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8 Children's Health Problems: Implications for Parental Labor Supply and Earnings

David S. Salkever

A considerable amount of empirical research has been carried out on the economic impact of adults' health problems (e.g., Bartel and Taubman 1979; Luft 1975; Grossman and Benham 1974). A principal objective of the research has been to estimate the effects of these problems on the labor supply and earnings of illness victims. Policymakers and analysts have also expressed interest in these estimates as inputs to the process of allocating health sector resources among prevention and treatment programs for various diseases (Fuchs 1966; Fein 1958; Klarman 1965; Rice, Feldman, and White, 1976). By contrast, very few econometric studies have examined the economic impact of health problems on other family members. In particular, little is currently known about impacts on the spouses of illness victims or the parents of children with health problems. As a result, consideration of these impacts in policy analyses have been based on conjecture or, more frequently, ignored altogether.

The present study focuses on the effect of chronic health problems and disabilities among children on parental labor supply and earnings. The severity of these problems, along with the long-term expense and difficulty of coping with them, raises the possibility of substantial impact on the psychological, physical, and economic health of the child's family. While relatively few children report such problems, a dramatic increase

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has occurred over the past decade. According to National Center for Health Statistics data (Table 8.1), the number of children with activity limitations due to chronic conditions nearly doubled from 1967 to 1978. The reasons for this increase are not presently known, but it seems likely that a variety of factors are involved, including more sophisticated medical therapies which increase survival rates for children born with physical impairments and the growing emphasis on "mainstreaming" and deinstitutionalization in public educational and social services programs.[1]

Most previous research on economic impacts of children's health problems consists of descriptive evidence based upon interviews of small samples of families. Several of these studies indicate pronounced negative effects on maternal market work. Meyerowitz and Kaplan (1967) interviewed 111 families in Texas with children suffering from cystic fibrosis and found that while 54% of the mothers were employed prior to diagnosis of their children's problem, only 26% were employed after the diagnosis was made. Similarly, Barsch's (1967) data from interviews with 177 families of handicapped children in Milwaukee showed a maternal employment rate of only 25%. (This is comparable to the rate during the 1960s for all married women with children under 6 and considerably below the overall rate for mothers.) Barsch's data also indicate higher maternal employment rates for families with mongoloid children and deaf children than for three other handicapping conditions studied (cerebral palsy, other neurologic impairments, and blindness). Moreover, Barsch reported that the majority of the working mothers worked only part time. Recent research shows higher maternal employment rates, however: Both the McCubbin et al. (1979) study of 100 families of children with cystic fibrosis and the study by Breslau et al. (1980) of 370 families with handicapped children report about one-half of all mothers

Table 8.1 **Numbers (Percentage) of Noninstitutionalized Children (0–17 years) with Limitations in Activity Due to Chronic Conditions, Selected Years**

	Activity Limitation	Limitation in Major Activity
1967	1,418,000 (2.1)	712,000 (1.1)
1972	1,921,000 (3.0)	1,037,000 (1.6)
1978	2,309,000 (3.9)	1,178,000 (2.0)

Source: U.S. National Center for Health Statistics, *Vital and Health Statistics: Data From the National Health Survey*, Series 10, Nos. 52, 85, and 130 (Washington: U.S. Dept. of HEW).

with either full or part time employment. McCollum's (1971) Connecticut study of 54 families of children with cystic fibrosis found that 41% of the mothers were employed. Reported evidence on other labor market effects is even more scanty. McCollum reported that 62% of the fathers in her sample took on overtime work or second jobs to help pay the cost of medical treatments. In contrast, the study by Sultz et al. (1972) of 390 families in New York State found only a small minority of families reporting employment changes to obtain additional income.

The only prior econometric research is in two preliminary studies by Salkever (1980, forthcoming). The first of these utilized 1972 data from the Panel Study of Income Dynamics to estimate child disability effects on maternal work probability and hours of work. Results for two-parent families indicated little effect on the probability that a mother worked at all during the year but a fairly strong negative effect on annual hours of work. Regressions for one-parent families showed negative effects on work probability but no effect on hours of working mothers. No significant effects were found for nonwhite two-parent families. The second study, based on 1972 Health Interview Survey data, reported that in white two-parent families mothers of disabled children were significantly less likely to report working as a usual activity or that they had worked at all during the two weeks preceding the interview; however, no significant child disability effects were observed for mothers in nonwhite or one-parent families.

The present study expands upon this preliminary research in several ways. In addition to estimating child disability effects on maternal labor supply, it also,examines effects on paternal labor supply and on earnings per hour and earnings for both parents. Moreover, it utilizes a much larger data base on households with disabled children than any previous study and it differentiates among types of functional limitations and disabilities caused by health problems.

Theoretical Considerations

The relationship between children's disabilities and parental labor supply can be described within the framework of a simple household production model.[2] In particular, let us assume that the family seeks to maximize a utility function $U(H,X)$ whose arguments are the levels of child health (H) and other goods (X).[3] Child health production is described by the function $G(M,C_1,C_2;H_0)$ where M is purchased medical inputs, C_1 and C_2 are maternal and paternal child health production time and H_0 is the child's health endowment. Other goods are produced according to the function $X(Q,P_1,P_2)$ where Q is purchased nonmedical goods and services, and the P_i's are parental time inputs. Letting L_i denote parental market work time and T_i denote total time available, the parental time constraints are $T_i = C_i + P_i + L_i (i = 1,2)$. The family's binding expenditure constraint is $Q + \Pi M = Y + w_1 L_1 + w_2 L_2$ where Y is unearned income, the w_i's are parental wage rates, Π is the price of M, and Q is the numeraire good.

The family's optimal levels of X and H can be depicted as the tangency of an indifference curve and an opportunity locus as shown at Points A and B in Figure 8.1. The opportunity locus is derived by maximizing X for a given level of H (or vice versa) subject to the time, budget, and production function constraints. If either production function displays nonconstant returns to scale, the opportunity locus will be nonlinear. When the child's health endowment is reduced from H_0^1 to H_0^2 because of a chronic health problem, the opportunity locus shifts leftward from $X^1 H^1$ to $X^2 H^2$. If this decline in health endowment also increases (decreases) the marginal products of M, C_1, and C_2, the slope of the opportunity locus will become less (more) negative.

Further restrictions on the model are necessary if we are to determine whether parental labor supplies (the L_i's) increase or decrease in response to a decline in H_0. Consider the simple case where the health

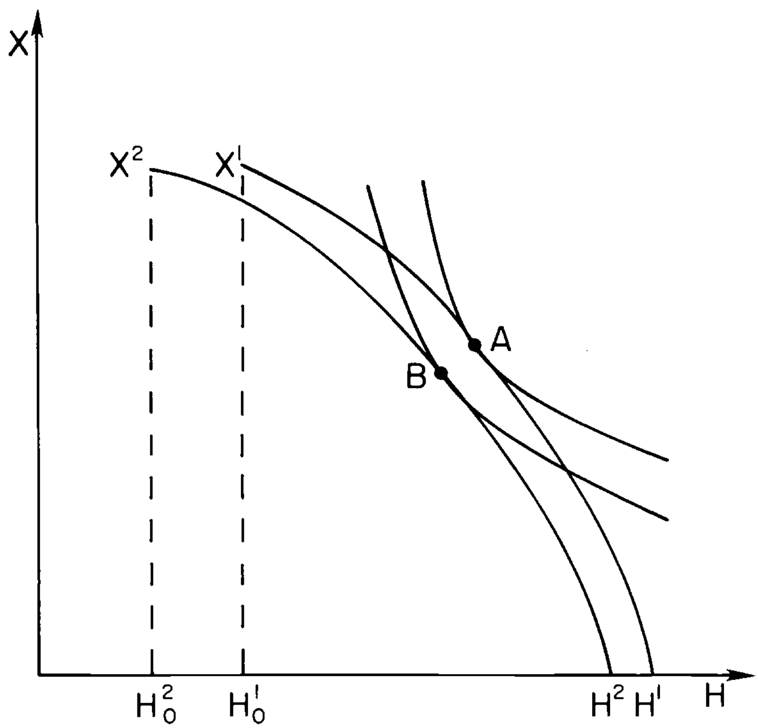

Fig. 8.1 Family consumption decisions with differing child health endowments.

production relationship takes the form $H = G(M, C_1, C_2) + H_0$ and $G(\cdot)$ and $X(\cdot)$ are characterized by constant returns to scale. Because these assumptions imply constancy of optimal factor input ratios and optimal input-output ratios (for given values of Π, w_1 and w_2), we can write the family's opportunity locus as

$$(1) \qquad (w_1 + \theta w_2 + \beta) \frac{X}{\gamma} + (w_1 + \rho w_2 + \alpha \Pi) \frac{(H - H_0)}{\delta} = Y + w_1 T_1 + w_2 T_2 \ ,$$

where θ, β, ρ and α are the optimal values of the input ratios $P_2/P_1, Q/P_1, C_2/C_1$, and M/C_1, and where γ and δ are the optimal values of the input-output ratios $X(\cdot)/P_1$ and $G(\cdot)/C_1$. Similarly, the parental time constraints become

$$(2a) \qquad L_1 + \frac{X}{\gamma} + \frac{(H - H_0)}{\delta} = T_1$$

$$(2b) \qquad L_2 + \frac{\theta X}{\gamma} + \rho \frac{(H - H_0)}{\delta} = T_2.$$

Allowing L_1, X, H, and H_0 to vary and taking differentials in equations (1) and (2a), we can show that when H_0 declines, maternal labor supply (L_1) will also decline if (1) $dH_0 - dH < 0$ and (2) $(w_1 + \rho w_2 + \alpha \Pi) < (w_1 + \theta w_2 + \beta)$. The first of these two conditions follows from the reasonable assumption that X is a normal good (i.e., $dX/dH_0 > 0$). The second condition implies that maternal time costs comprise a larger fraction of total costs in producing child health than in producing other goods. The analogous result holds for the response of paternal labor supply (L_2) to a decline in H_0. It also follows, in this simplified model, that the labor supply response to children's health problems will be more negative for mothers than for fathers provided that the production of child health is relatively more maternal-time intensive (i.e., $\theta > \rho$).[4] Finally, it is clear that these same conclusions hold if the model is generalized to allow for the possibility of a proportionate increase in the marginal productivity of all child health inputs (i.e., a decrease in δ) as H_0 declines.[5]

While this simple model describes impacts of children's health problems in terms of income effects and changes in the productivity of child health inputs, a number of other possible effects must be recognized. For example, one might expect these problems to influence parental wage rates for several reasons. Since wage rates are related to work experience, labor supply effects in any time period will impact on wages in subsequent time periods. Moreover, parents may spend some nonworking time in the accumulation of human capital. Pursuing educational programs to acquire or improve marketable skills and migration to take advantage of better job opportunities are examples of this phenomenon.

Here again effects of child health problems on the amount of time spent in these pursuits implies corresponding effects on observed wage rates. Finally, even if one abstracts from any intertemporal effects, it may be more reasonable to regard individuals' market opportunities as described by a continuum of jobs offering differing combinations of wages and required time and effort rather than by a single fixed wage rate. In this situation, both wages and hours of work are determined by parental labor supply decisions, and thus both may be influenced by child health problems.

Further generalizations of the standard labor supply model point to further possible avenues of influence for child health problems. In recent work, Cogan (1977) has focused attention on the fixed money and time costs of working and presented empirical estimates relating these costs to maternal child care responsibilities. One might reasonably presume that children's health problems increase these costs and thereby impact on parental labor supply decisions. Based on Cogan's analysis, one would expect these increased fixed costs to reduce the probability that a mother works; the effect on hours of work of working mothers is ambiguous, since higher fixed money costs imply longer hours of work while higher fixed time costs imply shorter hours. An additional factor, brought out in Heckman's (1974, 1977) treatment of the relationship between labor supply and the availability of nonparental child care, is variable costs of work (i.e., costs which vary with the mother's hours of work). If these costs are constant per hour of work, they are equivalent to a reduction in the mother's hourly wage. They could also rise more than proportionately with hours of work. For example, if mothers of school age children work full time, they may face after-school child care costs which would not be incurred if they only worked part time. In either case, one might conjecture that upward shifts in the level of these variable costs due to children's health problems will reduce maternal labor supply. The possibility of direct preference effects should also be noted. In the model sketched above, utility depended only on the attained levels of X and H. However, in view of the evidence that children's physical health problems are associated with increased stress or psychological problems of parents (Breslau et al. 1980; Cummings et al. 1966; Cummings 1976), it may be more realistic to assume that parental time spent at home also has a direct effect on utility (apart from its effect on the level of X and H) and that this effect will depend upon child health endowments.

Empirical Models and Estimation Techniques

The foregoing discussion suggests the following empirical representation of child health problem effects on parental labor supply and wages:

$$L_1 = F_1(Z_1, w_1, w_2, Y, H_0, u_1) \quad (3a)$$

(3b) $$L_2 = F_2(Z_1, w_1, w_2, Y, H_0, u_2)$$

(4a) $$w_1 = F_3(Z_1, Z_2, A, Y, H_0, u_3)$$

(4b) $$w_2 = F_4(Z_1, Z_2, A, Y, H_0, u_4)$$

where Z_1 denotes parental and family characteristics which affect preferences and productivity in home production of X and H, Z_2 denotes parental characteristics which affect market productivity, A denotes area labor market conditions which affect offered wage rates, and the u_i's are random disturbance terms. Note that in the wife's wage equation (4a), the inclusion of Z_1, Y, H_0, and the elements of Z_2 and A which pertain to the husband's market productivity and market opportunities is intended to capture the influence of these variables on the wife's accumulation of human capital. A similar rationale applies to the specification of the husband's wage equation (4b).[6]

In our empirical analyses, the work hours equations (3a and b) were estimated in reduced form (obtained by replacing w_1 and w_2 by the right sides of equations (4a and b). In addition, earnings relationships, which can be represented by multiplying the wage equations by the corresponding reduced-form hours equations, were also estimated. Estimation of the work hours, wage, and earnings regressions for wives involved two steps: estimation of a probit maternal work probability regression and estimation of hours, wages, and earnings regressions based on data for working wives with Heckman's (1977) selectivity variable (computed from the probit regression) included to correct for sample censoring. This procedure is preferable to the alternative of using Tobit regression since it is consistent with both the standard labor supply model and the fixed-cost model recently developed by Cogan (1977).

Since the household equilibrium conditions are different for families with working wives and those with nonworking wives, husband's hours, wage, and earnings regressions were estimated separately for those two groups of households (again with the inclusion of selectivity variables).[7] All hours, wage, and earnings regressions for both husbands and wives were estimated with ordinary least squares.[8]

Two different sets of regression estimates were used to measure the effects of the variables relating to children's health problems. The first set was based on a simple additive model in which it was assumed that the coefficients for all other variables were the same for families that reported children's health problems and for families without such problems. Data from both types of families were used to estimate these regressions and no interactions between the child health problem variables and other variables were included. The second set, which was used to examine interactions between children's health problems and other family characteristics, involved two stages. First, earnings and maternal work probability regressions were estimated from data on families with no child health problems. The estimated coefficients from these regressions were used to compute predicted dependent variable values for families with children's health problems, and deviations of actual from predicted values for these families. Then, these deviations were used as dependent variables in regressions estimated from data for these same families.

Data Base And Definition Of Variables

The data base for our analysis was the Survey of Income and Education (SIE). This survey was administered to 151,170 households throughout the United States during the period April–June 1976. The interviews included detailed questions about labor market activity and income (similar to those used in the Current Population Survey) as well as a large number of questions dealing with sociodemographic characteristics, housing, health insurance, and disabilities of household members.[9]

Because the prevalence rates for children's disabilities are rather low (see Table 8.1), the large sample size of the SIE was particularly important for the purposes of this study. Information was available on approximately 4,000 households containing children aged 3 to 17 with reported disabilities. (Disability data for children under 3 was not reported in the SIE.) This data base is roughly four times larger than that employed in any of the previous studies cited above.

The study sample for our analysis was constructed in several steps. First, all SIE households were divided into two groups: those containing children with reported health problems and those containing no children with reported health problems. Second, a 1-in-10 random sample of the second group of households was selected. Third, from the households with reported child health problems and the random sample of other households we selected out all white, two-parent, single-family households with no married childen, children over 18, other relatives living with them, or reported maternal health problems. This process yielded a study sample of 5,885 families composed of 2,685 families containing children with reported health problems (referred to as "disabled families") and 3,200 families with no such children (referred to as "nondisabled families").

Characteristics of these families are described in Table 8.2, which presents definitions and mean values for all independent and dependent variables used in our regressions. The independent variables are of four types: family characteristics, location variables, area labor market conditions, and variables pertaining to children's health problems. Family characteristics include number and ages of children (KIDOT2 through KIDNUM in Table 8.2), age and education of both parents, husband's health status (HEALTHLM and DUMHUSLM), a proxy for unearned

Table 8.2 **Variable Definitions and Mean Values**

Independent Variables		Mean Values	
Name	Definition	Disabled Families (n-2685)	Nondisabled Families (n-3200)
KID0T2	Number of children 0–2 years.	.163	.387
KID3T4	Number of children 3–4 years.	.219	.250
KID5T9	Number of children 5–9 years.	.921	.651
KIDNUM	Number of children	2.859	2.136
WIFEAGE	Wife's age (years)	35.233	32.884
WFAGESQR	WIFEAGE^2	1287.100	1147.047
WFEDUC	Wife's years of education	12.117	12.623
WFEDSQR	WFEDUC^2		
HUSBAGE	Husband's age (years)	38.447	35.618
HSAGESQR	HUSBAGE^2	1537.125	1350.477
HSEDUC	Husband's years of education	12.435	13.151
HUSEDSQR	HSEDUC^2		
HEALTHLM	= 1, if husband has any reported health problem	.129	.066
DUMHUSLM	= 1, if husband needs any help in daily activities	.009	.004
CASHDUM	= 1, if family assets in savings accounts, savings bonds, checking accounts, and cash total more than $5000	.228	.249
DFARMINC	= 1, if family has income or losses from farming	.063	.061
DUMVET	= 1, if husband is veteran of armed forces	.535	.487
DUMALIEN	= 1, if husband immigrated to U.S. since 1970	.004	.008
DUMSPAN	= 1, if husband is of Spanish origin	.033	.039
NE	= 1, if in New England	.156	.137
MA	= 1, if in Mid-Atlantic region	.076	.079
ENC	= 1, if in East North Central region	.134	.144
WNC	= 1, if in West North Central region	.147	.149
SA	= 1, if in South Atlantic region	.088	.097
ESC	= 1, if in East South Central region	.036	.034

Table 8.2 (continued)

Independent Variables		Mean Values	
Name	Definition	Disabled Families (n-2685)	Nondisabled Families (n-3200)
WSC	= 1, if in West South Central region	.066	.059
M	= 1, if in Mountain region	.193	.197
BIGSMSA	= 1, if residence is in one of the 20 largest SMSA's	.143	.142
MEDSMSA	= 1, if residence is in one of the 78 next largest SMSA's	.211	.202
OTHMETRO	= 1, if identified in SIE as in other SMSA's	.098	.095
OTHNONM	= 1, if identified in SIE as not in an SMSA	.235	.262
HUSBWAGE	Area wage for husband	5.675	5.832
HSUNEMRT	Area unemployment rate for husband	.048	.047
WIFEWAGE	Area wage for wife	3.453	3.592
WFUNEMRT	Area unemployment rate for wife	.068	.068
DUMDIS	= 1, if family has a child with a health problem	1.0	0
WORK[a]	Number of children limited in schoolwork (but not attendance) by health problems	0.671	0
CANTABS[a]	Number of children limited in schoolwork and unable to attend regular school or frequently absent because of health problems	0.045	0
PLAY[a]	Number of children with health problems but not limited in schoolwork or attendance	0.383	0
USMOB	Number of children usually or occasionally needing assistance in getting around outside the home	0.045	0
USHELP	Number of children usually or occasionally needing assistance in daily activities	0.070	0
DIS3T4	Number of children aged 3–4 with health problems	.072	0

Table 8.2 (continued)

Independent Variables		Mean Values	
Name	Definition	Disabled Families (n-2685)	Nondisabled Families (n-3200)
DIS5T9	Number of children aged 5–9 with health problems	.389	0
DIS10T13	Number of children aged 10–13 with health problems	.360	0
DIS14T17	Number of children aged 14–17 with health problems	.296	0
Dependent Variables			
Name	Definition		
ANNHRS1	Husband's hours worked in 1975	2128.874	2147.030
ANNHRS2	Wife's hours worked in 1975	651.578	690.071
DUMWFWK	=1, if $ANNHRS_2 > 0$	.542	.548
WIFEEARN	Wife's earnings in 1975	1927.674	2244.432
HUSBEARN	Husband's earnings in 1975	12,130.397	12,284.951
WWAGE	Wife's earnings per hour in 1975	3.250	3.684
HWAGE	Husband's earnings per hour in 1975	6.502	6.356

[a]This variable is based on data for disabled children aged 5–17.

income or wealth (CASHDUM), a farm residence dummy (DFARMINC), and other background characteristics of the husband (DUMVET, DUMALIEN, DUMSPAN). These variables are included to account for variations in husbands' and wives' market and nonmarket productivity and preferences. Locational variables indicate region of residence (NE through M with the West being the omitted region) and metropolitan or nonmetropolitan status (BIGSMSA through OTHNONM).[10] Area labor market conditions are described by race-sex specific unemployment rates (HSUNEMRT and WFUNEMRT) and race-sex-education specific wage rates (HUSBWAGE and WIFEWAGE) calculated from data on all SIE respondents. In most cases these variables are defined for the metropolitan area in which the family resides, for all metropolitan areas within the state of residence (except SMSA's specifically identified in the SIE), or for the nonmetropolitan areas of the state of residence for non-SMSA families. In a minority of cases, the entire state or even larger geographical aggregates had to be used because more specific areas were not identified or because the numbers of individuals in particular race-sex-education groups were small.

Variables pertaining to children's health problems are of four types. DUMDIS indicates the presence of a child with any reported chronic health problems.[11] The variables PLAY, WORK, and CANTABS relate to what Nagi and Luken (1975) have termed "role disabilities." In particular, these variables indicate whether children's health problems limit their ability to function in a regular school setting.[12] Functional limitations in mobility and in activities of daily living (eating, dressing, personal hygiene) are indicated by the variables USMOB and USHELP. DIS3T4, DIS5T9, DIS10T13 and DIS14T17 differentiate among families by the age of the disabled children.

The last segment of Table 8.2 reports mean values for our seven dependent variables. Note that the mean values for the wage variables only apply to persons reporting nonzero hours and earnings. Also note that the wage and earnings variables are defined to include self-employment and farm income as well as salary and wage income. The first two types of income probably include some returns to capital, but it is not possible to break this out with the SIE data.

With regard to differences between disabled and nondisabled families, Table 8.2 shows that the disabled families have more children above the age of 4, more children in total, and parents who are about 2.5 years older on average. These differences are to be expected since prevalence rates increase with age and the probability of having at least one disabled child increases with the number of children in the family. (Moreover, since health problem data were not reported for children under 3, families with only children under 3 could not be defined here as disabled families.) Parents in nondisabled families have slightly higher levels of education and considerably lower rates of paternal health problems.

Differences in mean values for the dependent variables are rather small but do show a consistent pattern. Maternal annual hours of work, earnings, and earnings per hour are clearly lower for disabled families, but the fraction of mothers who worked at all is virtually identical for the two groups. Paternal earnings and annual hours are only slightly lower in disabled families, while paternal earnings per hour are slightly higher.

Empirical Results for the Simple Additive Model

For each of our dependent variables, at least four different regressions employing different sets of child health variables were estimated. Each regression was first estimated with all other independent variables (besides the child health variables) included. They were then reestimated deleting independent variables (other than the child health variables) with verylow *t*-statistics.[13] All regressions except those on DUMWFWK also included a selectivity variable.[14] The resulting coefficients for the child health variables are shown in Tables 8.3 and 8.4.[15]

Looking first at the maternal work status regressions in Table 8.3, we observe in regression A that the coefficient for DUMDIS is small and insignificant, indicating that on average children's health problems do not deter mothers from working.[16] However, the results for regressions B–D suggest that this finding is not consistent across all age groups and types of disabilities. The significant or nearly significant negative coefficients for WORK, CANTABS, and USMOB imply that health problems which limit the ability to function in school and which limit mobility do in fact reduce maternal work probabilities. Moreover, the magnitude of the estimated effects is sometimes fairly large. For example the coefficient for CANTABS in regression D (– 0.2304) implies that for a mother who would otherwise have a 0.5 probability of working, the presence of a child whose health problem interferes with school attendance reduces this probability to 0.421. In contrast, the strongly positive coefficients of DIS3T4 and DIS14T17 suggest that children's health problems have less of a deterrent effect in families with very young or older disabled children.

The maternal work hours regressions in Table 8.3 generally show more significant negative effects on children's health problems, particularly when the disabled child needs assistance in mobility. Variations in impact by age of the disabled child are similar to those for the work status regressions, although the positive effects for children aged 3 to 4 is somewhat weaker and the effects for children aged 5 to 9 and 10 to 13 are more strongly negative. It is also surprising that the coefficients of CANTABS are much less significant than the coefficients of WORK and similar to the latter in magnitude. Comparing the results for regressions B through E, one observes some instability in the results for WORK, CANTABS, DIS10T13, and DIS14T17 stemming from collinearity of the health problem variables.

Negative health problem effects on maternal wages are also rather pronounced. The significant coefficient of –0.1 for DUMDIS implies a 9.5% reduction in maternal wages due to the presence of a disabled child.[17] Results for CANTABS imply even larger reductions for mothers of children limited in their ability to attend school. Coefficients of WORK are also significantly negative, but only when DIS5T9 and DIS10T13 are not included in the regression. Finally, it is interesting to note that coefficients of DIS3T4, DIS5T9, DIS10T13, and DIS14T17 indicate increasingly negative effects as the child's age increases. Presumably, this pattern of results reflects the cumulation over time of impacts on labor market experience and investment in human capital.

Table 8.3 **Estimated Effects of Children's Health Variables: Maternal Labor Supply and Earnings**

Dependent Variable		DUMDIS	PLAY	WORK	CANTABS	USHELP	USMOB	DIS3T4	DIS5T9	DIS10T13	DIS14T17
Maternal work status	A	−0.036									
		(0.37)									
	B		0.0461	−0.0583	−0.1958	0.1076	−0.2685	0.1262			
			(1.06)	(1.60)	(1.68)	(0.90)	(1.83)	(1.62)			
	C			−0.0832	−0.2462	0.1176	−0.2766	0.1236	0.0168	−0.0115	0.1131
				(1.62)	(2.02)	(0.98)	(1.88)	(1.23)	(0.28)	(0.20)	(2.01)
	D			−0.0757	−0.2304		−0.1906	0.1248			0.1109
				(2.12)	(2.01)		(1.57)	(1.25)			(2.15)
Annual work hours, working wives	A	−101.84									
		(3.28)									
	B		10.66	−123.34	−120.78	2.77	−529.07	51.56			
			(0.27)	(3.06)	(0.91)	(0.03)	(2.93)	(0.50)			
	C			−79.58	−144.52	40.65	−581.67	50.28	−55.86	−159.66	180.12
				(1.46)	(0.98)	(0.35)	(3.19)	(0.49)	(1.05)	(3.36)	(2.85)
	D			−152.94	−196.48		−561.07	54.24		232.78	
				(3.44)	(1.38)		(4.03)	(0.52)			(3.82)
	E			−97.01	−103.18		−522.37		−16.57	−80.82	78.15
				(1.77)	(0.77)		(4.11)		(0.30)	(1.64)	(1.66)

Logarithm of wages, working wives	A	−0.1000 (3.53)									
	B		−0.0724 (2.14)	−0.0746 (2.48)	−0.2977 (3.07)	0.0184 (0.02)	−0.0291 (0.22)	−0.0279 (0.35)			
	C			−0.0123 (0.30)	−0.2251 (2.24)	−0.0144 (0.14)	0.0379 (0.29)	−0.0263 (0.32)	−0.0373 (0.78)	−0.0729 (1.65)	−0.0929 (2.18)
	D			−0.0533 (1.81)	−0.2628 (2.71)		0.0309 (0.30)	−0.0225 (0.28)			−0.0668 (1.71)
	F				−0.1971 (2.04)				−0.0500 (1.35)	−0.0864 (2.41)	−0.0929 (2.44)
Logarithm of earnings, working wives	A	−0.2265 (4.37)									
	B		−0.1237 (1.98)	−0.1752 (3.04)	−0.0302 (1.68)	−0.0811 (0.05)	−0.3250 (1.32)	−0.0787 (0.51)			
	C			−0.0175 (0.23)	−0.1702 (0.90)	−0.0729 (0.40)	−0.3481 (1.41)	−0.0847 (0.55)	−0.1070 (1.20)	−0.2834 (3.59)	−0.0221 (0.27)
	D			−0.1556 (2.71)	−0.2887 (1.59)		−0.3973 (2.09)	−0.0798 (0.52)			0.0809 (1.05)
	G			−0.0970 (1.62)	−0.2588 (1.45)		−0.4511 (2.40)			−0.2047 (2.98)	

t-statistics in parentheses.

Negative health problem effects on earnings of working mothers are particularly strong, since they are the combined result of the negative wage and hours effects noted earlier. The DUMDIS coefficient of −0.227 implies a 20% earnings reduction for mothers in disabled families. Again there is evidence from the results for WORK, CANTABS, and USMOB that school-related role disabilities and mobility limitations are particularly important, although collinearity with the age-related variables is also apparent. Coefficients of the age-related variables are most negative for the age groups 5 to 9 and, particularly, 10 to 13. Possible reasons for this pattern of results are discussed later in this paper.

Estimated effects on labor supply, wages, and earnings of fathers are reported in Table 8.4. Relatively few of the coefficients reported there approach statistical significance. In the work hours regressions, limitations in schoolwork and attendance, daily activities, and mobility tend to have negative effects, but the only significant coefficients are for CANTABS with husbands of working wives. Among the estimated wage effects, only the negative coefficients of CANTABS and DIS3T4 in the regressions for husbands of nonworking wives are significant. In the earnings regressions for husbands of nonworking wives, significantly positive coefficients are observed for DIS5T9, DIS14T17, and PLAY while the coefficients of DIS3T4 and the variables for school-related and functional limitations tend to be negative. On the whole, the results in Table 8.4 suggest that the presence of children with such limitations tends to reduce paternal labor supply and earnings while the presence of a chronically ill child without such limitations tends to have a more positive impact as the age of the child increases. It is also interesting that the results for DUMDIS show consistently more negative effects for husbands of working wives than for husbands of nonworking wives, although they are clearly not significant.

Estimated Interaction Effects

An analysis of interaction effects of children's health problems was undertaken for two reasons. First, it provided alternative estimates of the impacts shown in Tables 8.3 and 8.4 that did not involve the strict assumptions of the simple additive model. Second, it permitted us to explore the possibility that health problem impacts vary with parental and family characteristics. While our interest in this possibility was primarily exploratory, there were two hypotheses deriving from the results of previous research (Salkever, forthcoming) which we wished to test. One was that negative health problem effects on maternal labor supply would be smaller for families with young children and/or large numbers of

Table 8.4 **Estimated Effects of Children's Health Variables: Paternal Labor Supply and Earnings**

Dependent Variable		DUMDIS	PLAY	WORK	CANTABS	USHELP	USMOB	DIS3T4	DIS5T9	DIS10T13	DIS14T17
Annual work hours, husbands of working wives	A	−25.90 (0.90)									
	B		22.15 (0.65)	−25.78 (0.85)	−165.70 (1.66)	34.51 (0.33)	−133.23 (0.98)	−45.62 (0.55)			
	C			−54.81 (1.30)	−189.10 (1.83)	27.01 (0.26)	−124.82 (0.91)	−44.70 (0.54)	38.79 (0.79)	29.81 (0.66)	8.71 (0.20)
	D			−27.88 (0.94)	−165.61 (1.66)		−103.71 (0.97)	−48.10 (0.58)			−5.65 (0.14)
	H			−31.23 (1.08)	−177.62 (1.81)						
Annual work hours, husbands of nonworking wives	A	15.63 (0.46)									
	B		64.23 (1.49)	31.98 (0.95)	−28.91 (0.27)	−114.14 (1.11)	−108.12 (0.90)	−4.69 (0.06)			
	C			−27.17 (0.56)	−96.02 (0.98)	−118.60 (1.14)	−110.31 (0.92)	−7.69 (0.09)	82.97 (1.60)	21.27 (0.39)	80.03 (1.31)
	D			9.71 (0.30)	−80.81 (0.74)		−159.76 (1.53)	−12.42 (0.14)			57.12 (1.03)
	I		55.43 (1.32)			−106.75 (1.05)	−109.97 (0.93)				

Table 8.4 (continued)

Dependent Variable		DUMDIS	PLAY	WORK	CANTABS	USHELP	USMOB	DIS3T4	DIS5T9	DIS10T13	DIS14T17
Logarithm of wages, husbands of working wives	A	−0.017 (0.53)									
	B		0.036 (0.96)	−0.023 (0.69)	0.054 (0.50)	0.001 (0.01)	0.026 (0.17)	−0.043 (0.47)			
	C			−0.044 (0.95)	0.016 (0.14)	0.016 (0.14)	0.016 (0.11)	−0.045 (0.49)	−0.011 (0.20)	0.024 (0.49)	0.070 (1.47)
	D			−0.038 (1.16)	0.025 (0.23)		0.023 (0.19)	−0.046 (0.50)			0.064 (1.46)
Logarithm of wages, husbands of nonworking wives	A	0.015 (0.54)									
	B		0.033 (0.93)	−0.0002 (0.01)	−0.195 (2.13)	0.006 (0.08)	0.040 (0.42)	−0.184 (2.70)			
	C			−0.033 (0.83)	−0.231 (2.38)	0.009 (0.011)	0.043 (0.45)	−0.183 (2.69)	0.023 (0.54)	0.043 (0.97)	0.038 (0.77)
	D			−0.007 (0.28)	−0.205 (2.23)		0.050 (0.58)	−0.187 (2.76)			0.019 (0.42)
	K		0.033 (0.98)		−0.182 (2.10)			−0.185 (2.72)			

Logarithm of earnings, husbands of working wives	A	-0.028									
		(0.82)									
	B		0.030	-0.035	-0.081	-0.020	0.029	0.002			
			(0.77)	(0.99)	(0.70)	(0.17)	(0.18)	(0.02)			
	C			-0.053	-0.114	-0.008	0.021	0.001	-0.007	0.019	0.059
				(1.09)	(0.95)	(0.06)	(0.13)	(0.01)	(0.12)	(0.38)	(1.19)
	D			-0.049	-0.109		0.009	-0.0003			0.055
				(1.40)	(0.93)		(0.07)	(0.004)			(1.19)
Logarithm of earnings, husbands of nonworking wives	A	0.029									
		(0.96)									
	B		0.090	0.006	-0.016	-0.058	-0.128	-0.138			
			(2.36)	(0.21)	(0.16)	(0.64)	(1.22)	(1.86)			
	C			-0.079	-0.113	-0.057	-0.127	-0.139	0.094	0.061	0.115
				(1.82)	(1.06)	(0.63)	(1.21)	(1.87)	(2.05)	(1.26)	(2.13)
	D			-0.019	-0.069		-0.138	-0.148			0.074
				(0.67)	(0.68)		(1.49)	(2.00)			(1.54)
	J			-0.080	-0.123		-0.158	-0.140	0.092	0.059	0.122
				(1.87)	(1.17)		(1.69)	(1.89)	(2.00)	(1.19)	(2.33)

t-statistics in parentheses.

children. The other was that these negative health problem effects would be stronger for lower income families.

Interaction effects were examined by regressing child health variables and other parental and family characteristics on the differences between actual and predicted dependent variable values for disabled families. (The predictions were derived from regressions for nondisabled families.) Five sets of parental and family characteristics variables were included in the analysis: parental education (HSED, WFED), the variables describing the number and ages of children in the family (KID0T2, KID3T4, KID5T9, KIDNUM), the large SMSA location dummies (BIGSMSA, MEDSMSA), other characteristics associated with the family's economic status (HEALTHLM, DFARMINC, DUMSPAN, and CASHDUM), and selectivity variables (obtained from maternal work status regressions for nondisabled families). The large SMSA dummies were included on the presumptions that families in urbanized areas had access to more supportive services and that the availability of these services would influence parental labor market behavior.[18]

The analysis of interactions began by including all the child health variables (except PLAY and DUMDIS) and all the parental and family characteristics variables just mentioned in preliminary regressions. Variables in the latter set with the lowest estimated *t*-statistics were then deleted from the interaction regressions shown in Table 8.5. (DFARMINC was insignificant in all cases and does not appear in the table.) Looking first at the maternal work status findings, we note several similarities to the additive model findings. First, the reported mean dependent variable value of −0.01 indicates little average impact on maternal work status; the fraction of mothers in disabled families who worked (0.542) was only .01 below the predicted fraction based on the maternal work status regression for nondisabled families. Second, significantly negative effects on maternal work probabilities are again observed for WORK, CANTABS, and USMOB, while DIS14T17 is significantly positive. The positive coefficients for KID0T2, KID3T4, and KID5T9 are in accord with our expectations, although only KID0T2 is significant. Results for HEALTHLM, DUMSPAN and CASHDUM are consistent with the income-interaction result from our previous study, but the findings for WFED do not fit this pattern.

The results for health problem variables in the maternal earnings regressions are also somewhat similar to the additive model results. The mean dependent variable value of −0.195 is close to the value of −0.2265 for the corresponding DUMDIS coefficient in Table 8.3. Also, the coefficient of DIS10T13 is again significantly negative. However, the strongly negative effects of WORK, CANTABS, and USMOB in the additive model are greatly diminished in the interaction analysis. Evidence on the hypothesized interactions with economic status and with numbers and ages of children is mixed. While the coefficients for KIDNUM, WFED, HEALTHLM, and DUMPSPAN are consistent with the results of our previous study, the significantly negative coefficients of KID5T9 and HSED contradict these results.

Results for earnings of husbands of working wives show no significant interactions except the strongly positive effect of the SMSA location dummies. For husbands of nonworking wives, the strong negative effects of school-related disabilities and mobility limitations are consistent with the estimates of the additive model. It is difficult to interpret other significant or nearly significant coefficients because their signs are not consistent with one another; while MEDSMSA and KID0T2 are positive, BIGSMSA and KIDNUM are negative. Finally, it is interesting to note that while the mean dependent variable values for both groups of husbands are more negative than the corresponding DUMDIS coefficients in Table 8.4, comparison between the two groups again suggests a more negative effect of health problems for husbands of working wives.

Summary and Discussion

Our empirical results provide rather consistent evidence that children's chronic health problems have a more pronounced negative effect on labor supply and earnings for mothers than for fathers. A possible explanation for this finding, suggested by our simple theoretical model, is that the production of child health is relatively more maternal-time intensive. In addition, we have found that on average the reduction of maternal labor supply and earnings is due primarily to shorter hours of work and lower wage rates for mothers of chronically ill children rather than to reductions in the probability that these mothers work at all. This finding, which is consistent with results from our previous studies, could possibly indicate that health problems impact on maternal labor supply primarily through effects on the variable costs of maternal work. For example, if the costs of nonparental after-school care for school-age children with disabilities are greater than the corresponding costs for their nondisabled counterparts, net wages (i.e., wages minus variable costs of working per hour) for their mothers will fall more sharply as hours of work increase beyond the length of the school day.

With regard to the labor supply and earnings impacts of differing types of disabilities, our estimates generally show that these impacts are more negative for school-related disabilities and mobility limitations than for limitation in activities of daily living or playing with other children. In particular, the additive model results show strong negative impacts of the former types of disabilities in most of the maternal regressions, in the work hours regressions for husbands of working wives and in the wage and earnings regressions for husbands of nonworking wives. In the in-

Table 8.5 **Interaction Analysis for Maternal Work Status and Parental Earnings**

Independent Variables	Dependent Variables						
	Maternal Work Status		Ln (Earnings) Working Wives		Ln (Earnings) Husbands of Working Wives	Ln (Earnings) Husbands of Non-Working Wives	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
WORK	−0.027	−0.032	0.032		−0.029	−0.076	−0.081
	(1.42)	(1.93)	(0.42)		(0.53)	(1.81)	(2.24)
CANTABS	−0.086	−0.087	−0.050		−0.077	−0.140	−0.144
	(1.87)	(1.96)	(0.27)		(0.58)	(1.36)	(1.45)
USMOB	−0.091	−0.068	−0.179	−0.273	0.057	−0.178	−0.204
	(1.69)	(1.52)	(0.75)	(1.47)	(0.32)	(1.76)	(2.27)
USHELP	0.0345		−0.126		−0.032	−0.048	
	(0.76)		(0.68)		(0.23)	(0.55)	
DIS3T4	0.018		0.048		0.132	−0.138	−0.138
	(0.36)		(0.27)		(1.02)	(1.60)	(1.76)
DIS5T9	−0.012		0.082		0.037	0.063	0.064
	(0.35)		(0.60)		(0.40)	(0.97)	(1.56)
DIS10T13	−0.011		−0.168	−0.183	0.049	−0.013	
	(0.38)		(1.35)	(2.50)	(0.56)	(0.20)	
DIS14T17	0.044	0.051	−0.004		0.043	0.015	
	(1.47)	(2.41)	(0.32)		(0.52)	(0.22)	
HSED			−0.027				
			(1.70)				

WFED	−0.007	−0.007	0.045	0.046			
	(1.57)	(1.54)	(2.24)	(2.29)			
HEALTHLM	−0.081	−0.082	0.130	0.132			
	(2.86)	(2.94)	(1.16)	(1.18)			
BIGSMSA					0.155	−0.118	−0.116
					(1.90)	(2.11)	(2.09)
MEDSMSA	0.058	0.058			0.242	0.116	0.117
	(2.55)	(2.55)			(3.55)	(2.24)	(2.26)
DUMSPAN	−0.086	−0.087	−0.255	−0.254	−0.156		
	(1.63)	(1.63)	(1.20)	(1.19)	(1.03)		
CASHDUM	0.057	0.057					
	(2.48)	(2.47)					
KID0T2	0.037	0.039				0.081	0.080
	(1.57)	(1.66)				(1.60)	(1.59)
KID3T4	0.033	0.040					
	(1.28)	(1.85)					
KID5T9	0.020	0.019	−0.125	−0.089			
	(1.45)	(1.58)	(1.82)	(1.79)			
KIDNUM			0.067	0.060		−0.043	−0.042
			(1.91)	(1.88)		(2.51)	(2.56)
SELECTIVITY						0.348	0.354
						(3.41)	(3.51)
R^2	0.018	0.018	0.015	0.014		0.052	0.051
Mean dependent variable value		−0.010	−0.195		−0.100	−0.067	−0.067

t-statistics in parentheses.

teraction analysis, similar effects of school-related and mobility limitations are obtained for maternal work status and earnings of husbands of nonworking wives, but negative effects on earnings of working mothers and earnings of working wives' husbands are weaker.

Variations in health problem impact with the age of the disabled child are strongest in the maternal regressions with the additive model. Effects on maternal work probabilities, work hours, and earnings are most negative for the 5 to 9 and 10 to 13 age groups while the negative maternal wage effects increase with age. The additive model results for fathers shows a weak tendency for hours, wage, and earnings effects to become more positive with age. In the interaction regressions, the patterns of age effects on maternal work status and parental earnings are less clear.

Finally, the interaction analysis tends to confirm our previous findings that negative effects of children's health problems on maternal work status are stronger in lower income families and families with fewer young children. However, analogous results for parental earnings are rather mixed.

A number of factors could be invoked to explain the age-related variations in health problem impact reported here. The greater reduction in maternal labor supply for disabled children in the 5 to 13 age group suggests that while mothers of healthy children can cut back substantially on child care responsibilities as their children reach school age, mothers of disabled children are much less able to substitute educational services for their own time inputs.[19] Similarly, while healthy children start assuming more responsibility in caring for themselves as they enter the 10 to 13 age group, mothers of disabled children may be reluctant to rely on self-care until their children are somewhat older.

Differences in the types of reported health problems may also be relevant. Although the distribution of problem types reported in the SIE is, in general, similar across age groups, it is noteworthy that hearing and speech limitations are more than twice as prevalent for the 5 to 13 age groups than for the 14 to 17 age groups. (In contrast, among the other reported types of problems, only back impairments and arthritic or rheumatic problems clearly increase in prevalence with age.)[20] If parental time inputs (for home therapy, regular visits to health professionals, etc.) are in fact typically greater for hearing and speech limitations and other problems more frequently reported in the 5 to 13 age groups, a more negative effect on maternal labor supply would be expected.[21]

It is also possible that age differences in health problem impacts may be due, at least in part, to unmeasured parental characteristics. For example, if mothers with a very strong labor force attachment prior to childbearing are more likely to have children with health problems because they devote less time to prenatal care, or because they subsequently devote less time to child health maintenance and illness prevention activities, a positive bias in our disability coefficients would result. If this bias is strongest for mothers of young children, the more positive coefficients for DIS3T4 reported here would occur.

More generally, a variety of biases could result from unmeasured parental characteristics in a cross-sectional study such as this one. Although mothers with reported chronic health problems were excluded from the study, some variation in maternal health levels is probably still present in the data. If so, any positive association between maternal and child health levels will presumably cause a negative bias in the disability coefficients of the maternal labor supply and earnings regressions. Similarly, the probability of having a disabled child is positively related to the number of children, so that unmeasured parental preferences for large families (which presumably are negatively related to maternal preferences for market work) will cause a similar negative bias.[22] Moreover, families with disabled children are only so classified in our study if they have not chosen to institutionalize these children. While this raises the possibility of a systematic selection bias, the effect of such a bias on our estimates is difficult to predict a priori.

These various threats to the validity of our cross-sectional findings could be greatly diminished by using panel data and examining changes in parental labor supply and earnings after the onset of children's chronic health problems. However, because the prevalence rates for these problems are low, the sample size for a prospective panel study would have to be extremely large to yield enough households with such problems. As an alternative, panel data could be collected retrospectively on a large number of households with disabled children, but one might question whether this retrospective approach yields sufficiently reliable data.

Conclusion

The major conclusion emerging from this analysis is that children's chronic health problems have substantial economic impacts, particularly in the form of reduced maternal earnings. A conservative estimate of the annual magnitude of this earnings reduction can be derived by assuming no effect on maternal work probability, using the 20% negative effect implied by the maternal earnings coefficient for DUMDIS in Table 8.3, and using a mean maternal earnings figure for nondisabled families of $4,100. (Using the data in Table 8.2, the exact figure is $2244.43/0.548 = $4,095.68.) This yields a per family annual reduction of $820 (in 1975 dollars). Assuming that half of the more than two million mothers with disabled children work, and thus experience this earnings reduction, we estimate that the total annual reduction is roughly $1 billion (in 1975 dollars). Of course, our estimates may overstate the earnings reduction for types of families excluded in our study (e.g., nonwhites, single-parent families, families where mothers have chronic health problems). However, this is probably offset by omitting the negative effects on maternal work probability and paternal earnings which were found to be significant for certain types of health problems.

Our finding that this economic impact depends on the extent to which health problems limit children's abilities to participate in educational activities is also of interest from a policy research standpoint. These limitations, which were reported by more than 60% of the children with health problems in the SIE, result from the interaction of physiological or psychological abnormalities and impairments with the structure and characteristics of available educational programs. Following the passage in 1975 of P.L. 94–142 (The Education for All Handicapped Act), increasing amounts of resources have been devoted to special education programs and to making regular programs more accessible to handicapped children. It has been suggested that the major economic benefits of these expenditures will occur in future years as more handicapped children become productive, tax-paying adults. Our own analysis raises the possibility of more immediate benefits in the form of increased parental productivity and earnings, and suggests that evaluation researchers should attempt to determine the extent, if any, of such benefits.

While the present study has focused on parental labor supply and earnings, it is likely that children's chronic health problems have a variety of other effects on parental behavior and time allocation. In particular, effects on child-spacing and family size, which have been ignored in the present study, may themselves have important secondary effects on parental labor supply and earnings.[23] Children's health problems may also affect other aspects of parental time allocation, such as the total amount of time spent in housework and child care.[24] Moreover, the distribution of this time among children in the household may also be affected; by causing parents to spend less time with healthy siblings, children's health problems may have deleterious effects on intellectual development or even the future health of these siblings.[25] Still other interesting areas for future research include possible impacts on family stability and parental mental and physical health,[26] and more detailed analysis of specific categories of chronic diseases. We hope that sufficiently large and detailed data sets will become available in the future to permit investigation of these issues.

Notes

1. Another possible explanation is aging of the population of children, since prevalence of chronic health problems increases with age; however, Bureau of the Census estimates for 1967 and 1979 show that the median age of the under-18 population increased by only about

one year during that time span. Alternatively, one might argue that the prevalence increase is mostly due to increased reporting of chronic conditions. As visits to physicians have increased, more chronic illnesses among children have been diagnosed; this has probably increased the percentage of children reporting disabilities in the household surveys conducted by the National Center for Health Statistics. However, the increase in prevalence shown in Table 8.1 for the 1967–72 period should contain only a minimal upward bias since per capita physician visits for children were virtually unchanged over this period, according to National Center for Health Statistics data. Moreover, the increases in prevalence of major activity limitations probably are not strongly influenced by this upward bias since we would expect that few of these limitations went unreported even in 1967.

2. Several other economic analyses of child health have used similar models. See, for example, Edwards and Grossman (1977*a*).

3. H could be interpreted as the average level of child health for all children in the family or as the health level for one particular child (with health levels for other children included in the composite good X). We do not explicitly consider the possibility of intrafamily variations in child health levels.

4. If one makes the more extreme assumption that paternal time inputs into child health production are zero (Inman 1976), then $\rho = 0$ and it follows from equation 2b that if X is a normal good, the occurrence of child health problems will increase paternal labor supply.

5. Another interesting property of this simple model is that the reduction in parental earnings in response to a child health problem (i.e., $w_1 dL_1 + w_2 dL_2$) must be less than the welfare cost to the family of this problem as measured by the relevant compensating income variation $(w_1 + \rho w_2 + \alpha\Pi) dH_0/\delta$. (We assume δ is constant.) This offers some justification for viewing empirical estimates of earnings reductions (i.e., so-called "indirect costs of illness") as lower bounds on the relevant welfare cost figures. (We are indebted to Michael Grossman for suggesting this point.)

6. A recent study of maternal labor supply using a similar wage equation is Nakamura et al. (1979). While that study only includes selected elements of Z_1 in the wage equation because of this effect on work experience (i.e., labor supply in prior periods), this approach logically implies the more inclusive specification used here.

7. Of course, the selectivity variables are defined differently for the two groups. For husbands of working wives (and for working wives), the variable is the ratio of the probability density (calculated from the maternal work status regression) to the estimated probability of working. For husbands of nonworking wives, it is the ratio of the probability density to the estimated probability of not working.

8. Since heteroscedasticity is to be expected on a priori grounds in censored samples, the OLS estimates of t-statistics for the regression coefficients may be biased away from zero. However, the results cited in n. 15 suggest that in fact the extent of this bias may be small.

9. For more detailed information on the methods and content of the SIE, see U.S. Department of Commerce (1978).

10. OTHMETRO and OTHNONM can only be nonzero for residents of Massachusetts, Connecticut, New York, Pennsylvania, Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Virginia, North Carolina, Georgia, Florida, Tennessee, Alabama, Louisiana, Texas, Colorado, New Mexico, Arizona, and Oregon.

11. All health problems reported in the survey are chronic or long-term. Short-term problems (e.g., broken bones) are not indicated in the data.

12. The SIE questions on which these variables are based first determined whether each child aged 5 to 17 had a physical, emotional, or mental condition which limited or interfered with regular school work. If they did have such a condition, a question was then asked about limitations in ability to attend school. If they did not, a question was asked about physical, emotional, or mental conditions which limited the child's ability to take part in sports, games, or similar activities. If the response to this last question was negative, the child was not considered to have a health problem. For children aged 3 to 4 only this last question

about limitations in play was asked. Also, the reader should note that classification of emotional and mental conditions as health problems in the SIE is consistent with recent epidemiological work emphasizing that this type of problem (termed "the new morbidity") is an important portion of the total spectrum of child health problems (Haggerty et al. 1975, pp. 94–113; Starfield et al. 1980).

13. This deletion had little effect on the estimated coefficients for the child health variables.

14. In most cases, the selectivity variables were computed from maternal work status regressions using the same selection of child health variables. For example, in Table 8.3 maternal wage regression D used a selectivity variable calculated from maternal work status regression D. For the regressions labeled E through K in Tables 8.3 and 8.4 maternal work status regression C was used to calculate the selectivity variables.

15. Complete results for all these regressions are available from the author. It should also be noted that the residuals from several of the hours and earnings regressions reported here were examined for evidence of heteroscedasticity. More specifically, since the censored sample model implies that the residual variance will be a function of the value for the selectivity variable (Cogan 1977; Nakamura et al. 1979), we grouped the observations in each regression into ten roughly equal groups ordered by this value. We then calculated the mean square residual for each of the ten groups. These mean figures were generally close to one another (with the largest being no more than roughly 1.5 times the smallest) except in the husband's earnings regressions. Moreover, variation in the mean squares among the groups did not seem to be systematically related to the value of the selectivity variable. Thus, it seems safe to conclude that sample censoring is not an important source of heteroscedasticity in the data.

16. Coefficients are regarded as significant if their t-statistics exceed 1.645, which indicates significance at the 0.1 level in a two-tailed test.

17. Since the dependent variables in the wage regressions are natural logarithms, the percentage reductions referred to in the text are calculated as $(1\text{-}e^{bx})$, where b is the estimated coefficient and x is the variable under discussion.

18. All regressions for nondisabled families used for predictions and all regressions on disabled families reported here were estimated by OLS. Selectivity variables used in these regressions were based on a probit maternal work status regression for nondisabled families.

19. Regression results for the variables KID0T2, KID3T4, KID5T9, and KIDNUM are consistent with this explanation. In the maternal work status, hours, and earnings regressions, coefficients for the first two of these variables are always large and significantly negative, while coefficients of the latter two indicate less negative effects which are sometimes insignificant.

20. Other types of health problems reported in the SIE are mental retardation, visual impairments, other musculoskeletal problems (besides back problems), digestive disorders, respiratory disorders, emotional and nervous disorders, and heart disease. Note, however, that 40% of the reported problems did not fall into any of the categories mentioned here or in the text. Data on the nature of these problems was not available.

21. The SIE data also indicate that the reported health problems for this age group were more likely to involve limitations in schoolwork. In particular, the percentages of children with schoolwork limitations (including those with attendance limitations) were 73.7, 64.6, and 40.6 for the age groups 5 to 9, 10 to 13, and 14 to 17 respectively. These figures are not surprising in view of collinearity between WORK, CANTABS, DIS5T9, and DIS10T13 already noted.

22. A related criticism, based on the analysis of Rosenzweig and Wolpin (1980), is that it might be more appropriate to view parental labor supply and child-bearing decisions over the life-cycle as jointly determined. From this perspective, independent variables relating to fertility (such a the number and ages of children), which are typically included in standard

labor supply analyses, are viewed as endogenous and estimated labor supply equations containing these independent variables are *conditional* labor supply functions. Furthermore, estimates of these functions may be biased by unobservable preference variations among households. If, in the present analysis, these fertility-related independent variables are simply excluded, the possibility of bias still remains since unobserved preference variations are related to family size and thus to the probability of having a disabled child. If, however, the disability variable could be defined in a manner unrelated to fertility, estimated child disability effects free of this bias would be obtained. For example, one might define a disability dummy equal to 1 if the family's firstborn child was disabled at birth (or shortly thereafter) and use this in labor supply regressions which excluded fertility-related variables. As an approximation to this procedure, we reestimated regressions A and B for maternal work status and parental earnings, excluding disabled families where the oldest child was not disabled and excluding nondisabled families with no children over 2 years of age. The results for both specifications A and B are similar to the findings in Tables 8.3 and 8.4. The DUMDIS coefficients are small and clearly insignificant except in the maternal earnings regression where a highly significant coefficient of -0.1822 is obtained. The coefficients of WORK, CANTABS, and USMOB in the maternal work status regression are all negative with t-statistics greater than 1; however they are smaller in magnitude than those in Table 8.3 and only the WORK coefficient is clearly significant. The positive coefficient of PLAY is also significant. In maternal earnings regressions B, the coefficients for WORK, CANTABS, and USMOB are not significant, while the negative coefficients for DIS3T4, USHELP, and PLAY became larger and highly significant. In summary, regardless of the weight one gives to the Rosenzweig-Wolpin critique of the standard labor supply model, it does not appear to have important implications for our major empirical results.

23. Note, however, that the estimation method described in n. 22 does capture these secondary effects.

24. We are currently examining this possibility with 1976 data from the Panel Study of Income Dynamics.

25. For indirect evidence that parental time inputs influence children's intellectual development, see Edwards and Grossman (1977*a*). Empirical evidence on the interrelationships of children's health and intellectual development over time is presented in Shakotko et al. (1980) and Edwards and Grossman (1977b).

26. Further research in the project described by Breslau et al. (1980) is examining some of these impacts.

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