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Journal of Health Economics 23 (2004) 629–636

JOURNAL OF
**HEALTH
ECONOMICS**

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The demand for health, 30 years later: a very personal retrospective and prospective reflection

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Available online 10 June 2004

This symposium and the American Economic Association/International Health Economics Association roundtable on which it is based would have shocked my late father. A little more than 30 years ago he phoned me about an editorial in a magazine that he received each week. The magazine was called *Financial World: America's Investment and Business Weekly*. The 13 December 1972 issue had an extremely critical editorial on my National Bureau of Economic Research monograph *The Demand for Health: A Theoretical and Empirical Investigation* (Grossman, 1972b). The thrust of the editorial was that it was foolish to talk about people choosing their level of health. My father was quite upset over its negative tone. I told him: "Dad, bad publicity is always better than no publicity at all."

I think that most professional economists find that their education never ceases. Mine certainly never does, and I want to acknowledge the contributions that the participants in this symposium have made to my education as an economist.

John Mullahy began to work on the demand for cigarettes in the context of models of addiction before I did (Mullahy, 1985) and has made seminal contributions to the literature on the effects of alcohol abuse and mental health problems on labor market outcomes (for example, Mullahy and Sindelar, 1990, 1993). More recently, his penetrating development of the two-part model and its extensions (Mullahy, 1998; Manning and Mullahy, 2001) has added "mullit" to tobit and heckit as tools that all Ph.D. students in economics must learn. John also puts up with and answers all of my somewhat naive econometrics questions in a prompt manner.

Arleen Leibowitz and Bob Michael entered the Columbia University Ph.D. Program in Economics together with me in September 1964. Arleen and I were child prodigies, so we are much younger and much less gray than Bob. We all took Gary Becker's two semester course in microeconomics. We all took Gary Becker's two semester course in microeconomics. I

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learned a tremendous amount from Arleen and Bob during the many hours that we studied together that first year.

I have benefited greatly from Arleen's work in health economics on the effects of cost-sharing and managed care on patients' use of the health care system (for example, Leibowitz, 1986) and her more recent work on the cost of financing HIV care (for example, Joyce et al., 1999). While I gave up trying to do research in labor economics a long time ago, Arleen has kept her finger in that field as well as the health field. I still try to follow labor a little and based on that and conversations with labor economists, her work on the labor market behavior of young mothers and the determinants of children's academic achievement has had an enormous impact on the field (for example, Leibowitz, 1977; Klerman and Leibowitz, 1999).

What can I say about Bob Michael? He was my best friend in graduate school for the four and a half years it took him to get a Ph.D. It took me 6 years to get my degree, so for the last year and a half I was on my own. Bob's dissertation dealt with the effects of education on efficiency in nonmarket production. It became a classic in the fields of labor economics and the economics of education and led to publications in the *Journal of Political Economy* (Michael, 1973) and as a National Bureau of Economic Research monograph (Michael, 1972). When I needed a conceptual framework to examine why education might lead to better health, I was able to draw on his work. Bob has gone on to do pioneering work in the economics of demography and household behavior including his classic books on sexual practices in the United States (Laumann et al., 1994; Laumann and Michael, 2001).

Joe Newhouse was the driving force behind the RAND Health Insurance Experiment. His work produced the definitive set of estimates of the effects of health insurance on the demand for medical care (Newhouse, 1993). I owe a real debt to Joe because he gave me the opportunity to participate in the formulation of the experiment in its early stages by inviting me to spend a month at RAND during the summer of 1972 and another month during the summer of 1973. Of course, Joe has gone on to establish a reputation as the leading health economist in the United States, if not the world, as reflected by his position at Harvard University, his editorship of the *Journal of Health Economics*, and his co-editorship of the *Handbook of Health Economics* with Tony Culyer (Culyer and Newhouse, 2000).

Paul Schultz is the only person I know who enjoys a reputation as a leading senior researcher in four different fields: labor economics, population economics, economic development, and health economics. In 1979 I decided to start to work on infant health outcomes. I did not have to do much theorizing because Paul had already developed an extremely rich conceptual approach to this issue (Rosenzweig and Schultz, 1983, 1991). My colleagues in that endeavor—Hope Corman and Ted Joyce—and I drew heavily on Paul's framework (Corman and Grossman, 1985; Corman et al., 1987; Grossman and Joyce, 1990). Ted continues to use it in his work with Bob Kaestner and Sandy Korenman on birth outcomes (for example, Joyce et al., 2000).

Adam Wagstaff made important theoretical and empirical extensions of demand for health models in his Ph.D. dissertation and subsequent publication in the *Journal of Health Economics* (Wagstaff, 1986). He also made me think hard about the implications of costs of adjustment for optimal health stock and investment paths (Wagstaff, 1993; Grossman, 2000). More recently, Adam has moved on to fascinating research on the determinants and consequences of inequalities in health and in health care financing and delivery (for example,

Wagstaff and van Doorslaer, 2000). His work served in part as the basis of Nobel Laureate Amartya Sen's keynote address at the International Health Economics Association Third International Conference in York, England in 2001. In my view during the discussion that followed Sen's presentation, Adam got the best of him. In sharp contrast, the only Nobel Laureate with whom I interact, whose initials are G.S.B., always tells me that I am wrong.

I can never sufficiently acknowledge the contributions to my education and professional career made by Victor Fuchs, Gary Becker, and Jacob Mincer. Vic hired me as his research assistant at the National Bureau of Economic Research in June 1966. At the time, I had just finished my all course work and exams at Columbia University; I was thinking about getting married; and I did not have much money. At the end of the summer, he said that I could continue to work for him half time and have office space to work on my dissertation if I wrote in the health economics field. That is how I became interested in the field; until then I had no exposure to it. In retrospect, in 1966 an investment in health economics certainly paid me the best interest.

When I entered Columbia, I was going to specialize in public finance. Then I met Gary Becker and decided to specialize in whatever interested him. He and Jacob Mincer taught me 80% of what I learned about economics at Columbia, and my fellow students taught me the remaining 80%. The sum is greater than 100% because I had to unlearn all the wrong things I had been taught as an undergraduate. More seriously, Gary and Jacob had a profound effect on my professional career, and I owe them a debt which I can never repay. Gary in particular suggested the topic of my dissertation. Originally it was supposed to be a study of the effects of education on health, but along the way he encouraged (some might say demanded) me to broaden it into a theoretical and empirical analysis of the demand for health.

Now let me turn to the topic of this symposium. I want to be brief because I think the other contributors did an excellent job in addressing what we know and what we need to know about the demand for health. Besides, I felt very strongly about spending most of my time acknowledging the debts that I owe to a lot of people.

I want to discuss just one issue that I think we need to know: Does education cause health? I have been working on this issue on and off since I began my Ph.D. dissertation in 1966 (for example, Grossman, 1972a,b, 1975, 2000, submitted for publication; Grossman and Kaestner, 1997). It is a natural topic to interest someone like me who came out of the human capital tradition at Columbia because it deals with complementary relationships between the two most important components of the stock of human capital.

Extensive reviews of the literature conducted by Grossman and Kaestner (1997) and by Grossman (2000, submitted for publication) suggest that years of formal schooling completed is the most important correlate of good health. This finding emerges whether health levels are measured by mortality rates, morbidity rates, self-evaluation of health status, or physiological indicators of health, and whether the units of observation are individuals or groups. In a broad sense, this correlation between health and schooling may be explained in one of three ways. The first argues that there is a causal relationship that runs from increases in schooling to increases in health. The second holds that the direction of causality runs from better health to more schooling. The third argues that no causal relationship is implied by the correlation; instead, differences in one or more "third variables," such as physical and mental ability and parental characteristics, affect both health and schooling in the same direction.

I have argued for causality from schooling to health in my research and have presented and summarized a good deal of empirical evidence in favor of this hypothesis. But until recently, this evidence has not been based on natural or quasi-natural experiments or on techniques such as two-stage least squares that attempt to establish causality in a definitive manner. Hence, challenges to the conclusion that the role of schooling is causal, especially the time preference hypothesis proposed by Fuchs (1982), have attracted a good deal of attention. Fuchs argues that persons who are more future oriented (who have a high degree of time preference for the future) attend school for longer periods of time and make larger investments in health. Thus, the effect of schooling on health is biased if one fails to control for time preference.

Very recent work by Arkes (2001), Lleras-Muney (2002), Adams (2002), Arendt (2002), Spasojevic (2003), de Walque (2003), and Currie and Moretti (2003) address the schooling-health controversy by using compulsory education laws, unemployment rates during a person's teenage years, college openings, or the risk of draft induction during the Vietnam war era to obtain consistent estimates of the effect of schooling on health or on cigarette smoking—a key determinant of many adverse health outcomes. These variables, some of which result from quasi-natural experiments, are assumed to be correlated with schooling but uncorrelated with time preference. Hence, they serve as instruments for schooling in the estimation of health equations by two-stage least squares and its variants.

Lleras-Muney (2002) employs compulsory education laws in effect from 1915 to 1939 to obtain consistent estimates of the effect of education on mortality in synthetic cohorts of successive U.S. Censuses of Population for 1960, 1970, and 1980. This instrument is highly unlikely to be correlated with unobserved determinants of health, especially because she controls for state of birth and other state characteristics at age 14. Her ordinary least squares estimates suggest that an additional year of schooling lowers the probability of dying in the next 10 years by 1.3 percentage points. Her IV estimate is much larger: 3.6 percentage points.

Adams (2002) uses the same instrument as Lleras-Muney in the first wave of the Health and Retirement survey, conducted in 1992. He restricts his analysis to individuals between the ages of 51 and 61 and measures health by functional ability and self-rated health. He finds positive and significant effects of education on these positive correlates of good health and larger IV coefficients than the corresponding OLS coefficients.

Arendt (2002) capitalizes on compulsory school reform in Denmark in 1958 and 1975 to study the impact of schooling on self-rated health in the 1990 and 1995 waves of the Danish National Work Environment Cohort Study. Respondents were between the ages of 18 and 59 in 1990. His results are similar to those of Adams.

Spasojevic (2003) focuses on a unique social experiment, the 1950 Swedish comprehensive school reform. Between 1949 and 1962, the school system created by the 1950 act was implemented randomly and in stages by municipalities in Sweden. Because of that, persons born between 1945 and 1955 went through two different school systems, one of which implied at least one additional year of compulsory schooling. This serves as the instrument for schooling in estimates of health equations for males born between 1945 and 1955 in the 1981 and 1991 waves of the Swedish Level of Living Survey. Health is measured by an index constructed from information on the presence of 50 different health conditions (illnesses and ailments). Results suggest that the negative IV effects of schooling

on the index of poor health are at least as large in absolute value as the corresponding OLS effects.

Arkes (2001) focuses on white males aged 47–56 in the 1990 Census of Population. His instrument for schooling is the state unemployment rate during a person's teenage years. With state per capita income held constant, he argues that a higher unemployment rate should lead to greater educational attainment because it reduces the opportunity cost of attending school. From two-stage least squares probit models, he finds that an additional year of formal schooling lowers the probability of having a work-limiting condition by 2.6% points and reduces the probability of requiring personal care by 0.7% points. Both estimates exceed those that emerge from probit models that treat schooling as exogenous.

Currie and Moretti (2003) examine the relationship between maternal education and birthweight among US white women with data from individual birth certificates from the Vital Statistics Natality files for 1970–2000. They use information on college openings between 1940 and 1990 to construct an availability measure of college in a woman's 17th year as an instrument for schooling. They find that the positive effect of maternal schooling on birthweight increases when it is estimated by instrumental variables. They also find that the negative IV coefficient of maternal schooling in an equation for the probability of smoking during pregnancy exceeds the corresponding OLS coefficient in absolute value. Since prenatal smoking is the most important modifiable risk factor for poor pregnancy outcomes in the United States (U.S. Department of Health and Human Services, 1990), they identify a very plausible mechanism via which more schooling causes better birth outcomes.

de Walque (2003) examines the effect of schooling on the probability that males born between 1937 and 1956 are current cigarette smokers in the 1983, 1985, 1987, 1988, 1990, 1991, 1992, 1994, and 1995 US National Health Interview Survey. These men were of draft age during the Vietnam war era, and some of them enrolled in college to avoid the draft. Thus, de Walque uses the risk of induction, defined as the average yearly number of inductions in Vietnam during the years in which a particular birth cohort was aged 19–22 divided by the size of the cohort, as an instrument for college education. In some specification, the induction risk is multiplied by the risk of being killed in Vietnam (the ratio of the number of soldiers killed in action in a year and the number of troops engaged in Vietnam in that year) to obtain the risk of being inducted and killed in action. The IV estimates of the effect of education on the probability of smoking are negative and significant. In some cases, they are at least as large in absolute value as the corresponding OLS coefficients.

The results of the seven very recent studies just reviewed suggest causality from more schooling to better health. The finding that the IV estimates often exceed the OLS estimates may arise because the instruments are based on policy interventions that affect the educational choices of persons with low levels of education (Card, 2001). If different individuals face different health returns to education, IV estimates reflect the marginal rate of return of the group affected by the policies (Angrist et al., 1996). Card (2001) points out: "For policy evaluation purposes. . . the average marginal return to schooling in the population may be less relevant than the average return for the group that will be impacted by a proposed reform. In such cases, the best available evidence may be IV estimates of the return to schooling based on similar earlier reforms (p. 1157)."

A second explanation of the larger IV than OLS estimates is that the schooling variable contains random measurement error, which leads to a downward bias in the OLS estimates. As long as the instruments for schooling are not correlated with this error, the IV procedure eliminates this bias (Card, 2001). A third explanation is that there may be spillover effects in the sense that the health outcome of an individual depends on the average schooling of individuals in his or her area as well as on his or her own schooling or that of his or her parents (Acemoglu, 1996; Acemoglu and Angrist, 2000). Currie and Moretti (2003) show that IV estimates of this combined effect based on area-level instruments are consistent, while OLS estimates understate it. Whatever the interpretation of the findings, they do not support the hypothesis that the observed effect of schooling on health is due to time preference.

In summary, the seven very recent studies that I have discussed underscore the utility of employing IV techniques with area-level instruments to obtain consistent estimates of the effects of schooling on health. None of these studies, however, deals with a developing country, and only one considers outcomes for children as opposed to adults. These are important omissions because the positive correlation between mother's schooling and child health in numerous studies was one factor behind the World Bank's campaign in the 1990s to encourage increases in maternal education in developing countries (World Bank, 1993). Moreover, all of the studies employ a single data set, examine one or two outcomes, and frequently employ small samples. Finally, the number of IV health-schooling studies is dwarfed by studies that use the same methodology to obtain consistent estimates of the effects of schooling on earnings. These factors suggest large payoffs to future research dealing with the health-schooling causality issue.

I began this paper by noting that the contributors to this symposium have all made very significant contributions to my education as an economist. The same applies to my many co-authors and former and current students. So I am going to conclude with a plea. Please do not stop your efforts to continue my education as an economist because in the words of my favorite president's favorite poet—and this unfortunately is not Chicago-style kosher

... I have promises to keep.

And miles to go before I sleep,

And miles to go before I sleep...

—(Robert L. Frost, "Stopping by Woods on a Snowy Evening")

Acknowledgements

I want to thank John Mullahy, who is one of the nicest people I know, for having been kind enough to organize this symposium and the AEA/iHEA roundtable on which it is based. I also want to thank Arleen Leibowitz, Bob Michael, Joe Newhouse, Paul Schultz, and Adam Wagstaff for having been kind enough to participate in the symposium and roundtable. I can never sufficiently acknowledge my debts to Gary Becker, Victor Fuchs, and Jacob Mincer. This paper has not undergone the review accorded official National Bureau of Economic

Research publications; in particular, it has not been submitted for approval by the Board of Directors.

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