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ABSTRACT

The purpose of this research is to investigate empirically the determinants of children's health with particular reference to home and local environmental variables such as family income, parents' schooling, preventive medical care, and health manpower availability. Wherever possible, children's health is studied in the context of the nature-nuture controversy. The findings indicate that family characteristics (especially the mother's schooling) do have significant effect on children's health and that preventive care is an important vehicle in the case of dental health, but not in the case of physical health. Similarly, the greater availability of dentists has a positive effect on dental health, but greater availability of pediatricians does not alter the physical health measures. (Author/JD)

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RESEARCH SUMMARY SERIES

Determinants of Children's Health

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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Abstract

The purpose of this research is to investigate empirically the determinants of children's health with particular reference to home and local environmental variables such as family income, parents' schooling, preventive medical care, and health manpower availability. Wherever possible, children's health is studied in the context of the nature-nurture controversy. The findings indicate that family characteristics (especially mother's schooling) do have significant impacts on children's health and that preventive care is an important vehicle for this impact in the case of dental health but not in the case of physical health. Similarly, the greater availability of dentists has a positive impact on dental health, but greater availability of pediatricians does not alter the physical health measures.

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Foreword

Studies dealing directly with maternal and child health care represent an important part of the research activities of the National Center for Health Services Research.

The relative importance of heredity (nature) and the home and school environment (nurture) have been studied in attempts to define cognitive development in children. However, the degree to which environmental factors affect health status of children have only recently been addressed by researchers using multivariate techniques and survey data.

This report represents a summary of six closely related studies conducted by Michael Grossman, Ph.D. and colleagues on the determinants of child health, with particular reference to home and local environmental variables, including parents' schooling, family income, family size and mother's working status; local environmental factors being health manpower availability, public provision of fluoridated water, climate and air pollution.

Highlighted in this study is the necessity of explicitly recognizing the multidimensional nature of health; thereby underscoring the importance of treating children's health status of multidimensional and illustrating how the use of a single health index could lead to erroneous conclusions about health status and its relation to income.

This research provides a framework identifying important determinants of children's health, mechanisms by which these determinants affect health, and groups in the population for whom the effects are relatively large. The conclusions presented herein are most relevant to policy on health programs for children and should have some impact in that arena.

Gerald S. Rosenthal, Ph.D.
Director
July 1981

This NCHSR Research Summary was written by the following staff of the National Bureau of Economic Research, New York, New York: Michael Grossman, Ph.D., Principal Investigator; Douglas Coate, Ph.D., Research Associate; Linda N. Edwards, Ph.D., Research Associate; Robert A. Shakotko, Ph.D., Research Economist; and Dov Chernichovsky, Ph.D., Visiting Scholar. The study was supported through grant HS 02917 from the National Center for Health Services Research. The final report, PB 80 163 1603, is available from the National Technical Information Service, Springfield, VA 22161, 703/487-4650.

Additional copies of this summary may be obtained on request from the NCHSR Publications and Information Branch, Room 7-44, 3700 East-West Highway, Hyattsville, MD 20782 (301/436-8970). Current NCHSR publications are listed in the back of this publication.

Contents

Objective

The objective of this research is to investigate empirically the determinants of children's health with particular reference to home and local environmental factors.[1] Home environmental factors include basic family background variables such as parents' schooling, family income, family size, and mother's labor force status. They also include mechanisms by which background variables operate such as preventive medical care (preventive services delivered by physicians), preventive dental care, and nutrition. Local environmental factors include health manpower availability, public provision of fluoridated water, climate, and air pollution.

Wherever possible, we study children's health in the context of the nature-nurture controversy. Despite the existence of a massive (but inconclusive) literature on the relative importance of heredity (nature) and the home and school environment (nurture) in the determination of cognitive development, the corresponding issue has not been directly addressed by researchers in child and adolescent health. This is partly because much of the health research is limited either to poverty or to minority populations, and partly because researchers who use representative samples do not adopt the multivariate context necessary for distinguishing between genetic and environmental influences. Our research uses multivariate statistical techniques to provide some evidence of the degree to which the family and local environment acts in determining the health levels of representative samples of children and adolescents.

Methods of procedure

Our research consists of six closely-related studies. Multivariate techniques are used to study the determinants of children's health using several different survey sources. Analytically, children's health is examined within the context of an economic model of fertility. In this model the parents' preferences depend on their own consumption, their family size, and the "quality" of each child. Child "quality" refers to those characteristics of the child that are considered worthwhile by the parents: his health, sex, wealth, social adjustment, intellectual development, etc. Therefore, when parents choose their optimal family composition, they choose not only how many children they will have but also what portion of the family's resources will be devoted to each child. This choice is made in the usual way: parents choose the number and quality of children, as well as of other consumption goods, so as to maximize their utility subject to the constraints imposed by their wealth (their potential earned and nonearned income) and the various prices they face. In the case of children, there is a further constraint in the form of children's genetic endowments which in part determine their quality. Genetic endowments act as a constraint because they are largely outside of the family's control.

The cost of rearing children and the cost of various components of their quality are determined by a fundamental insight embedded in the household production function approach to consumer behavior: consumers produce their basic objects of choice with inputs of goods and services purchased in the market and their own time. This insight is of particular relevance in dealing with children and their health because parents obviously do not buy these objects of choice directly in the market; both a child's home environment and his genetic endowment are important determinants of his ultimate health level. Therefore, the price of health depends on the cost of the parents' or other caretakers' time, the prices of medical care, nutrition, and any other purchased inputs used to improve children's health. It also depends on the number of children in the family because the more

children there are in the family, the more costly it is to raise their average health level. In addition, to the extent that there are systematic differences in the ability of families to produce children's health with given inputs, these differences in efficiency are also relevant. For example, more educated parents are more likely to be able to follow doctors' instructions, to have general information about nutrition, and to be willing and able to acquire medical information from published materials. Consequently, one would expect more educated parents to be more efficient in producing healthy children.

Given these considerations, the following factors are expected to influence children's health levels: the child's exogenous (genetic) health endowment, family wealth, parents' wage rates, family size, parents' educational attainment and other measures of their efficiency in household production, and the direct and indirect costs of medical care and other market health inputs (vitamins, sanitation, etc.) (The indirect costs of medical care are generated by the time spent in traveling, waiting, and obtaining information about this care.) The relationship between the child's ultimate health and this set of factors may be termed a demand function for the output of health. Empirically, we estimate equations that may be termed mixtures of health demand and production functions. In addition, we estimate derived demand functions for endogenous health inputs such as medical care, dental care, and nutrition.

In the first study we examine the relationship between a number of family characteristics and the health of white children aged 6 through 11 years in the period 1963 through 1965. The data set employed is Cycle II of the U.S. Health Examination Survey (HES II). HES II 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.[2] The data comprise complete 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 detailed physical examinations given to the children by pediatricians and dentists employed by the Public Health Service. For this study, we use data for white children who live with either both of their parents or with their mothers only. The exclusion of children for whom there were missing data brings the final sample to 4,196. The characteristics of the final sample do not differ significantly from those of the

full sample. (This comment applies to our other studies with the HES.) Our aim is to paint a complete picture of the health of this childhood cohort. Therefore, a variety of health measures from physical examinations by pediatricians and dentists and from interviews with parents and school officials are analyzed.

In the second study we explore race and income differences in the health of children in the Cycle II data set. We compare such differences in mid-childhood to race and income differences in infant mortality and birth weight. The study is based on a working sample of 4,777 children.

In the third study we investigate the health of white adolescents aged 12 through 17 years in the 1966–70 period. The data set employed is Cycle III of the Health Examination Survey (HES III), a national sample of 6,768 noninstitutionalized youths. The working sample, which is similar to the working sample of white children, contains 4,121 youths. The data collected in HES III are supplemented by two medical resource inputs specific to the youth's county of residence (the number of pediatricians per capita and the number of dentists per capita) and information on the presence of controlled or natural fluorides in the water supply that services the youth's community. Our research in this study focuses on the heredity environment controversy by examining in detail the impacts of four important components of the home and local environment: family background, preventive health care, health manpower specific to the youth's county of residence (the number of pediatricians per capita and the number of dentists per capita), and information on the presence of controlled or natural fluorides in the water supply system that services the youth's community. Four specific health indicators are studied: oral health, obesity, anemia, and corrected distance vision. These indicators are chosen because they represent health problems that are capable of being affected by family decisions concerning diet, other forms of at-home health care, as well as by medical and dental care.

Two types of relationships are estimated: a health production function and a derived demand function for preventive care. The resulting estimates permit us to answer the following questions. What is the size of the home environmental effect on adolescent oral and physical (obesity, anemia, corrected distance vision) health outcomes? How important is the home environment as a determinant of the demand for preventive dental and medical care? How large are the effects of dentists, preventive care, and fluoridation on oral health outcomes? How large are the effects of pediatricians and preventive care on physical health out-

comes? In addressing the last two questions, we recognize explicitly the commonsense proposition that an increase in a community's physician or dental manpower will not increase health outcomes unless it encourages more utilization of medical care services. Note that we could not study relationships among preventive care, health manpower, and health outcomes in Cycle II of the HES because there are no measures of preventive care in Cycle II.

Since the estimated impacts of preventive care are of particular interest, it is important to define our measures of preventive dental and medical care precisely. They are based on whether or not the youth had a dental or medical check-up within the past year. In the case of a medical check-up, the doctor seen could have been a general practitioner, an internist, an obstetrician-gynecologist, or a pediatrician. The preventive care measures distinguish between two groups of adolescents: (1) those who received preventive care; and (2) those who received no care at all or only curative care. These two measures of preventive care are preferred to alternatives like the number of dental or physician visits or the receipt of curative care alone because our measures are less likely to reflect reverse causality from poor health to more medical care. Of course, our measures reflect the possibility that adolescents received treatment as well as an examination, but the appropriate treatment of problems revealed by an annual check-up is an integral component of preventive care.

Although youths receive medical care services from several types of physicians, the only health manpower variables in the derived demand function for preventive medical care is the number of pediatricians per capita in the youth's county of residence. This measure of availability is selected because general practitioners, internists, and obstetrician-gynecologists treat adults, while pediatricians do not. Therefore, we focus on pediatricians as the most important supplier of physicians' services to youths. Moreover, we maintain that the number of pediatricians per capita is a relevant determinant of the propensity to obtain preventive care even for youths whose parents change the youth's usual source of a care from a pediatrician to another physician before the youth reaches the age of 17. Here our argument is that current access and other indirect costs of obtaining care are heavily dependent on past costs (costs when the youth was a child) and that past costs are negatively related to the pediatrician variable.

In the fourth study we shift from cross-sectional to panel data to shed further light on the pure environmental contribution of

family background in general and parents' schooling and family income in particular to the health of adolescents. We also examine whether health causes cognitive development, cognitive development causes health, or both cause each other. The sample consists of the white adolescents in Cycle III of the HES who were also examined in Cycle II when they were children and who lived with either both of their parents or with their mothers only as of the date of the Cycle II examination. After deletion of observations with missing data, the final sample size is 1,434. This panel data set contains measures of health and cognitive development in adolescence, corresponding measures in childhood, and family background variables.

To study the dynamics of health and cognitive development and to deal with the problem of simultaneity, we investigate the causal priorness of these measures. Specifically, we assume that the processes that generated them can be specified and estimated as a simple first-order autoregressive process. We show that, if the genetic impact on these variables is restricted to the determination of initial conditions, then the estimates of the time paths will be free of genetics bias and will reflect the true environmental effects of family background variables. Empirically, we estimate two multivariate equations: one relating adolescent health to childhood health, childhood cognitive development, and family background; and a second relating adolescent tive development to childhood cognitive development, childhood health, and family background. In the health equation, the coefficient of family background gives an estimate of the environmental effect that controls for the initial or inherited level of health. The coefficient of childhood cognitive development indicates whether the latter variable causes adolescent health. The adolescent cognitive development equation can be interpreted in a similar manner. In particular, the coefficient of childhood health measures the significance and size of the causal relationships from health to cognitive development.

In the fifth and sixth studies, we investigate relationships among children's growth, diet, and family background. The growth measures are height, weight, and head circumference. The diet measures are intakes of calories and proteins. The fifth study is based on infants and young children between the ages of zero and 36 months in the 1968 70 period who were members of the Ten State Nutrition Survey (TSNS). In this survey, 30,000 families in ten states were selected from low-income enumeration districts. Demographic data were obtained from 24,000 of the families by interview. Selected subgroups of infants and young

children, adolescents, pregnant or lactating women, and persons over 60 years of age received detailed dietary and biochemical evaluations. Dietary intake data for the previous 24 hours were collected for about 1,700 children less than three years of age by interview of the homemaker. Of these children less than 1,200 could be matched with the characteristics of their family in the editing of the data. This sample was reduced to a working sample of roughly 500 children by deleting all observations (children) with missing data for those variables specified in our model and by deleting all children whose parents reported their age to be 12, 24, or 36 months.

The sixth study is based on children aged 1 through 5 in the 1971-75 period who were members of Cycle I of the Health and Nutrition Examination Survey (HANES I). HANES I is a national sample of the population of the United States, with oversampling of low-income families. The entire HANES sample, which was collected between 1971 and 1975 by the National Center for Health Statistics, contains approximately 28,000 individuals between the ages of 1 and 74. Slightly less than 3,000 children aged 1 to 5 years were included in the sample. Dietary intake data for the previous 24 hours were collected for children less than five years of age by interview of the homemaker. A working sample of 2,515 was created by deleting all observations (children) with missing data. The roughly 450 children deleted from the sample did not differ significantly from the working sample in terms of age and sex-specific nutrient intakes or height, head, and weight growth.

Three types of empirical results were presented in the two studies of growth and diet. These are (1) descriptive statistics of variables in the TSNS and in HANES I that are important in an analysis of children's diet and growth; (2) ordinary least squares multiple regressions in which diet or growth are dependent variables and exogenous child and family characteristics are independent variables; and (3) two-stage least squares estimates of a structural model in which diet and growth are determined simultaneously.

Summary of findings

Our most important findings pertain to the nature-nurture controversy; the impacts of preventive care and health manpower; income and race differences in children's health, the multidimensional nature of children's health and relationships among growth, diet, and family background. These findings are highlighted below.

1. Nature-nurture controversy

The home environment in general and mother's schooling in particular play an extremely important role in the determination of children's health. It is not surprising to find that a child's home environment has a positive impact on his health with no other variables held constant. Moreover, it is difficult to sort out the effect of nature from that of nurture because it is difficult to measure a child's genetic endowment and because genetic differences may induce environmental changes. Nevertheless, we have accumulated a number of suggestive pieces of evidence on the true importance of the home environment. With birth weight, mother's age at birth, congenital abnormalities, other proxies for genetic endowment, and family income held constant, parents' schooling has positive and statistically significant effects on many measures of health in childhood and adolescence. Children and teenagers of more educated mothers have better oral health, are less likely to be obese, and less likely to have anemia than children of less educated mothers. Father's schooling plays a much less important role in the determination of oral health, obesity and anemia than mother's schooling. The latter findings are important because equal effects would be expected if the schooling variables were simply proxies for unmeasured genetic endowments. Moreover, they are especially strong results because oral health, anemia, and obesity reflect health measures that can be modified by inputs of medical care, dental care, proper diet, and parents' time.

Several additional pieces of evidence underline the robustness of the above findings. The relative magnitude of the effect of mother's schooling on oral health, measured by the number of decayed permanent teeth in adolescence, is not altered when the periodontal index, a proxy for genetic oral health endowment, is held constant. When oral health is examined in a longitudinal context, mother's schooling dominates father's schooling in the determination of the periodontal index in adolescence, with the periodontal index in childhood held constant. Similar comments apply to the effect of mother's schooling on school absence due to illness in adolescence (with school absence due to illness in childhood held constant) and to the effect of mother's schooling on obesity in adolescence (with obesity in childhood held constant).

The identification of plausible mechanisms via which mother's schooling influences children's health has increased our confidence that the impact of schooling represents a behavioral effect as opposed to a genetic effect or a statistical artifact. Children of highly educated mothers come from small families and are likely to have seen a dentist for preventive reasons in the past year. In turn, family size is negatively related to several measures of adolescent health, and preventive care is positively related to oral health. Another mechanism is that cognitive development in childhood has a positive effect on health in adolescence, and cognitive development is positively related to mother's schooling.

To summarize, we have evidence that nurture as opposed to nature plays an important role in the health of children and youths and that the effect of mother's schooling is behavioral as opposed to genetic. Thus public policies aimed at children's health must try to offset the problems encountered by children of mothers with low levels of schooling; in particular, they should try to improve the skills in uneducated mothers in their capacity as the main provider of health care for their children.

2. Impacts of preventive care and health manpower

With regard to the role of preventive dental care, youths who received a preventive dental check-up within the past year and youths exposed to fluoridated water have much better oral health than other youths. Moreover, the probability of a preventive examination is positively related to the number of dentists per capita in a youth's county of residence. This implies that a program to increase the availability of dentists in medically deprived areas would improve the oral health of youths in these areas. Indeed, we estimate that the payoffs to increasing dental man-

power by one per thousand population are about the same as the payoffs to the coverage of preventive dental care under national health insurance.

The probability of obtaining a preventive check-up by a doctor is also positively related to family income and to the number of pediatricians per capita in the county of residence. But we have little evidence that preventive care delivered to youths by physicians is effective in terms of their physical health. Therefore, the payoffs to national health insurance for physicians' services delivered to youths or programs to increase the availability of doctors who treat youths may be small.

The above conclusions with respect to the effectiveness of preventive dental care and lack of effectiveness of preventive medical care are subject to a number of important qualifications. The physical health measures of anemia, obesity, and abnormal corrected distance vision may not necessarily be amenable to preventive care by physicians. Obviously, glasses are prescribed by eye specialists. Pediatricians, internists, and general practitioners can, however, play an important role in eye care by giving the youth an initial eye examination and referring his parents to an eye specialist if necessary.

In the cases of anemia and obesity, our conclusion is that preventive medical care is not effective, although it may be efficacious. Preventive care is efficacious if there exists a course of action that can be taken after detection of an adverse symptom that will reduce the need or extent of later treatment. Whether preventive care is efficacious or not is a medical question. Preventive care is said to be effective if a unit of preventive activity by an individual improves his later health. Effective preventive care requires adequate symptomatic identification, efficaciousness, and compliance with the prescribed course of action. Hence, effectiveness is a stricter requirement than efficaciousness.

In general a contrast between dental and medical services tends to exist in attitudes toward prevention, emphasis of training (on curative in the medical system), and narrowness of the application. The measures of dental health are more specific to the things that dentists do than the measures of physical health. Also the prevalence of dental cavities is much greater than the specialty-related problems many physicians see. Even the specialized physician is more of a generalist than the dentist.

In spite of these qualifications, our findings are important because the Health Examination Survey is the only large representative sample of children and youths taken from the recent past for which such a rich array of health and family background

data are available. Hence our results with regard to the effectiveness of various kinds of preventive care will provide a benchmark for comparisons as future samples become available.

3. Income and race differences in children's health

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 and birth weight data. 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 socioeconomic factors, significant differences exist only for subjective health measures (parental assessment of child's health, prevalence of tension, and prevalence of allergies). In the cases of allergies and tension, prevalence rates are smaller among black children than among white children. With regard to income differences in health, the high-income children do appear to be rated healthier according to measures other than allergies and tension, but their advantage is greatly diminished when one controls for related socioeconomic factors like parents' educational attainment. It is important to note 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.

Since income is not an important determinant of children's health, policies that aim to improve the well-being of children via income transfers, such as those advocated by the recent Carnegie Council on Children would have, at best, very small effect on health.[3] This implication is subject to the modification that, in the long run, income transfers might raise health by narrowing schooling differentials. But the direct effect of income transfers, which holds parents' schooling constant, is small.

4. Multidimensional nature of children's health

Our findings highlight the necessity of explicitly recognizing the multidimensional nature of health. For example, poor children are in worse health when traditional health measures are used, but they tend to be in better health when the prevalence rates of allergies and tension are under study. Such fine distinctions are

hidden when a single index like infant or childhood mortality is used. These results underscore the importance of treating children's health status as multidimensional and illustrate how the use of a single health index could lead to erroneous conclusions about health status and its relation to income. That is, positive and negative income effects might offset each other in a single index.

To be sure, the positive effects of income on allergies and tension may reflect in part a reporting problem. That is, high-income parents may be more cognizant of the presence of these conditions than low-income parents. Yet it is plausible that the results are not due solely to reporting bias. Higher-income parents may be more demanding regarding their children's behavior, creating more tension and accompanying allergies than lower-income parents. Even if the results are due entirely to perceived, rather than actual, differences, they are important. As income rises over time, the perceived prevalence rates of these conditions will rise. This will tend to increase utilization of physicians' services and further fuel the rate of inflation in medical care prices.

5. Diet, growth, and family background

Average nutrient intakes (calories and protein) of infants and young children are well above recommended dietary standards in both the TSNS and HANES I studies. Moreover, nutrient intakes for children in households of lower economic status are very similar to intakes of children in households of higher economic status. Rates of children's growth are also similar in these households.

There are substantial effects of protein intakes on children's height and head growth, even though protein is consumed in excess of dietary standards. This finding and the apparent correlation between children's growth and their cognitive development brings to question the adequacy of present protein standards. Could American mothers, who provide very high protein diets for their children in household at all levels of socioeconomic status know more about what constitutes an adequate diet for their children than the experts do?

In general family income and parents' schooling have statistically significant but very small positive effects on the nutrient intakes of young children. Hence, we have little evidence that intakes of calories and proteins are mechanisms via which family

background affects the growth of young children. Indeed, when nutrition is not held constant, the impact of family background on height, weight, and head circumference are very small.

References to footnotes

1. The final report summarized here is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The order number is PB 80 163 603.

2. A full description of the samples, the sampling technique and data collection is presented in the National Center for Health Statistics, *Plan, Operation and Response Results of a Program of Children's Examinations.* U.S. Department of Health, Education, and Welfare, Public Health Service, Vital and Health Statistics, Series 1, No. 5, 1967.

3. Keniston, Kenneth and the Carnegie Council on Children. *All our Children: The American Family under Pressure.* New York: Harcourt Brace, Jovanovich, 1977.

Variables and data sources used in six studies for determinants of children's health [A]

Study	Variable name	
		Child Health Measures
I [B]	PFGHEALTH	parental assessment of child's health.
	HEIGHT	
	WEIGHT	
	HEARING	
	ABVIS	visual acuity
	HDBP	blood pressure
	ALLEG	hayfever or allergies
	TENS	parental assessment of tension
	ACABN	presence of one or more significant acquired abnormalities on physical exam.
	APERI	periodontal index
	SCHABS	excessive school absence for health reasons in last six months.
		Explanatory Variables
	FINC	family income
	MWORKPT	mother works part-time
	MWORKFT	mother works full-time
	MEDUCAT	mother's years of formal education
	FEDUCAT	father's years of formal education
	FLANG	foreign language spoken in home
	LIGHT1	birth weight under 4.4 pounds
	LIGHT2	birth weight under 5.5 pounds
	CABN	significant congenital abnormality found by doctor
	NOFATH	
	MALE	
	LMAG	mother's age ≤ 20 at birth
	HMAG	mother's age ≥ 35 at birth
	FIRST	child is first born in family
	TWIN	

Study	Variable name	
	URB1	if child lives in urban area with population of 3 million
	URB2	If child lives in urban area with population 1 and 3 million
	URB3	if child lives in urban area with less than 1 million
	DENT12	not been to dentist in last year
	DENT3	never been to dentist
	LESS20	persons in household 20 years or less
	NEAST	if child lives in northeast
	MWEST	midwest or south, respectively
	SOUTH	
		Child Health Measures
II [B]	PASSESS	parental assessment of child's overall health
	HEIGHT	
	ABVIS	visual acuity
	HDBP	blood pressure
	ALLEG	hayfever or allergies
	TENS	parental assessment of tension
	ACABN	presence of one or more significant acquired abnormalities
	APERI	periodontal index
	SCHABS	excessive school absence for health reasons in last six months
	FINC	family income
	RACE	
	LIGHT	birth weight under 5.5 pounds
	INFANTMORTALITY [C]	
		Health Measures
III [D]	APERI	periodontal index
	IDECAY	number of decayed permanent teeth
	OBESE	obesity
	PVIS	poor distance vision or wear glasses
	ANEMIA	
		Preventive Medical Care Measures
	DTPREV	saw dentist in past year for check-up
	DRPREV	saw doctor in past year for check-up

Study	Variable name	
	FLUOR	community uses naturally fluoridated or controlled fluoridated water [E]
		Other Variables
	FINC	family income
	FEDUCAT	father's years of formal schooling
	MEDUCAT	mother's years of formal schooling
	NOFATH	
	FLANG	foreign language spoken in home
	LESS20	persons in household 20 years or less
	MWORKFT	mother works full-time
	MWORKPT	mother works part-time
	DENT	number of dentists/1000 population in community [F] of residence
	PED	number of pediatricians per 1000 population in community of residence
	NEAST	equals one if youth lives in northeast
	MWEST	midwest or south respectively
	SOUTH	
	URB1	equal one if youth lives in area greater than 3 million
	URB2	equal one if youth lives in area between 1 and 3 million
	URB3	in urban area less than one million
	NURB	lives in non-urbanized area
	LMAG	mother's age ≤ 20 at birth
	HMAG	mother's age ≥ 35 at birth
	LIGHT1	birth weight under 4.4 pounds
	LIGHT2	birth weight under 5.5 pounds
	FYPH	medical difficulty with youth before age of one
	ABN	physician's diagnostic impression of significant abnormality
	TWIN	
	FIRST	child is first born in family
	AGE	age of youth
	MALE	
		Cognitive Development [L]
IV [H]	WISC	youth's IQ measured by vocabulary and block design subtests of the Wechsler Intelligence Scale for children

tudy	Variable name	
	WRAT	school achievement measured by the reading and arithmetic subtests of the Wide Range Achievement Test
		Health Measures [I]
	APERI	periodontal index
	APN	physician's diagnostic impression of significant abnormality
	HDBP	blood pressure
	OBESE	
	PFGHLEATH	parental assessment of child's health
	SCHABS	excessive school absence for health reasons in the last six months
		Family and Youth Characteristics [B]
	FEDUCAT	father's years of formal schooling
	MEDUCAT	mother's years of formal schooling
IV [H]	FINC	family income
	LESS20	persons in household less than 20 years
	MWORKFT	mother works full-time
	MWORKPT	mother works part-time
	NEAST	equals one if youth lives in northeast
	MWEST	midwest or south respectively
	SOUTH	
	URB1	if youth lives in urban area with population of 3 million
	URB2	if youth lives in urban area between 1 and 3 million
	URB3	if youth lives in area of less than one million
	NURB	youth lives in non-urban area
	LIGHT1	youth's birth weight under 4.4 pounds
	LIGHT2	youth's birth weight under 5.5 pounds
	FYPH	parental assessment of child's health at one year
	BFED	child was breast fed
	LMAG	mother's age $\leq$ 20 at birth
	HMAG	mother's age $\geq$ 35 at birth
	NOFATH	
	FIRST	youth is first born in family
	TWIN	

Study	Variable name	
	FLANG	foreign language is spoken in home
	MALE	
	AGE	age of youth
	Diet Variables	
V[J]	CALORIES	daily consumption
	PROTEIN	
	Children's Growth	
	HEIGHT	
	WEIGHT	
	HEAD CIRCUMFERENCE	
	Children's Health	
	PNEUMONIA	lifetime number of cases
	DIARRHEA	cases in prior 6 months
	Genetic and Parental Traits	
	AGE	
	SEX	
	BIRTHWEIGHT	
	RACE	
	MOTHER's HEIGHT	
	FINC	
	FAMSIZE	
	MEDUCAT	mother's years of formal schooling
	URBAN	
	FOOD STAMPS	
	Diet Variables	
VI[K]	CALORIES	
	PROTEIN	
	VITAMIN C	
	Children's Growth	
	HEIGHT	
	WEIGHT	
	HEAD CIRCUMFERENCE	
	Children's Health	
	HOSPITALIZATIONS	lifetime number
	COLDS	number in the past 6 months

Study	Variable name	
	Genetic and Parental Traits	
	AGE	
	SEX	
	BIRTH WEIGHT	
	BIRTH ORDER	
	RACE	
	MOTHER'S HEIGHT	
	MOTHER'S WEIGHT	
	FATHER'S HEIGHT	
	FINC	
	FAMSIZE	
	EDUCATION	years of schooling of household head
	SEX OF HOUSEHOLD HEAD	

Note: Data sources are listed under study column. Exceptions are noted directly under variable name.

A – All studies are contained in NTIS PB 80-168-603, "Determinants of Children's Health."

Study I: Children's Health and The Family

Study II: Income and Race Differences in Children's Health

Study III: Adolescent Health, Family Background and Preventive Medical Care

Study IV: The Dynamics of Health and Cognitive Development in Adolescence

Study V: The Choice of Diet for Young Children and Its Relationship to Children's Growth

Study VI: An Economic Analysis of The Diet, Growth, and Health of Young Children in the United States

B – National Center for Health Statistics. *U.S. Health Examination Survey, Cycle II.* This survey is a national sample of non-institutionalized children aged 6 to 11 years in 1963-1965.

C – National Center for Health Statistics. *Infant Mortality Rates: Socioeconomic Factors*, Series 22, No. 16, Table 3, p. 14, United States 1964-1966.

D – National Center for Health Statistics. *Plan and Operation of a Health Examination Survey of U.S. Youths 12-17 Years of Age.* U.S. Department of Health, Education and Welfare, Public Health Publication No. 1000, Series 1, No. 8, 1969.

E – Fluoridation is indicated by a dichotomous variable equal to one if the community in which the youth resides uses naturally fluoridated or controlled fluoridated water. Respective sources for natural fluoridation

and controlled fluoridation are: Division of Dental Health, National Institutes of Health. *National Fluoride Content of Community Water Supplies, 1969.* Washington, D.C.: GPO, 1979; Division of Dental Health, National Institutes of Health. *Fluoridation Census* 1969. Washington, D.C.: GPO, 1970.

F — American Dental Association, Bureau of Economic Research and Statistics. *Distribution of Dentists in the United States by State, Region, District, and County, 1968.* Chicago: American Dental Association, 1969.

G — Used number of pediatricians (PED) per capita in the country for the year 1964 from the American Medical Association. PED in 1964 is used as a proxy for the number in 1968.

H — Sample consists of roughly one-third of adolescents in Cycle III, of the Health Examination Survey (HES) who were also examined in Cycle II, when they were children. Specifically of the total number of children in HES, Cycle II; 2,177 are also in Cycle III thus constituting a longitudinal data set on these 2,177 youths with measures of health and cognitive development of the same youth at two different ages.

I — Analysis uses data from Cycle II, Cycle III of the Health Examination Survey.

J — Center for Disease Control. *The-State Nutrition Survey in the United States, 1968–1970. Highlights.* DHEW Pub. No. (HSM) 72-8134. Atlanta, Georgia: Health Services and Mental Health Administration, 1972. This data source is used to analyze the nutritional status of children up to the age of 36 months in poor American families.

K — National Center for Health Statistics. *Plan and Operation of the Health and Nutrition Examination Survey.* U.S. Department of Health Education, and Welfare, Public Health Service Publication No. (HPA) 76-1310, Series 1, No. 10a, 1975.

Current NCHSR Publications

National Center for Health Services Research publications of interest to the health community are available on request to NCHSR, Publications and Information Branch, 3700 East-West Highway, Room 7-44, Hyattsville, MD 20782 (telephone: 301/436-8970). Mail requests will be facilitated by enclosure of a self-addressed, adhesive-backed mailing label. These publications also are available for sale through the National Technical Information Service (NTIS), Springfield, VA 22161 (telephone: 703/487-4650). PB and HRP numbers in parentheses are NTIS order numbers. Publications which are out of stock in NCHSR are indicated as available only from NTIS. Prices may be obtained from the NTIS order desk on request.

Research Digests

The *Research Digest Series* provides overviews of significant research supported by NCHSR. The series describes either ongoing or completed projects directed toward high priority health services problems. Issues are prepared by the principal investigators performing the research, in collaboration with NCHSR staff. Digests are intended for an interdisciplinary audience of health services planners, administrators, legislators, and others who make decisions on research applications.

(HRA) 76-3144	Evaluation of a Medical Information System in a Community Hospital (PB 264 353, available NTIS only)
(HRA) 76-3145	Computer-Stored Ambulatory Record (COSTAR) (PB 268 342)
(HRA) 77-3160	Program Analysis of Physician Extender Algorithm Projects (PB 264 610, available NTIS only)
(HRA) 77-3161	Changes in the Costs of Treatment of Selected Illnesses, 1951-1964-1971 (HRP 0014598, available NTIS only)
(HRA) 77-3163	Impact of State Certificate-of-Need Laws on Health Care Costs and Utilization (PB 264 352, available NTIS only)
(HRA) 77-3164	An Evaluation of Physician Assistants in Diagnostic Radiology (PB 266 507, available NTIS only)
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(HRA) 77-3171	Analysis of Physician Price and Output Decisions (PB 273 312)

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The *Research Summary Series* provides rapid access to significant results of NCHSR-supported research projects. The series presents executive summaries prepared by the investigators. Specific findings are highlighted in a more concise form than in the final report. The *Research Summary Series* is intended for health services administrators, planners, and other research users who require recent findings relevant to immediate programs in health services.

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(HRA) 77-3176	Quality of Medical Care Assessment Using Outcome Measures (PB 272 455)
(HRA) 77-3183	Recent Studies in Health Services Research, Vol. II (CY 1976) (PB 279 198)
(PHS) 78-3187	Criterion Measures of Nursing Care Quality (PB 287 449)
(PHS) 77-3188	Demonstration and Evaluation of a Total Hospital Information System (PB 271 079)
(PHS) 78-3192	Assessing the Quality of Long-Term Care (PB 293 473)
(PHS) 78-3193	Optimal Electrocardiography (PB 281 558)
(PHS) 80-3199	Comparisons of Prepaid Health Care Plans in a Competitive Market: The Seattle Prepaid Health Project
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(PHS) 78-3219	Needed Research in the Assessment and Monitoring of the Quality of Medical Care (PB 288 826)
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(PHS) 79-3220	Emergency Medical Services Systems Research Projects, 1978 (PB 292 558)
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(HRA) 77-3182 Controlling the Cost of Health Care (PB 266 885)

Program Solicitations

(PHS) 81-3292 Grants for Research on Health Promotion and Disease Prevention
(PHS) 81-3299 Grants for Dissertation Support, 1981

p-21192d

NCHSR Fact Sheets

NCHSR Fact Sheets provide concise information on NCHSR's organization and mission, as well as on key problems in health services and research directed toward meeting health care needs.

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United Mine Workers of American Health Care Plan
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NCHSR Research Grant Application and Scientific/Technical Merit Review Procedures
Computer Applications in Health Care

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16. Abstracts

The purpose of this research is to investigate empirically the determinants of children's health with particular reference to home and local environmental variables such as family income, parents' schooling, preventive medical care, and health manpower availability. Wherever possible, children's health is studied in the context of the nature-nurture controversy. The findings indicate that family characteristics (especially mother's schooling) do have significant impacts on children's health and that preventive care is an important vehicle for this impact in the case of dental health but not in the case of physical health. Similarly, the greater availability of dentists has a positive impact on dental health, but greater availability of pediatricians does not alter the physical health measure.

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Linda A. Siegenthaler, NCHSR Project Officer; 301/436-8944

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