in children from high-income families, compared with children from low-income families. But the NCHS differentials are statistically significant, while those in Table 1 are not, probably because we exclude congenital abnormalities, while the NCHS includes them. The black–white differential in the proportion of congenital abnormalities is significant in our sample.

Decomposition of Observed Race and Income Differences

We have documented that race and income differences in health status in the Cycle II sample children are much less sharp that the corresponding differences in measures of infant health. Nevertheless, some differences still do exist. To what ex-

** Note that the differences in the prevalence rates of tension and abnormal uncorrected distance vision between the high-income and low-income samples are significant if the unadjusted "z" statistics in Table 1 are used. Kish[28] shows that the procedure used to adjust for design effects overstates the true standard error of the difference in means. This is because "... two subclass means from clustered samples, although based on distinct sets of elements, tend to come from the same set of clusters. The positive correlation between cluster influences on the two means tends to reduce the variance of the difference (p. 582)." Kish also shows that the estimate of the standard error of the difference in means based on the assumption of simple random sampling understates the true standard error. Hence, caution is required with respect to conclusions concerning the statistical significance of gross income difference in the prevalence of tension and abnormal vision. Note that the preceding point refers only to computing the standard error of the difference in means and is not relevant to our procedure for computing adjusted "z" statistics of regression coefficients.

TABLE 3. Gross and Net Income Differences in the Health Status of White Children*

Health Measure	High Income Mean	Low Income Mean	Gross Income Difference†	"z" Statistic on Gross Difference	Net Income Difference‡	Ratio of Net to Gross Income Difference
ASSESS	0.394	0.589	−0.195§	11.62	−0.079	0.41
VISION	0.127	0.091	0.036	3.25	0.006	0.17
BLOODP	0.052	0.056	−0.004	0.84	0.006	−1.50
ALLERGY	0.176	0.108	0.068§	5.59	0.016	0.24
TENSION	0.484	0.456	0.028	1.65	−0.002	−0.07
ABNORMALITY	0.036	0.037	−0.001	0.04	−0.001	1.00
PERI	−0.097	0.117	−0.214§	8.38	−0.077	0.36
ABSENT	0.043	0.049	−0.006	0.85	0.001	−0.17

* There are 2,718 white children in the high-income (≥ $5,000/yr) sample and 1,227 white children in the low-income (< $5,000/yr) sample.

† This is computed as the mean in the high-income sample minus the mean in the low-income sample.

‡ Computation described in text.

§ Significant income differences at the 5 per cent level of significance, whether or not adjustment is made for sample design.

tent are these uniquely associated with income and race, and to what extent can they be attributed to correlated socioeconomic factors? This question is especially relevant here because it is the subjective measures for which significant differences are observed, and these measures are most likely to be affected by systematic variations in reporting and/or scaling related to socioeconomic characteristics.

Race Differences

It is well known that race and income are highly correlated. Thus it is not surprising that two of three of the health measures displaying significant race differences also exhibit significant income differences (Table 1). An obvious first step, therefore, is to try to determine whether these observed race differences really are just a result of differences in income. To do so we obtain mean values for the eight health measures when the Cycle II sample is cross-classified by both income and race (Table 4). There are still significant race differences in health, but different measures are affected in the two income classes. Among low-income families significant race differences are observed for tension and the periodontal index, and for both of these measures black children are rated in better health than white children from families of comparable low-income levels. In high income families, significant race differences are reported for the parents' assessment, allergies and tension, black children being rated in worse health according to the parents' assessment and in better health according to tension and allergies. Thus, within income classes significant health differences still exist between black and white children. As before, these differences do not uniformly favor children of either race, but most of the significant differences are for the subjective measures and most of them show blacks to have a better rating.

These results can again be contrasted with comparable data for the two infant health measures discussed earlier. Even within income classes, race differences in infant mortality and in the incidence of low birth weight remain large and consistently favor whites (Table 5).

TABLE 4. Gross and Net Race Differences in Children's Health Status

Health Measure	Gross Difference (Black Mean–White Mean)	Low-Income Families (< $5,000/yr): Black Mean (n = 418)	Low-Income Families (< $5,000/yr): White Mean (n = 1,227)	Low-Income Families (< $5,000/yr): Difference	Low-Income Families (< $5,000/yr): "z" Statistic for Black–White Difference	High-Income Families (≥ $5,000/yr): Black Mean (n = 163)	High-Income Families (≥ $5,000/yr): White Mean (n = 2,969)	High-Income Families (≥ $5,000/yr): Difference	High-Income Families (≥ $5,000/yr): "z" Statistic for Black–White Difference	Net Difference
ASSESS	0.162*	0.612	0.589	0.023	0.89	0.614	0.394	0.220*	5.57	0.119†
VISION	−0.002	0.108	0.091	0.017	0.98	0.129	0.127	0.002	0.10	0.009‡
BLOODP	0.013	0.069	0.056	0.013	0.79	0.061	0.052	0.009	0.51	−0.003‡
ALLERGY	−0.068*	0.084	0.108	−0.024	1.39	0.098	0.176	−0.078*	2.57	0.205†
TENSION	−0.139*	0.354	0.456	−0.102*	3.66	0.295	0.484	−0.189*	4.74	−0.153*‡
ABNORMALITY	0.007	0.046	0.037	0.009	0.80	0.037	0.036	0.001	0.03	0.018‡
PERI	−0.039	−0.063	0.117	−0.180*	3.63	−0.101	−0.097	−0.004	0.10	−0.059‡
ABSENT	−0.003	0.045	0.049	−0.004	0.32	0.034	0.043	−0.009	0.51	−0.005‡

* Significant race differences in means at the 5 per cent level of significance. These results hold whether or not an adjustment for the sample design is made in the variances with the exception of ALLERGY in the high-income families, in which case the adjusted "z" is 1.43.

† Net difference equals difference in health levels predicted for blacks and whites assuming that all explanatory variables are fixed at their mean values for the full working sample. We do not present the results of significance tests in these cases because of computational difficulty.

‡ Net difference equals regression coefficient of a race dummy variable (1 = black) from a pooled regression of black and white children that holds constant all other independent variables.

A further way of investigating the nature of race differences in children's health is to look at residual race differences after a much larger list of socioeconomic variables is held constant. This is done with the use of multiple regression analysis.†† The dependent variables in the regression equations are the eight health status measures. For the explanatory variables a set suggested by the economic model of family investment in children's health described in Edwards and Grossman was used.[30] Included are family income; parents' educational attainment; whether the child's father lives with the family; whether the child is a twin or a first-born; whether a foreign language is spoken in the home, an indication of the region of residence and size of city of residence; and the sex of the child (the latter is included only for health measures that are not standardized by sex). These variables are defined in detail in Edwards and Grossman.[30]

Race differences in children's health net of differences in this set of socioeconomic variables are presented in the last column of Table 4. Net differences are computed in two different ways, depending on whether or not there are significant race differences in slope coefficients in the underlying health equations. If there are no significant differences in the slope coefficients by race (as in the case for the dependent variables, BLOODP, VISION, TENSION, ABNORMALITY and ABSENT), the net race difference is represented by the regression coefficient of a race dummy variable (black = 1) from a pooled regression of black and white children that holds constant all other

TABLE 5. Infant Mortality and Birth Weight

	Low Income (< \$5,000/yr.)		High Income (≥ \$5,000/yr.)	
	Blacks	Whites	Blacks	Whites
Infant mortality	43.9	24.2	23.6	18.6
Incidence of low birth weight	13.2	7.6	17.1	6.6

Sources and definitions of health measures are the same as in Table 1.

dependent variables. When there are significant race differences in the slope coefficients (as in the case of the dependent variables PERI, ASSESS and ALLERGY), the net difference is computed according to the following formula: Net difference = $(a_b + b_b \bar{X}) - (a_w + b_w \bar{X})$, where a_b and b_b represent the intercept and vector of slope coefficients estimated when one is using the black subsample, a_w and b_w represent the corresponding coefficients estimated when one is using the white subsample, and $\bar{X}$ represents a vector of means of the set of explanatory socioeconomic variables computed over the entire working sample. In either case, the net difference can be interpreted as that portion of the gross difference that would remain if both race groups had the same mean values of all explanatory variables.

In general, the net differences are not smaller than the gross differences. Indeed, in some cases they are substantially larger and /or change signs. For example, for the tension variable, the net difference is greater than the gross difference, implying that if both black and white families had the same socioeconomic characteristics, the blacks relatively would be even less likely than whites to report excessive tension. Or, in the case of allergies, the net difference implies that blacks would be more likely than whites to report allergies if both blacks and whites had the same

†† Ordinary least squares was used to estimate linear equations using the health measures as dependent variables. When the health measures are dichotomous, this procedure is not correct because the residuals variance will exhibit heteroscedasticity. However, experiments with a more appropriate (and much more costly) estimation procedure—LOGIT—indicated that our results are virtually unchanged when LOGIT is used in place of ordinary least squares.

socioeconomic characteristics. The net difference for the ABNORMALITY variable is also greater than the gross difference, but it still does not increase enough to reach statistical significance. The one important exception to the generalization above is the parents' assessment variable. In this case, the net difference is less than the gross difference.

To sum up, the various statistics in Table 4 suggest the following conclusions. First, our view of race differences in children's health is not altered substantially when income and other socioeconomic variables are held constant. Second, these differences do not obviously favor children of either race. Third, it is notable that for some of the harder measures—the physician's overall assessment, unusually high blood pressure, poor vision—significant race differences are never reported. On the other hand, differences in subjective measures tend to be significant. The latter may reflect actual differences or it may reflect only perceived differences. It may even reflect systematic differences in scaling: for example, a family undergoing many stresses (as a low-income family might) may not place much weight on a child's symptoms of allergy or tension. Indeed, it may only be a visit to a doctor that makes a family aware that a child is afflicted with allergies or is excessively tense. Thus, it is clear that results for these subjective measures must be interpreted with extreme caution.

Income Differences

Gross race differences in children's health did not disappear when various socioeconomic factors (including income) were held constant. Does the same conclusion hold for income-related differences? In other words, to what extent do the gross differences in health status between income classes disappear when additional socioeconomic factors are held constant? To answer this question, we use the same type of multiple regression analysis described earlier. We simplify the analysis, however, by restricting the decomposition of gross income differences to the white sample only.

According to the adjusted "z" statistic, the list of health measures for which there are significant income differences is the same for the white sample as it is for the full black-and-white sample. If the unadjusted "z" statistic is used, however, there is no significant income difference for tension in the white sample, but there is in the white–black sample.

Gross and net income differences for the eight health measures are presented in Table 3. The net income differences are computed similarly to the corresponding net race differences. They should be interpreted as the difference in mean health status between the two income classes if all of the socioeconomic variables (other than income, of course) took the same values in both classes. Unlike the case of race differences, there were no significant differences for health measures in the slope coefficients in the two income classes. The calculations, however, do permit the coefficient of income to be different among high- and low-income families. The theoretical rationale for this is discussed in Edwards and Grossman.[30] The net income difference for any health measure is computed as the coefficient of income multiplied by the difference in mean income in the two income classes. Note that in these equations income is measured as a continuous variable, whereas race is dichotomous. Income in Cycle II is reported in ten classes: less than $500, $500–$999, $1,000–$1,999, $2,000–$2,999 $3,000–$3,999, $4,000–$4,999, $5,000–$5,999, $6,000–$6,999, $7,000–$9,999, $10,000–$14,999, and $15,000 and over. We convert these classes into a continuous variable by assigning midpoints to the closed intervals, $250 to the lowest interval and $20,000 to the highest interval.

The number of health status measures for which statistically significant income differences exist is reduced from three (ASSESS, ALLERGY and PERI) to zero when related socioeconomic factors are held constant. For these three (and for most of the other measures as well) the magnitude of the net difference is substantially smaller than the corresponding gross difference (see the last two columns of Table 3). For example, on the basis of the gross difference, about 20 per cent more of the high-income parents than of the low-income parents assessed their children's health as being very good. When related socioeconomic factors are held constant, this differential is reduced to only 8 per cent. To conclude, no significant income differences in health status are reported when related socioeconomic characteristics are held constant, and the magnitudes of all of these income differences are greatly diminished. The main conclusion to be drawn is clear: gross income differences in health greatly overstate the true relationship between family income and health.

Further insight into the nature of gross income differentials in health status is obtained by study of the precise role of the explanatory socioeconomic variables. Table 6 presents calculations which illustrate how the gross income differences are decomposed among the various explanatory factors for the three health variables that exhibited significant gross income differences in Table 3. The procedure simply is to multiply the coefficients of these explanatory variables by the differences in their mean values in the high- and low-income samples of children. Several results in Table 6 are noteworthy. First, more than 80 per cent of the differences in the four health measures between the high- and low-income subsamples can be accounted for by differences in the independent variables that we have included in our multiple regression equation. Second, a detailed examination of the decomposition indicates that differences in parents' average schooling between high- and low-income families account for about as much or even more of the gross differences as does income itself. And finally, more of the income-related gross differences in children's health are accounted for by differences in correlated socioeconomic and regional characteristics of the child than by family income itself.

Our findings with respect to race and income differences may be compared with those in a recent study of infant mortality

TABLE 6. Components of the Difference in ASSESS, ALLERGY and PERI Between White Children from High- and Low-Income Families*

Component	ASSESS	ALLERGY	PERI
Family income	−0.079	0.016	−0.077
Parents schooling	−0.071	0.045	−0.131
Other family characteristics†	0.001	0.004	−0.011
Characteristics of child‡	−0.003	0.003	0.001
Region	−0.025	−0.005	0.019
City size	−0.005	−0.004	−0.001
Total = predicted gross difference	−0.182	0.059	−0.200
Actual gross difference	−0.195	0.068	−0.214

* Computed from coefficients in a multiple regression which includes the explanatory variables listed in the text.

† These include whether or not a foreign language is spoken in the home and whether or not the father is absent from the home.

‡ These include whether or not the child is a first-born or a twin, and his or her sex. The latter is not included for PERI which is standardized by sex.

by Gortmaker.[31] He attempts to determine what portion of the large income and race differences in infant mortality can be explained by differences in parents' educational attainment, mother's age, the child's birth order and the previous pregnancy experience of the mother. He finds that poor families and black families still display a much higher incidence of infant mortality even when these factors are controlled for. This contrasts with the findings in this article for later childhood. Once again, we are struck by the different views of child health from the alternative perspectives of infancy and midchildhood.

Conclusions

The first point that must be made in concluding is that income and race differences in infant mortality provide a poor and even misleading description of income and race differences in the health of older children for the 1963-65 period. This suggests that while it may be appropriate for one to use infant mortality statistics in broad across-country comparisons of the health status of various populations, one should not use these statistics to indicate the relative health statuses of various groups of older children within the United States.

We do find differences in the health status of black and white children and of children from high- and low-income families, but these differences by no means overwhelmingly favor the white or high-income children. With respect to differences by race, whether or not they are adjusted for differences in associated socioeconomic factors, significant differences exist primarily for the subjective health measures, and these do not always show black children to be rated in poorer health than their white counterparts. In the case of income differences in health, the high-income children do appear to be rated healthier according to most measures, but their advantage is diminished greatly when one controls for related socioeconomic factors like parents' educational attainment. It is important that one notes, however, that with respect to the variable that might reflect the most serious health problems—whether or not the doctor reports the child to have a "significant abnormality"—there are never statistically significant differences either by race or by income.

These results are especially intriguing when one considers that the children in the Cycle II sample were growing up in the late 1950s and early 1960s, a period prior to the introduction of a number of government health programs targeted at the poor such as Medicaid, maternal and infant care projects, and community health centers. A natural follow-up to our study would be similar analyses using a more recent national sample of children.

Implicit in our discussion is the necessity for recognizing the multidimensional nature of health. Our results clearly differ for different health status measures. Poor and black children tend to be rated in better health when subjective health measures are studied, but they are rated as being in the same or worse health when more objective health measures are used. Thus, our findings underscore the importance of treating children's health status as multidimensional, and illustrates how the use of a single health index could lead to erroneous conclusions about health status and its relation to income and race. Of course, when a set of measures is used instead of a single measure, the researcher is faced with more difficulty in synthesizing his results. But the fact that one is unlikely to be able to draw neat conclusions from a multifaceted analysis of health is not an acceptable reason to restrict that analysis to a single health measure.

The primary purpose of this article has been to expand upon commonly held notions about income and race differences in children's health by the use of a study of children who were 6 to 11 years old in 1963-65. We have found that the unambiguous picture drawn from infant mortality statistics becomes fuzzy and difficult to decipher when a collection of morbidity measures provides the medium. This raises an important and, as yet, unanswered question, especially if our findings are reinforced by other studies using different measures and different time periods. Why are the income and race differences in infant mortality so striking when corresponding differences in mid-childhood morbidity are not? This divergence is not simply a result of the type of measure (mortality vs. morbidity); differences in the mortality of older children also are less striking. Perhaps the health differences between various demographic groups are minimized in the mid-childhood years. If so, we need to know why. The answer to these questions are clearly pertinent to the conduct of public policy toward the welfare of children.

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Erratum

The figures on Table 1, page 181, of "Predicting the Outcome of Primary Care," by D. D. Wright and R. L. Kane, *Medical Care,* February 1982, are incorrect. The predictive value of a positive test should be 0.785, and the predictive value of a negative test should be 0.571.