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The Dynamics of Income-related Health Inequality among US Children

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SUMMARY

We estimate and decompose income-related inequality in child health in the US and analyze its dynamics using the income-related health mobility index recently introduced by Allanson et al., 2010. Data come from the 1997, 2002, and 2007 waves of the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID). The findings show that income-related child health inequality remains stable as children grow up and enter adolescence. The main factor underlying income-related child health inequality is income itself, although other factors, such as maternal education, also play a role. Decomposition of income-related health mobility indicates that health changes over time are more favorable to children with lower initial family incomes vs. children with higher initial family incomes. However, offsetting this effect, our findings also suggest that changes in income ranking over time are positively related to children's subsequent health status.

Keywords

inequality; child health; income-related health inequality; income-related health mobility; health inequality

INTRODUCTION

There is a large and growing literature in economics that focuses on estimating and decomposing the sources of SES-related inequality in health, and examining how SES-related health inequality evolves over time. Most recent work employs the concentration index (CI), which captures the degree to which inequality in a health outcome measure is associated with inequality in a measure of SES, typically income (van Doorslaer et al., 2000). An important advantage of the CI is that it can be decomposed into a weighted sum of the CIs corresponding to the determinants of health (e.g., age, education), in which each weight represents the elasticity of health with respect to a particular determinant of health evaluated at the sample mean (Wagstaff et al., 2003). The CI is also useful when longitudinal data are available, since the change in the CI over time can be decomposed to provide information regarding whether the health of the poor is improving or worsening over time relative to that of the rich (Allanson et al., 2010).

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In this study, we estimate and decompose income-related inequality in child health, and analyze its dynamics, using data from the 1997, 2002, and 2007 waves of the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID). Recent studies document a positive relationship between family income and child health.¹ However, to our knowledge there are no previous studies which focus on how and why income-related inequality in child health evolves as children grow up. In the present study, we add to existing research, which shows that children in better health tend to be from higher income families, by applying the income-related health mobility index recently introduced by Allanson et al., 2010 to examine how and why income-related child health inequality has been evolving in recent years in the US. Using the Allanson et al. approach, we try to shed light on how changes in children's health over time and changes in children's positions in the family income ranking over time underlie changes in income-related child health inequality over time in the US.

DATA AND METHODS

Data come from wave I (1997), wave II (2002), and wave III (2007) of the CDS-PSID and the PSID family history files. The CDS-I includes 3,563 children 0 to 12 years old. In the CDS-II, 2,907 of these children were interviewed a second time, and in the CDS-III, 1,506 of the original respondents were interviewed a third time. Our sample is a balanced panel of 3,174 observations. From the original sample of 7,976 observations from the pooled CDS I, II, and III waves, we dropped observations whose mothers were not either the head of the household or the wife of the head (613). We also dropped observations with missing values on: race (15), gender (192), birth weight (29), family income (1), rural/urban location (136), smoking in the family unit (5), health insurance (4), mother's education (334), mother's employment (39), and analysis weight (99). Finally, we excluded children that were not present in all three CDS waves (3,335).² The concentration and mobility indices discussed below are calculated using sample weights, and standard errors of these indices are generated using bootstrapping methods (Petrie et al., 2011).

To measure child health, we use parent-reported health (PRH), which is the primary caregiver's response to the following question - "In general, would you say (CHILD'S) health is excellent, very good, good, fair, or poor?" In the CDS data, PRH is coded from 1 to 5, with 1 representing excellent health and 5 representing poor health. In our analyses, we re-code this variable as: 1 (poor), 2 (fair), 3 (good), 4 (very good), and 5 (excellent). Information on family income comes from the 1997, 2003, and 2007 main PSID family files, and includes taxable income, transfer income, and social security income of all family unit members. Family income is deflated to 1996 dollars. Since we use the log of family income in our analyses, negative and zero values of family income are coded as one dollar.

¹The main empirical approach used in prior literature on the family income-child health gradient is to estimate a regression model in which a measure of child health is the dependent variable, and the independent variables include family income and a range of other demographic and family background characteristics. The estimated coefficients on family income and its interactions with other variables (e.g., child age, prior health shocks) are of primary interest. Recent studies in this area include: Case, Lubotsky, & Paxson, 2002; J. Currie & Stabile, 2003; Propper, Rigg, & Burgess, 2007; A. Currie, Shields, & Price, 2007; Condliffe & Link, 2008; Murasko, 2008; Khanam, Nghiem, & Connelly, 2009.

²We also ran all analyses with an unbalanced panel, including these 3,335 observations. The findings were very similar to those presented here.

In our analyses of income-related child health inequality, we use predicted child health. This prediction is generated from a random effect ordered probit model in which the variable PRH is regressed on child characteristics (i.e., child age, race/ethnicity), family background characteristics (i.e. family income, parental education), and objective measures of child health (i.e. low birth weight). These variables are included in the vector of covariates $\mathbf{w}$, which are the determinants into which we decompose the concentration index.³ We rescale the predicted value of child health into the [0, 1] interval as follows:

$h_{it} = (\hat{h}_{it}^* - \hat{h}_{min}^*) / (\hat{h}_{max}^* - \hat{h}_{min}^*)$ where $\hat{h}_{max}^*$ and $\hat{h}_{min}^*$ are the maximum and minimum of the predicted quality of health, respectively.

Using h_{it} , we measure income-related health inequality using the CI (Wagstaff, Paci, & van Doorslaer, 1991). The CI is then decomposed into its determinants as demonstrated by Wagstaff et al. (2003). Next, we use the approach proposed by Allanson et al. (2010) to decompose the change in the cross-sectional CI from the starting period s (CI^s , the CI calculated using CDS I) to the final period f (CI^f , the CI calculated using either CDS II or CDS III), into two components M^R and M^H (Equation 1) (see Allanson et al. 2010 for a detailed discussion of the approach). Intuitively, using this approach provides information on whether changes in child health over time have favored children who had initially lower or higher family incomes, and/or whether changes in children's family income rankings over time are associated with children's subsequent health.

In equation 1 below, CI^f denotes the concentration index of the final period health ranked by starting period income.

$$CI^f - CI^s = (CI^f - CI^{fs}) - (CI^s - CI^{fs}) = M^R - M^H \quad (1)$$

In equation 1, M^R measures the change in the CI over time that is due to the change in the income-ranking ("health-related income mobility"), and M^H captures the change due to the change in the level of child health itself ("income-related health mobility"). The term M^H is positive if changes in health over time favor the poor, is negative if health changes favor the rich, and is equal to zero if relative health changes are independent of income or health does not change. Furthermore, M^H can be decomposed into two parts (Allanson et al., 2010),

$$M^H = CI^s - CI^{fs} = (CI^s - CI^{\Delta s}) \left(\frac{\overline{\Delta h}}{\bar{h}^f} \right) = Pq \quad (2)$$

where CI^s is the concentration index of health changes ranked by initial period income, and $\overline{\Delta h} = \bar{h}^f - \bar{h}^s$ is the average health changes between the starting and final periods

(Equation 2). The term $P = (CI^f - CI^s)$ is called the progressivity index, and $q = \frac{\overline{\Delta h}}{\bar{h}^f}$ is called the scale factor.

³See notes to Table 1 for a list of all the covariates included in the vector $\mathbf{w}$.

RESULTS

Weighted summary statistics, and results from the random effects ordered probit model are available in Chatterji, Lahiri & Song (2011). The cross-sectional concentration index is 0.119 for CDS-I, 0.107 for CDS-II, and 0.112 for CDS-III (Table 1). All of the concentration index estimates are positive and statistically significantly different from zero, indicating that income related child health inequality in the US begins early and persists as children grow up and enter adolescence.

In Table 1, for each CDS wave, we examine the relative importance of the social determinants of income-related child health inequality. Several findings are notable in Table 2. First, in all waves, family income contributes more than 30 percent to income-related child health inequality. This is consistent with prior research on adult health. (Lahiri & Pulungan, 2006; van Doorslaer & Jones, 2003). Second, maternal college education is highly unequal between the rich and the poor (C_{kt} is relatively large), and child health is responsive to this maternal education level (ξ_{kt} is relatively large). Third, in all waves, race/ethnicity and family structure are important factors underlying income-related child health inequality. Fourth, low birth weight contributes to income-related child health inequality only to a small degree, but it is notable that its effects persist into the CDS-III, when most respondents have entered adolescence and young adulthood.

The stability of the CI across the CDS waves suggests that income-related child health inequality changes little as children grow up and enter adolescence, but it may mask important changes at the individual level in income-related health mobility and health-related income mobility. Thus, in Table 2, we decompose the change in the CI across CDS waves into M^H (income-related health mobility) and M^R (health-related income mobility), and then further decompose M^H into the progressivity index P and the scale factor q to examine the reasons behind income-related health mobility (Allanson et al., 2010). The positive M^H for CDS-I to CDS-II and CDS-I to CDS-III implies that the relative health changes ranked by children's initial level of family income had the effect of reducing income related inequality in child health. Further decomposition of M^H shows that the progressivity index P is relatively large compared to the scale factor q (Table 2). The large P indicates that progressive income-related health mobility is driven by improvements in health over time that favor children who are relatively poor in the initial income ranking, especially between CDS-I and CDS-III. The scale factor q shows, however, that average child health across all income groups improved only slightly over time, thus diminishing the effect of the large P on income related health mobility.

Health related income mobility (M^R) is positive, indicating that CDS III income is more correlated with CDS III health than is CDS I income (Table 2). In other words, children who moved up the income ranking over time were ultimately relatively healthier in the CDS III than those who moved down the income ranking over time. This effect counter-balances the progressive effect of income related health mobility on income-related child health inequality, leading to the result that there is virtually no change in the CI over time. In sum, our results show that income-related child health inequality does not change across the three CDS waves, despite a large, positive progressivity index (P), because: (1) children whose

families move up the income ranking over time are ultimately relatively healthier; and (2) the large P cannot have much effect because, on average, child health is only improving slowly over time.

CONCLUSION

From a policy perspective, it is important to understand whether the health of children in low-income families is improving or getting worse relative to the health of children in higher-income families over time. Our study of a nationally representative, longitudinal sample of U. S. children shows that income-related child health inequality has remained stable in recent years. However, this stability hides some policy-relevant changes. Our findings have important implications for mechanisms through which individual changes in child health and income ranking affect the evolution of income-related child health inequality in the US. Decomposition of income-related health mobility indicates that health changes over time are more favorable to children with lower initial family incomes vs. children with higher initial family incomes, reducing income-related inequality in child health. This may be because low-income children are able to recover their health from early health shocks, such as low birth weight, and quickly accumulate health relative to higher-income children, leading to less family-income related health inequality among children over time.

However, at the same time, our findings suggest that over time, changes in children's income ranking have worsened health inequality because children whose families moved up the income ranking were subsequently healthier than those who moved down. Since changes in income ranking are positively correlated with changes in children's relative health status,⁴ this finding is consistent with the idea that, for example, a negative family income shock would lead to both a worsening of child health and a lower family income rank. Also, this finding is consistent with the idea that families with children who receive negative health shocks may fall in the income ranking over time compared to families with healthy children, perhaps through effects of poor child health on parental employment (Gould, 2004; Norberg, 1998; Powers, 2003; Corman et al., 2005; Powers, 2001). To reduce income-related child health disparities in the US, the results suggest that public policy should focus not just on buffering the effects of early disadvantage on child health but also on protecting children from negative family income and health shocks early in life, perhaps through policies that reduce disruptions in health insurance, housing, and parental employment that may accompany such shocks.

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⁴Since the mobility index can be written as follows, we can confirm that changes in health status and changes in income ranking are positively correlated with each other. We thank an anonymous reviewer for clarifying this point.

$$M^R = CI^f - CI^{fs} = 2Cov(h^f, \Delta R) / \bar{h}^f = 2Cov(h^s + \Delta h, \Delta R) / \bar{h}^f = 2Cov(h^s, \Delta R) / \bar{h}^f + 2Cov(\Delta h, \Delta R) / \bar{h}^f$$

where R is the change in income ranking.

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Table 1

Decomposition of Income-related Concentration Index (CI)

Variable	β_k coef.	s.d.	C_{kt}			$\xi_{kt} = \beta_k w_{kt} / \bar{w}_t$			$\hat{I}_{kt}$		
			CDS-I	CDS-II	CDS-III	CDS-I	CDS-II	CDS-III	CDS-I	CDS-II	CDS-III
African-American	-0.483***	(0.086)	-0.492	-0.483	-0.509	-0.035	-0.033	-0.033	14.46%	15.01%	14.94%
Latino	-0.699***	(0.133)	-0.425	-0.400	-0.350	-0.055	-0.056	-0.058	19.57%	20.75%	18.03%
Age	0.059**	(0.020)	0.009	0.005	0.001	0.137	0.307	0.478	0.98%	1.38%	0.26%
Age square	-0.003**	(0.001)	0.010	0.009	0.001	-0.036	-0.153	-0.349	-0.31%	-1.34%	-0.43%
Log Family Income	0.145***	(0.036)	0.387	0.295	0.295	0.104	0.120	0.130	33.98%	32.87%	34.13%
Child lives with both parents	0.047	(0.075)	0.141	0.162	0.162	0.021	0.018	0.018	2.53%	2.80%	2.62%
Metropolitan area	0.172*	(0.067)	0.107	0.074	0.078	0.040	0.039	0.039	3.61%	2.67%	2.73%
Smoking in the FU	-0.072	(0.070)	-0.200	-0.197	-0.481	-0.011	-0.010	-0.005	1.90%	1.91%	2.02%
Mother some college	0.286*	(0.120)	0.064	0.069	0.029	0.046	0.045	0.046	2.49%	2.88%	1.17%
Mother college graduate	0.340*	(0.147)	0.492	0.471	0.492	0.037	0.034	0.036	15.31%	14.89%	16.00%
Mother post graduate	0.364*	(0.180)	0.470	0.502	0.525	0.015	0.015	0.016	5.77%	6.96%	7.48%
Low birth weight	-0.101	(0.119)	-0.158	-0.289	-0.402	-0.003	-0.003	-0.003	0.44%	0.86%	1.17%
CI of child health			0.119	0.107	0.112						
Standard error of CI			(0.007)	(0.006)	(0.006)						
Sample Size			1058	1058	1058						

* Note: Table 1 shows decomposition results for a subset of covariates used in the model. The CI of child health is the estimate of the income-related concentration index that we decompose. The full list of covariates in the regression and decomposition includes: log family income, age, age square, child gender, child race/ethnicity (African-American, Latino, Other), number of children in the family, child lives with both parents, mother's age when child was born, child lives in metropolitan area, smoking in the family unit, child has any kind of health insurance, mother is high school graduate, mother has some college education, mother is college graduate, mother has some post-graduate education, mother is employed, mother is retired/temporarily laid off/sick leave or maternity leave, mother is a student or homemaker, mother has other employment status, primary care-giver is not mother, primary care-giver is female, child has at least one chronic health condition, child born with low birth weight. $\hat{\beta}_k$ is the coefficient of each covariate in the regression. Standard errors in parentheses, $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

C_{kt} is the income-related concentration index of the covariate. ξ_{kt} is the elasticity of the covariate, and $\hat{I}_{kt}$ is the percentage contribution of the covariate to the income-related health inequality. The standard errors of the concentration indices were generated using bootstrapping.

Table 2

Decomposition of Changes in Income-related Health Inequality

Variable		
	(1) CDS-II	(2) CDS-III
Concentration index in the final period (CI^f)	0.107 (0.006)	0.112 (0.006)
Concentration index in the initial period: CDS-I (CI^s)	0.119 (0.007)	
Concentration index of the final period health ranked by initial income (CI^{fs})	0.101	0.102
Average health change ($\bar{\Delta h}$)	0.027	0.008
Final period average health ($\bar{h}^f$)	0.570	0.552
Concentration index of health changes ranked by initial income (CI^s)	-0.286	-1.181
Income-related health mobility (M^H)	0.018 (0.005)	0.017 (0.006)
Progressivity index P	0.380 (0.107)	1.137 (1.798)
Scale factor q	0.047 (0.070)	0.015 (0.008)
Health-related income mobility (M^R)	0.006 (0.003)	0.010 (0.004)

Note: Table 2 shows decomposition of changes in the cross-sectional CI from CDS-I to CDS-II (column 1) and from CDS-I to CDS-III (column 2). Standard errors generated using bootstrap techniques are in parentheses.