Children's Health and Social Mobility

Anne Case and Christina Paxson

Summary

Children from low-income families are more likely than other children to have serious health problems. And, as Anne Case and Christina Paxson show, childhood health problems can prevent poor children from achieving economic success as adults.

Income-related disparities in childhood health are evident at birth or even before, and the disparities grow more pronounced as children grow older. Not only do poor children have more severe health problems than wealthier children, but they fare less well than wealthier children who have the same problems. They also receive less and lower-quality medical care for their problems. And poor families may be less well equipped to manage their children's health problems, which could worsen their effects.

The available U.S. data sets do not allow researchers to track individuals' health and economic well-being from birth into adulthood, but three British data sets are producing growing evidence that health in childhood is a determinant of educational attainment, which in turn affects adults' employment opportunities and wages. Children in poor health are also more likely to have poor health as adults, and their health as adults adversely affects their economic status.

Case and Paxson note that eliminating income-related disparities in health problems in childhood would do little to reduce earnings disparities between richer and poorer adults. However, they emphasize that, for children in poor health, improvement in physical condition in childhood would lead to substantial improvement in economic circumstances.

The authors cite several areas, including expanded prenatal care, maternal smoking cessation programs, and nutrition programs, as deserving particular attention. They contend that increased access to health care is not sufficient to improve children's health. The next wave of policies should focus on improving the quality of health care and strengthening the ability of parents to manage their children's health problems.

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Do health problems in childhood make it harder to achieve economic success in adulthood? The question is important for all children, but it is especially so for children from low-income families because they are more likely than other children to have health problems. An income-related gap in health is evident as soon as children are born, and it widens as they grow older. Although not all physical and mental health conditions are more common among low-income children, many of the most serious conditions are. Moreover, the health problems of lower-income children appear to be more poorly managed. The "double disadvantage" of low income and poor health may combine to prevent poor children from achieving economic success as they become adults.

Poor childhood health could limit economic success later in life for several reasons. One may be that children with health problems tend to be less well educated than other children: they may have greater difficulty learning and may leave school when they are younger. Another reason may be that less healthy children become less healthy adults. Adults in poor health may find it more difficult to hold down good jobs or to work as many hours as their healthy peers. Because poor health in childhood may affect economic success in adulthood in a variety of ways, we will discuss evidence on a range of adult outcomes, including schooling, health, and labor market success. The general thrust of the evidence is that health in childhood has long-term consequences for economic success.

Improving the health of children is a policy goal worth pursuing whether or not childhood health is related to adult economic success. But the research finding that children's health affects their standard of living as adults suggests the particular importance of policies and programs that improve the health of all children, and especially lower-income children. The challenge is to find programs and policies that work effectively against the causes of poor childhood health. Low income can lead to poor health in a variety of ways, including adverse prenatal conditions, poor nutrition, and poor management of health problems. Not all childhood health conditions are preventable or treatable. Not all have known causes. Given the many factors that influence children's health, it is unlikely that any single program or policy will dramatically affect either child health or adult success. That said, some policies and programs hold more promise than others. We discuss these in the final section.

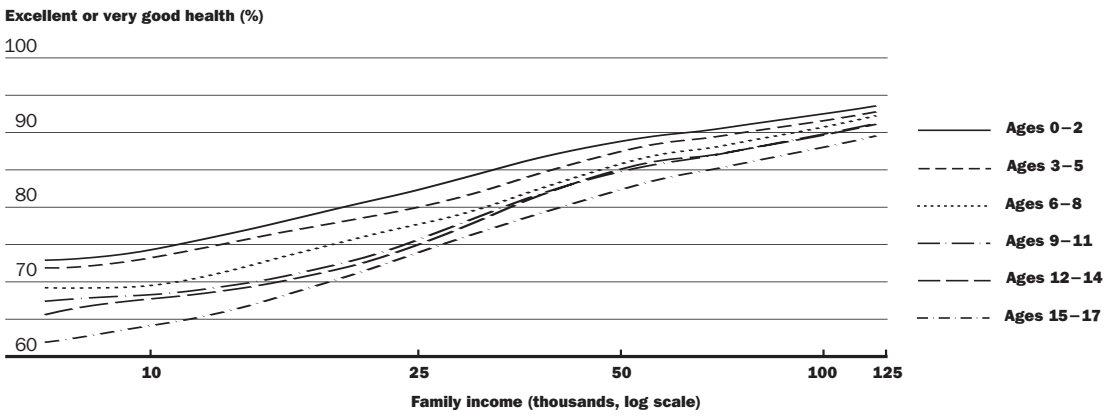
The Relationship between Economic Status and Health in Childhood

Numerous studies have analyzed the relationship between income and children's health. They have examined a variety of health measures, ranging from health status broadly defined to very specific health conditions experienced by children of different ages. A general conclusion is that lower-income children are more likely to be in poor health than are children from higher income groups.

Economic Status and Global Health Status

The National Health Interview Survey (NHIS), a nationally representative annual survey of U.S. families, asks respondents (or, for children, their adult caregivers) whether they are in excellent, very good, good, fair, or poor health. The resulting summary measure of health, called global health status, although crude, is highly correlated with spe-

Figure 1. Global Health Status and Family Income, by Age



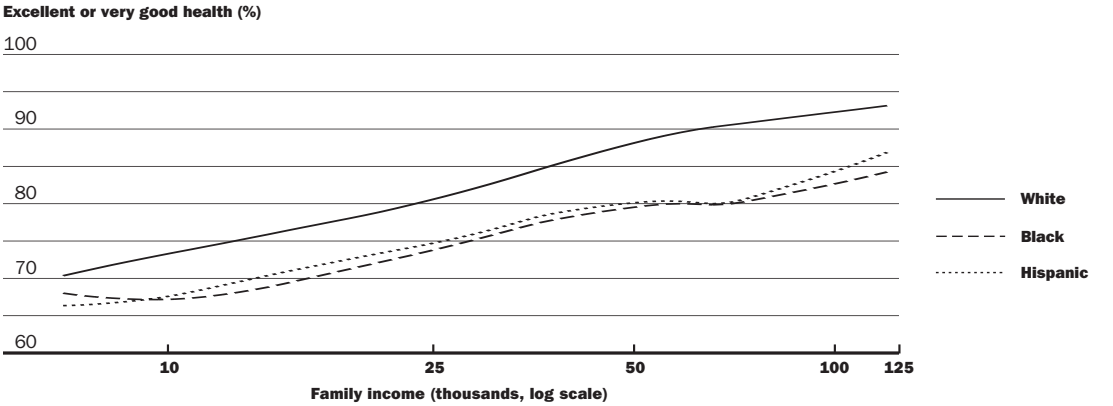
Source: National Health Interview Survey, 1997–2003.

cific types of illnesses and health conditions in childhood. Adults who report poorer global health status are more likely than others to become ill and to die sooner rather than later.[1] Using the NHIS surveys conducted from 1997 to 2003, we estimate how parents' reports of their children's health vary with family income.[2] Figure 1, based on these estimates, charts the share of children of different ages and with different family income who are reported to be in excellent or very good health.

For all age groups, children from higher-income families are more likely than those in other income groups to be in excellent or very good health. Among children from birth to age three, for example, fewer than 75 percent of those with family incomes less than $10,000 a year were in excellent or very good health, as against more than 90 percent of children with family incomes greater than $100,000. The relationship between health and income is apparent throughout the income range: middle-income children are healthier than lower-income children, and upper-income children are healthier than middle-income children. Moreover, income-related differences in health become more pronounced as the children grow older. Among children from birth to age three, those at the highest income level are 21 percentage points more likely to be in excellent or very good health than those at the lowest income level. This difference increases to 29 percentage points for children aged fifteen to seventeen. Children from poorer families are substantially more likely than their wealthier peers to enter adulthood with health problems.

Other researchers report similar findings. An analysis we conducted with Darren Lubotsky, using three large nationally representative data sets—the Panel Study of Income Dynamics, the National Health and Nutrition Examination Survey, and earlier years of the National Health Interview Survey—documents both that children's health differs by family income and that the gaps widen as children age.[3] Paul Newacheck and several colleagues conclude that the health of teens from poorer families is worse than that of teens from wealthier families.[4] Elizabeth Goodman reaches a similar conclusion in examining participants in the National Longitudinal Study of Adolescent Health, a nation-

Figure 2. Global Health Status and Family Income, by Race and Ethnicity



Source: Same as figure 1.

ally representative data set in which adolescents rate their own health.[5] Other broad (and arguably more objective) measures of poor health—including days spent in bed because of illness, school days missed because of illness, and hospital episodes—also decline as income rises.[6]

These income-related differences in health are not attributable to differences in health insurance coverage. In an earlier study, we found that even among children who have private insurance, higher-income children are in better health than lower-income children.[7] Nor do these differences exist only in the United States: Janet Currie and Mark Stabile find a nearly identical link between children's global health status and family income in Canada, which has universal health care.[8]

Finally, racial and ethnic differences in health status do not account for the income-related differences either. Using the same methods as for figure 1, figure 2 shows the share of black non-Hispanic, white non-Hispanic, and Hispanic children of various family incomes in excellent or very good health. African American and Hispanic children have worse global health status, on average, than white children with the same family incomes.[9] But within each racial and ethnic group, wealthier children are in better health. All the U.S. studies we have mentioned above also find strong links between family income and children's health after adjusting for differences in health across race and ethnic groups.

Socioeconomic Status and Birth Outcomes

Income-related disparities in childhood health are evident at birth or even before. Much research on this topic focuses on low birth weight, which provides a measure of the quality of both the intrauterine environment and the medical care received during pregnancy. Small newborns are categorized as being "low birth weight" (less than 2,500 grams), "very low birth weight" (less than 1,500 grams), or extremely low birth weight (less than 1,000 grams). Low birth weight stems from preterm birth (defined as less than thirty-seven weeks of gestation), prenatal growth retardation, or both. Almost all babies with very low birth weight are born preterm. Although low birth weight is not uncommon, only a small fraction of infants have very low and extremely low birth weights. In

2002, for example, 7.8 percent of infants had low birth weight; 1.5 percent, very low birth weight; and only 0.7 percent, extremely low birth weight.[10]

Low birth weight is associated with a variety of neurodevelopmental problems, including cerebral palsy, blindness, impaired lung function, and mental retardation. The smallest and most premature children are at much greater risk for these problems, though the rates of major disability among even the most premature infants (born at less than twenty-seven weeks of gestation) are relatively low. Only one-fifth to one-quarter of surviving infants born at less than twenty-seven weeks of gestation experience a major disability, including impaired mental development, cerebral palsy, blindness, or deafness.[11] Nevertheless, children born at very low birth weight without a major disability may have more subtle mental and emotional problems, such as attention deficit hyperactivity disorder (ADHD), behavioral problems, and reduced IQ. A recent review of the research concludes that infants who are low birth weight, especially those who are premature, have slightly lower IQs than normal-weight full-term babies.[12]

Children from low-income families are more likely than other children to have low birth weight. Among poor children, the rate of low birth weight is 10 percent, as against 6 percent among nonpoor children.[13] The National Health Interview Survey reveals similar income-related disparities in rates of low birth weight.[14] Among children with annual family incomes below $30,000 (measured in 2000 dollars), 9.3 percent were born at low birth weight and 1.5 percent at very low birth weight. Rates for children with family incomes between $30,000 and $60,000 were 6.9 percent and 1.1 percent, respectively. For children whose families earned more than $60,000, 5.6 percent had low birth weight and 0.8 percent had very low birth weight. As with global health status, the disparity is not just between poor and nonpoor children; birth outcomes improve steadily with income.

That poorer children are more likely to be born at low birth weight suggests that socioeconomic differences in health emerge even before birth. Because it is difficult to measure fetal health directly, researchers have instead focused on factors that may affect fetal health, such as socioeconomic differences in prenatal care and the incidence of risky behaviors in pregnancy.[15] Much of this research uses maternal education rather than family income as the measure of socioeconomic status, because the former but not the latter appears on birth certificates, which typically provide the data for analysis.

The use of early and regular prenatal care varies widely by maternal education. According to the National Vital Statistics, 68 percent of women without a high school degree began prenatal care in the first trimester of pregnancy, compared with 81 percent of high school graduates and 91 percent of women with at least some college education.[16] An important goal of prenatal care is to inform women about proper nutrition during pregnancy, and it appears that this goal is not being met for women with lower socioeconomic status. For example, women with less education are more likely to have folic acid deficiencies (associated with spina bifida and other neural tube defects)—indicating either poorer diets or less use of vitamin supplements during pregnancy.

Analysts observe similar patterns for cigarette smoking during pregnancy, a behavior that has been implicated in preterm birth, in-

trauterine growth retardation, and subtle but long-lasting effects on cognition and behavior. According to recent statistics, 78 percent of pregnant women without a high school degree refrained from smoking during pregnancy, as against 83 percent of those who were high school graduates and 94 percent of those with at least some college education.[17] Although it is difficult to gather reliable information on alcohol and illegal drug use, women with less education also appear more likely to use alcohol and drugs during pregnancy. Self-reported rates of drug use, though, are low. Shahul Ebrahim and Joseph Gfroerer, using data from the National Household Survey on Drug Abuse, report that 2.8 percent of pregnant women surveyed between 1996 and 1998 reported using illicit drugs.[18] And during the 1980s and 1990s, although 20 percent of women reported consuming at least some alcohol during pregnancy, only 1.3 percent reported an episode of binge drinking.[19] Unless pregnant women greatly underreport binge drinking and illicit drug use, alcohol and drugs cannot account for much of the income-related differences in children's health at birth.

Lower-income children experience a broader set of specific health problems than do children from higher-income households.

Socioeconomic Status and Health Conditions in Childhood

Children experience a wide variety of health problems, from common ailments such as colds and upset stomachs to rare and more serious conditions such as muscular dystrophy and cerebral palsy. Some problems appear shortly after birth; others develop later. But despite the diversity of these health conditions, lower-income children experience a broader set of specific health problems than do children from higher-income households.

Based on parent reports, nonpoor children are more likely than poor children to have only a handful of relatively minor health conditions, such as hay fever and sinusitis. Poorer children, by contrast, are more likely to have asthma, frequent headaches, heart conditions, kidney disease, epilepsy, digestive problems, mental retardation, and vision and hearing disorders.[20] Researchers comparing children in different social classes in the United Kingdom make similar findings.[21] Although many of these health conditions are rare, a substantial fraction of children have at least one. Paul Newacheck and Neal Halfon find that 9.6 percent of poor children and 5.7 percent of nonpoor children under age eighteen suffer from a disability, defined as a physical or mental health condition that limits their activities.[22] Some mental health and cognitive problems, such as learning disabilities and developmental delays, are also more common among poor than among nonpoor children.[23] Evidence on depression is mixed. Research using a nationally representative survey of adolescents finds that poorer adolescents are more likely to experience depressive symptoms.[24] A comparative review of studies based on the Children's Depression Inventory, however, finds no link between socioeconomic status and depression in children and adolescents.[25]

Socioeconomic Status and the Effects of Health Problems on Children

Not only are poor children more likely to have a variety of health problems, they also

fare less well than wealthier children who have the same problems. Consider, for example, two children with asthma, one from a low-income family and the other from a high-income family. The low-income child will be more likely to be reported in poor health, to spend more days in bed, and to have more hospital episodes.[26] Similar patterns emerge for other serious (although less common) health conditions, such as diabetes and epilepsy. A study of air pollution and children's asthma in California finds that poorer children are not only exposed to more pollution, but also more likely to be hospitalized than nonpoor children who live in similarly polluted areas.[27]

Poorer children could fare worse than wealthier children with the same health conditions for several reasons. First, there is evidence that poorer children receive less and lower-quality medical care for their problems. Poor children are less likely than nonpoor children to have a usual source of health care.[28] Even when poor children have a usual source of care, they are less likely to have continuity of care with a particular primary physician. They are also significantly less likely to be vaccinated for measles and to have received medical attention for specific acute health conditions, including pharyngitis, acute earache, recurring ear infections, and asthma. Second, poor families may be less well equipped to manage their children's health problems. Many such problems, including asthma and diabetes, require a great deal of parental oversight. Parents of children with asthma, for example, must monitor medications and keep their homes free of dust mites and tobacco smoke, which can exacerbate asthma. Parents of children with diabetes must carefully monitor blood glucose levels, administer insulin, and provide an appropriate diet. Evidence for selected childhood health conditions indicates that poorer families are less likely to comply with medical protocols, which could worsen the effects of health problems.[29]

Do Children's Health Problems Affect Family Income?

Although poor childhood health and low income are linked, it could be that low income does not cause the poor health. It is possible that the relationship runs the other way—that children's health problems lower family incomes. Mothers with sick children may be more likely to stay home rather than work; the stress of having a sick child may lead to a marital break-up that strains family finances; single mothers with sick children may find it more difficult to find new partners to bring income into the household.

Researchers have found mixed support for these hypotheses. For example, Hope Corman, Nancy Reichman, and Kelly Noonan, using a sample of primarily low-income single mothers, find that mothers with children born in poor health are about 10 percentage points less likely than mothers with healthy babies to be working when their children are twelve months old. And when these mothers are employed, they typically work about four fewer hours a week.[30] Some researchers find that single mothers with a disabled child work fewer hours than other mothers.[31] But others conclude that mothers of children born in poor health are no less likely to work in the three years following the child's birth.[32] Research on the effects of children's health on family structure yields somewhat more consistent evidence, at least for the United States. Angela Fertig, using two nationally representative U.S. data sets, concludes that parents of children born in poor health are more likely to divorce.[33] That finding, however, does not hold true in Britain.

Another study of primarily low-income women who are unmarried when their children are born finds that the mothers of children born in poor health are less likely to be cohabiting or married when their children are a year old.[34]

Interpreting these findings is complicated because unobserved factors that affect child health could also affect maternal labor supply and family structure. For example, mothers with drug or alcohol problems may be more likely to have children with health conditions and also more likely to divorce. But no matter how these findings are interpreted, several pieces of evidence argue strongly against the theory that reductions in family income caused by a child's poor health can explain the observed link between child health and socioeconomic status. First, as noted, children whose parents have less schooling are more likely to be born into poor health. But except for very young parents, children's health problems cannot lower their parents' educational attainment. Second, our study conducted with Darren Lubotsky shows that the link between child health and family income after the child's birth is the same as that between child health and family income *before* the child was born.[35] A child's poor health cannot possibly lower the family's income before the child's birth, or at least before conception. Thus, we do not believe that the link between low income and poor childhood health is attributable to the fact that children's poor health lowers their families' income.

Consequences of Childhood Health for Economic Success in Adulthood

Health problems in childhood can affect economic success in adulthood in two main ways. First, they can influence educational attainment, which in turn affects employment opportunities and wages—subjects investigated in other articles in this volume. Second, poor childhood health can affect adult health, which, again, affects employment and wages. Even when differences in education are taken into account, it may be that adults in poor health are less likely to be employed and more likely to command lower wages than healthy adults.[36]

Measuring the long-run effects of childhood health is complex. The ideal test of whether health in childhood has causal effects on economic status in adulthood would be a controlled experiment in which childhood health interventions are randomly assigned and adult economic outcomes are later observed. Such experiments are now under way and will eventually be able to document long-run effects of health interventions, though not for forty or fifty years in the case of many outcomes of interest.[37] And because these experiments are being conducted in developing countries, the findings may not generalize to the United States and other industrialized countries.

In the absence of such controlled trials, researchers generally analyze large data sets that follow children from infancy through to adulthood and use the temporal order of events to demonstrate causal effects of chronic conditions and ill health in childhood on economic status in adulthood. Complicating such analyses, childhood health and adult economic status may both be subject to influence by many of the same factors, which may not be observable to researchers. Childhood socioeconomic status, for example, has important effects on childhood health. And as other articles in this volume make clear, childhood socioeconomic status also has important effects on economic status in adult-

hood. Unless researchers can take into account an adult's socioeconomic status in childhood, they might attribute that adult's economic status to childhood health when it is instead attributable to childhood economic status. Similarly, other factors, such as genetic makeup or early life events, which researchers cannot observe, may lead some people to be healthy and wealthy and others to be sick and poor.

To take into account such "third factors" that may influence both health and economic well-being, researchers often include many household and individual control variables in their statistical analyses. These analyses require rich long-term data sets that follow the same people through time and carefully monitor their health, schooling, and economic status. Several such data sets follow children over time, making it possible to examine how health is related to progress through school. But data sources that can be used to examine how childhood conditions affect outcomes much later in adulthood are much rarer. No U.S. data set currently makes it possible to track people's health and economic well-being from birth through middle age and into retirement. The British, however, have been following three birth cohorts—the 1946 National Survey of Health and Development (NSHD), the 1958 National Child Development Study (NCDS), and the 1970 British Cohort Study. Data from the latter two cohorts are publicly available, and children from the NCDS are now old enough to enable researchers to examine the effects of childhood health on economic outcomes in middle age.

The NCDS has followed all children born in Great Britain during the week of March 3, 1958, from birth to age forty-two. At the time of the birth, mothers were asked a battery of questions about their prenatal behaviors and socioeconomic status. The study collected data on their children's health, chronic conditions, socioeconomic status, and education at ages seven, eleven, sixteen, twenty-three, thirty-three, and forty-two. It assessed childhood health by medical exams. An important measure of educational attainment in these data is the number of O-level exams a child passed at age sixteen. Passing five or more

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O-level exams, a feat accomplished by only 20 percent of the NCDS cohort, qualifies students to continue academic studies until age eighteen, when they take A-level subject exams that determine admission to university. A statistical analysis of the data that takes into account differences in family background and parents' characteristics finds that for men in the NCDS, each O-level passed at age sixteen is associated with an 8 percent increase in reported wages at age thirty-three. The exams thus provide an excellent marker for future economic success.

Childhood Health and Educational Attainment

Children in poor health may be less school-ready than other children. In addition to being less able to learn at school, they may miss more school days because of illness and may complete fewer years of schooling over-

all. Their poorer schooling, in turn, could limit their earning potential, quality of life, and possibly their health as adults. A small but growing literature indicates that health in childhood is in fact a determinant of cognitive ability and educational attainment.[38]

Some recent evidence indicates that educational attainment is affected by children's health at the time of birth. Among NCDS cohort members, there are strong links between fetal conditions and educational attainment.[39] Children born at low birth weight pass 0.5 fewer O-level exams, on average, than normal-weight children—a finding consistent with evidence, already noted, that children born at low birth weight are at greater risk for cognitive and behavioral problems that could make it more difficult for them to do well in school.

Maternal smoking during pregnancy is also linked with significantly fewer O-level passes, with cohort members whose mothers reported heavy smoking during pregnancy passing 0.4 fewer O-level exams, on average. These findings may reflect the role of the fetal environment and, more specifically, the effect of smoking during pregnancy on prenatal and later cognitive development. Maternal smoking while pregnant is also linked with behavioral and cognitive problems in older children, including lower IQ and ADHD, all of which negatively affect a child's educational attainment.[40] Animal studies have also found that prenatal nicotine exposure causally affects brain development.[41] But the NCDS research cannot rule out the possibility that the link between prenatal smoking and lower educational attainment is due to "third factors," such as unobserved characteristics of the women who smoked during pregnancy that affect their children's development.

Part of the link between poor childhood health and poor school performance may be attributable to poor nutrition. In a study of Peruvian children, Douglas Berkman and several colleagues find that those who suffered from malnutrition in early childhood tended to have poorer cognitive function at age nine.[42] Although malnutrition and vitamin deficiency are rare in U.S. children, anemia poses a serious risk to children from low-income households.[43] And iron deficiency may lead to attention deficits and poorer academic performance.[44] Jay Bhattacharya and several colleagues use data from the National Health and Nutrition Examination Survey to document the extent to which children in poorer families have poorer diets and higher levels of serum vitamin deficiencies.[45] A review of evidence on the effects of the Special Supplemental Program for Women, Infants, and Children (WIC), which provides nutritious foods and infant formula to pregnant women and young children, finds that WIC has many benefits for children.[46] Numerous studies have found that children exposed to WIC tend to have higher birth weights, consume more important nutrients, have less anemia, and (in two studies reviewed) have higher scores on a test of receptive language ability. Identifying the effects of WIC is difficult, though, because children who enroll may be systematically different from those who do not. These findings, although promising, must therefore be treated with some caution.

Chronic health conditions also put children at higher risk for poorer educational outcomes. In a study of the NCDS cohort that we conducted with Angela Fertig, we looked at the number of chronic conditions a child faces at ages seven and sixteen and his or her O-level performance.[47] We found, taking into account household and parental characteris-

tics, that for each chronic condition reported at age seven, a child passes on average 0.3 fewer O-level examinations at age sixteen, and for each condition reported at age sixteen, a child passes on average an additional 0.2 fewer O-levels. That chronic conditions at age seven are linked with O-level performance, even holding constant chronic conditions at age sixteen, suggests that the damage caused by chronic conditions may be cumulative in its effect on education. Paul Gregg and Stephen Machin, also using the NCDS data, find that cohort members who at age sixteen report being sick in the past year—with either minor or more serious ailments—are significantly less likely than others to stay on in school.[48]

Different types of childhood conditions have different effects on the O-level measures in the NCDS. Children with physical impairments (such as general motor handicaps or limb impairments) do not have fewer passes, although those with physical health problems other than impairments do. Mental and emotional conditions are particularly significant. A mental or emotional condition at age seven that persists through age sixteen is associated with 1.2 fewer O-level passes.

Janet Currie and Mark Stabile, using two large long-term surveys conducted in the United States and Canada, find that ADHD has similar effects on academic success.[49] Children with ADHD are significantly more likely to repeat grades and to perform poorly on reading and math tests. Currie and Stabile do not rely on parental reports of whether a child had been diagnosed with ADHD. (Such reports could produce biased results, in that children who are doing poorly in school might be likely to be tested for and diagnosed with ADHD.) Rather, they "diagnose" ADHD using a symptom checklist completed by all parents participating in the surveys. Children classified as having ADHD, with a score of 8 or higher on the hyperactivity index, have math and reading test scores that are, on average, a quarter of a standard deviation lower than those of other children.

Despite much evidence that physical and mental health problems in childhood impede academic success, this finding is far from universal. Asthma, one of the most common childhood ailments, is a case in point. A recent review of studies of the long-run consequences of childhood asthma concludes that children who experience asthma symptoms do miss more days of school, on average, than their peers without asthma; estimates (from the twenty studies reviewed) range from an additional 2.1 to 14.8 days a year.[50] But the missed school days do not appear to translate into worse academic outcomes. Only twelve studies examined the effects of asthma on academic achievement. Although they focused on different measures of academic achievement, including standardized test scores, school grades, grade failure, and educational attainment, none found differences between children with and without asthma. The impact of asthma may depend on a household's ability to cope with children's medical needs. For example, data from the National Health Interview Survey show that asthmatic children from low-income families are at greater risk of grade failure than nonpoor children.[51] This finding is consistent with evidence that poor children

Chronic health conditions also put children at higher risk for poorer educational outcomes.

with chronic health conditions (including asthma) progress through school more slowly than do wealthier children with the same number of conditions.[52]

Another worrisome childhood health condition is obesity, the prevalence of which among U.S. children rose from 5 percent in the 1970s to more than 15 percent in the late 1990s.[53] This increased incidence is prompting new research on the health and economic consequences of childhood obesity, though little reliable evidence yet exists on how obesity affects academic achievement. One study finds that children who are overweight in kindergarten tend to have poor kindergarten and first grade test scores, but the link vanishes once the study takes into account socioeconomic and behavioral measures.[54] The study thus highlights the correlation of childhood health with socioeconomic characteristics and other factors associated with academic success. Research that cannot adequately take into account these factors may seem to suggest that child health affects later outcomes, even when no such effect exists.

An intriguing, relatively new, line of research hypothesizes that poor nutrition in utero *leads to greater risk of chronic disease, particularly cardiovascular disease and non-insulin-dependent diabetes, in middle age and later.*

Childhood Health and Adult Health

Children in poor health are more likely to become adults in poor health, which may lead them to have lower incomes. An intriguing, relatively new, line of research hypothesizes that poor nutrition *in utero* leads to greater risk of chronic disease, particularly cardiovascular disease and non-insulin-dependent diabetes, in middle age and later. The "fetal origins hypothesis" suggests that insults to intrauterine health, particularly during key developmental stages, may result in long-term damage to an organism that may not be apparent until middle age.[55] The evidence on this hypothesis is mixed: some adult health outcomes in some settings are associated with earlier uterine nutrition deficits, but many others are not. Kathleen Rasmussen, in an exhaustive review of the research, finds little evidence that intrauterine health explains chronic diseases in middle age.[56] She concludes that programs to improve maternal nutrition are likely to have a much smaller effect on cardiovascular disease and diabetes than would other sorts of programs—those pertaining to lifestyle choices in adulthood, for example—even if researchers ultimately come to agree that nutrition *in utero* significantly protects against chronic disease later in life. That said, she supports improving maternal nutrition, regardless of its effect on cardiovascular disease and diabetes.

Though questions remain about the fetal origins hypothesis, there is clear evidence that health problems in adulthood may have their origins in childhood. The NCDS shows that chronic conditions in middle childhood did not significantly affect health in adulthood for members of the 1958 cohort unless these conditions persisted into adolescence.[57] A chronic condition at age seven that had disappeared by age sixteen showed no effect on health reported at ages thirty-three or forty-

two. But conditions present at age seven that continued into adolescence and those developed between ages seven and sixteen had large and lasting effects on health reports in middle age. Other evidence comes from the literature on obesity. Robert Whitaker and several colleagues show that obese children are more likely than nonobese children to become obese as adults, especially if one or both of their parents are obese.[58] Thus, obesity that develops in childhood may lead to adult obesity and its attendant health problems, including cardiovascular disease and diabetes.

Less healthy children, then, are at an elevated risk of becoming less healthy adults. But for poor childhood health to affect adults' *economic* outcomes, it must be that poor health in adulthood undermines adults' economic success. A vast literature links poor health and low income in adulthood: poorer adults are more likely than nonpoor adults at each age to die from almost all causes of disease and to experience a wide variety of health conditions, including heart disease and depression. Anne Case and Angus Deaton show that people in the bottom quartile of the income distribution at age twenty report worse health than do those in the top quartile at age fifty.[59] The question is whether low income causes poor health or poor health causes low income (or neither). Debate on the subject is vigorous, with epidemiologists generally favoring the "income-to-health" hypothesis and economists favoring the "health-to-income" hypothesis.[60] The two hypotheses need not be mutually exclusive, however, and for our purposes it is important only to examine evidence that poor health in adulthood adversely affects economic outcomes.

Many researchers have studied how health in adulthood affects performance in the labor market. After reviewing this research, Janet Currie and Brigitte Madrian conclude that the estimates of the effect of poor adult health on labor market performance vary widely and depend heavily on the measure of health chosen and the method of analysis used.[61] Existing studies often focus too narrowly (on older white males, for example) or too broadly (lumping all adults together, for example), thus making it difficult to see whether effects vary across demographic groups. Overall, research tends to find that poor adult health affects the number of hours worked more than it affects wage rates. Similarly, Case and Deaton find that income-related differences among U.S. adults in self-reports of poor health are driven mainly by health-related absences from the labor force.[62] Mental illness and alcoholism have particularly large effects on work hours and earnings. More recently, researchers focusing on the effects of obesity on wages have found that heavier women fare less well in the labor market.[63] John Cawley, for example, finds that heavier white women have lower wages than other women, perhaps because of lower productivity or discrimination, or both. This wage difference remains when he takes into account differences in schooling.

This research shows that health problems in adulthood adversely affect economic status, primarily through work hours and employment, but it does not provide direct evidence that *childhood* health problems have long-lasting effects on economic status in adulthood. This topic has been addressed in only a handful of papers that rely on the NCDS. Janet Currie and Rosemary Hyson show that children born at low birth weight are less likely to be employed at age thirty-three.[64] Because they also find that adults who were born with low birth weight have lower educational attainment, it is possible that the

poorer schooling of this group lowers their employment rates. Other evidence indicates that adults with chronic conditions in childhood are significantly less likely to be in the labor force.[65] For men in the NCDS, each chronic condition at age sixteen lowers the probability of labor force participation at age forty-two by 5 percentage points. Of all the childhood characteristics captured in the NCDS—parental education and socioeconomic status, the uterine environment, and childhood chronic conditions—the number of chronic conditions is the most important in explaining who is and is not in the labor force at age forty-two. More generally, for men in the NCDS, chronic conditions in childhood are also closely linked with lower socioeconomic status in adulthood (a measure based on a person's occupational class but not necessarily income). Even for men who have the same number of O-level passes, those with chronic conditions in childhood have lower socioeconomic status. These findings provide direct evidence that childhood health matters for economic outcomes in adulthood.

Implications for Policy

Childhood health problems are of concern whether or not they affect adult success. However, if childhood health has a large effect on adult economic success, it is all the more important to identify policies to prevent or treat these problems or to cushion their effects. Although it is not yet possible to provide a single comprehensive estimate of the long-run effects of poor health in childhood, it is possible to derive rough calculations of some specific effects on economic status in adulthood.

We start by considering the long-run effects of health at birth. Evidence from the NCDS links low birth weight and prenatal smoking with lower educational attainment. A British child born at low birth weight passes (on average) 0.5 fewer O-level exams at age sixteen, taking into account childhood socioeconomic status.[66] And, for men, each O-level pass is linked with an 8 percent increase in earnings at age thirty-three. Combined, these two estimates (which we assume represent causal effects) imply that being born at low birth weight leads to 4 percent lower earnings at age thirty-three. Similarly, children whose mothers smoked heavily when pregnant pass on average 0.4 fewer O-level exams, translating into a 3.2 percent earnings deficit. A similar calculation can be made for chronic childhood health conditions. Children who have a chronic condition at age seven and age sixteen on average pass 0.5 fewer O-level exams, which implies a 4 percent reduction in earnings. These reductions will be even larger if low birth weight, prenatal exposure to nicotine, and chronic conditions also influence earnings by affecting adult health and work hours (holding educational attainment fixed).

Although these calculations indicate that childhood health may have a large effect on adult economic success, eliminating income-related disparities in health problems in childhood would do little to reduce earnings disparities between richer and poorer adults. Low birth weight illustrates this point. As noted, the rate of low birth weight is 10 percent among poor children and 6 percent among nonpoor children. Closing that gap would, on average, increase the earnings of poor children less than one-fifth of 1 percent.[67] Similarly, rates of prenatal smoking are 12 percent for mothers with less than high school degrees and 6 percent for those with college degrees. Closing that gap would also have relatively small effects on the implied earnings differences between the children of more and less highly educated moth-

ers. Thus, although health has large effects on adult outcomes, equalizing health disparities between wealthier and poorer children would not significantly affect their later earnings disparities.

Policies and Programs

Improving children's health is likely to have payoffs in terms of greater economic success in adulthood. The challenge for policymakers and practitioners is to identify policies and programs that improve health at low cost. Although a systematic review of evidence on this matter is beyond the scope of this article, several areas deserve particular attention.

Prenatal Care

Children born at low birth weight to mothers who smoke have lower educational attainment and (as a consequence) lower earnings as adults. Differences in the rates of low birth weight among poor and nonpoor children are small, and reducing the rate among poor children will do little to close the gap between rich and poor in adulthood, but policies that improve fetal health may have a high payoff to the individuals concerned.

One possible policy is to expand prenatal care. Surprisingly, however, evidence is mixed on whether prenatal care produces healthier babies, and in particular reduces the likelihood of low birth weight. In 1985 the Institute of Medicine issued an influential report titled *Preventing Low Birth Weight*, which concluded that early and high-quality prenatal care reduced the incidence of low birth weight.[68] The report strongly supported expanding prenatal care. But more recent research sees less promise in expanding prenatal care *as now practiced*.[69] As an article in an earlier *Future of Children* volume on low birth weight concludes, "The collective evidence suggests that adequate prenatal care is associated with reduced rates of low birth weight but mainly among more mature full-term infants. Unfortunately, prenatal care has consistently been shown not to prevent fetal growth retardation among less mature preterm infants or to prevent preterm birth."[70] Most of the serious health problems, however, are concentrated among small preterm infants—those whom prenatal care is least likely to help.

The challenge for policymakers and practitioners is to identify policies and programs that improve health at low cost.

Further evidence on the effects of prenatal care on birth outcomes comes from expansions in Medicaid eligibility starting in 1984. By 1990, federal law required states to provide Medicaid to pregnant women with incomes up to 133 percent of the poverty line. Janet Currie and Jonathan Gruber show that the Medicaid expansions increased the intensity of treatment at birth (Cesarean section deliveries, fetal monitoring, induction of labor, and use of ultrasound) among teen mothers, high school dropouts, and unmarried mothers—all groups that would have largely been uninsured if not for Medicaid.[71] But at the same time, treatment intensity fell for better educated women, who may have lost access to private insurance as a result of the Medicaid expansions. During the 1990s welfare reform moved women out of welfare and off Medicaid. Although these policy changes resulted in reduced prenatal care for

both white and black women, they had no effect on birth weight and only a modest effect on fetal deaths.[72] The difficulty in assessing the effects of the Medicaid expansions is that Medicaid may increase access to prenatal care *and* improve the quality of medical care infants receive at birth. The finding that the expansions reduced infant mortality and fetal death without improving birth weight might suggest that their major benefit was to keep premature infants alive through better medical care, rather than to prevent prematurity.

The evidence on smoking cessation programs during pregnancy is less equivocal. A recent review of sixty-four randomized trials of smoking cessation programs for pregnant women finds that forty-eight resulted in reductions in smoking.[73] In addition, children born to women in these programs were less likely than the children of women in the control groups (who were not offered programs) to have low birth weight or to be born prematurely. Overall, these studies found no significant effects of smoking cessation programs on very low birth weight, stillbirths, or perinatal or infant mortality. The samples used in these studies were generally too small to detect effects on these relatively rare outcomes.

It may seem surprising that smoking cessation programs prevent preterm birth and that prenatal care does not. After all, counseling women on tobacco use while pregnant would seem to be part of high-quality prenatal care. But prenatal care as now practiced may not give pregnant women who smoke adequate help in quitting or cutting back. Recent expansions in Medicaid coverage for smoking cessation may improve results. In 1998 Medicaid covered tobacco-dependence treatment in only twenty-four states; by 2001 that number had grown to thirty-six.[74] But only 60 percent of Medicaid physicians in those states knew that coverage existed. We know of no published studies that examine whether Medicaid coverage for smoking cessation reduces smoking among pregnant women or improves birth outcomes. The effects are likely to depend on the quality of the programs and how widely they are used.

Nutrition

The research finding that improving maternal and child nutrition may improve childhood health and cognitive development raises the question of which nutrition policies and programs have been most effective and whether to expand them. Currie provides a comprehensive review of the three leading U.S. child nutrition programs: the Food Stamp Program, the national school meal program, and WIC.[75]

Each of these programs appears to have produced some health benefits for children. Of the three, the evidence for food stamps appears most mixed—some studies find benefits, others do not. Evidence on the health benefits from WIC is more consistently positive. Much of the research links participation in WIC with low rates of low birth weight: WIC participants, on average, are 10 to 43 percent less likely to have a low birth weight baby. Because WIC provides infant formula, it reduces the probability that women will breast-feed, but for infants of mothers who choose not to breast-feed, WIC seems, by delaying the introduction of solid foods and cow's milk, to provide a better diet than they would otherwise receive. Some researchers argue that WIC is responsible for reducing anemia among poor children.

The meals of children who participate in the national school lunch program are higher in nutrients than those of children who do not, although these benefits may be offset in part

by the quality of nutrition received out of school. Currie found no studies that examined the effects of the program on school performance. In another review of research, Eileen Kennedy and Carole Davis conclude that whether a child's school participates in the school breakfast program does not significantly affect whether a child eats breakfast from any source.[76] Among the reasons cited why children do not participate in the program are lack of time before class, the early timing of the breakfast, and social stigma. Kennedy and Davis note that numerous studies evaluate the program's effect on the nutritional status of participants, but that many of them lack a control group against which to compare participants (and those eligible to participate). Only a few studies try to evaluate how the program affects cognitive development. Although some find that it improves school attendance and test scores, Currie and Kennedy and Davis reserve judgment, given the lack of adequate control groups.

Health Care and Health Management

A conviction that improving children's access to health insurance should materially improve their health was one of the driving forces behind the dramatic expansion of Medicaid eligibility during the 1980s and 1990s, and many researchers have indeed documented that better access to insurance increases use of medical care. Paul Newacheck and several colleagues, for example, find that uninsured children are significantly less likely to have a usual source of care or to have access to a regular physician or to care after normal business hours.[77] Currie and Gruber show that the Medicaid expansions increased the use of care delivered in doctors' offices.[78]

Nevertheless, assessments of whether increased use of care improves health for poor and near-poor children are mixed, at best. Robert Kaestner, Theodore Joyce, and Andrew Racine find that black and Hispanic mothers assess their children's health more positively if they have access to either Medicaid or private insurance.[79] Access to insurance has no effect on the maternal health assessments of white children. Access to Medicaid or private insurance did not reduce days in bed in the past twelve months for any group. The authors speculate that Medicaid may be helpful only for specific illnesses, and they conclude that insurance does not have a strong measurable effect on health. And data from the National Immunization Survey for 1995–2001 suggest that the State Children's Health Insurance Program (SCHIP) has not led to improved immunization rates for most childhood illnesses—the exception being a significant improvement in rates for the varicella (chicken pox) vaccine.[80]

The meals of children who participate in the national school lunch program are higher in nutrients than those of children who do not, although these benefits may be offset in part by the quality of nutrition received out of school.

The lack of evidence that Medicaid and SCHIP improve children's health, along with the findings already noted on the income-related differences in children's health in countries (such as Canada and the United Kingdom) that provide universal health care,

suggest that a sole focus on access to health insurance would be misplaced. Parents, generally mothers, are the primary gatekeepers for their children's health.[81] If a mother does not understand the medical protocol she should follow during a child's asthma attack, for example, her child may fare poorly, even if the medical attention the child receives in the physician's office is adequate. Poorer or less well educated mothers may leave a doctor's office with a less clear idea of how to protect their children's health—either because the doctor discriminates in the advice he or she administers to parents, based on their socioeconomic status; or because poorer mothers are intimidated and do not ask questions when they do not understand the physician's advice; or because the physician's advice is more difficult to follow when household resources are stretched and time is scarce. That visits to the doctor may be less productive for poor and near-poor children is consistent both with the income-related differences in children's health and with the apparent failure of Medicaid expansions to improve poor children's health even though they increased the use of care. What is needed is dedicated survey work that documents how carefully the baton is passed from physician to primary caregiver, for children across the economic spectrum.

Conclusions

Although poor health is only one of many factors that can limit a child's ability to achieve economic success as an adult, the evidence discussed in this article indicates that it may be an important one. Children in poor health are more likely than those in good health to leave school early and to achieve lower socioeconomic status as adults. Moreover, the disadvantages that come with poor health may be more pronounced for lower-income children. The link between childhood health and adult success is yet another reason to develop policies and programs that improve health for all children.

Although the benefits of improving children's health are clear, how best to do so is less certain. Previous policies have focused on increasing health insurance coverage for lower-income pregnant women and children. Although health insurance coverage may be essential for children's health, evidence on recent expansions of Medicaid indicates that it is not sufficient. The available evidence makes a strong case for the next wave of policies to focus on improving the quality of prenatal health care and service delivery and strengthening the ability of parents to manage their children's health problems.

Notes

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2. These estimates are based on a sample of 152,706 children with no missing health information who were living in families with annual incomes of between $5,000 and $125,000 (expressed in 2000 dollars). The graph shows results of nonparametric regressions of an indicator that the child was in excellent or very good health against income. Weights provided in the survey data were used. Note that children's health is generally reported by a parent, although in a small fraction of cases another adult in the household provided information. Children aged seventeen years could report on their own health. Results presented in figure 1 are very similar when health status is plotted against the log of income per adult equivalent. In addition, the results show the same patterns when we plot the fraction of children in "excellent, very good, or good" health against a measure of family income. Jianqing Fan, "Design-Adaptive Nonparametric Regression," *Journal of the American Statistical Association* 87 (1992): 998–1004.

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7. Anne Case and Christina Paxson, "Parental Behavior and Child Health," *Health Affairs* 21, no. 2 (2002): 164–78.

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