



Education, Social Status, and Health

John Mirowsky and Catherine E. Ross



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Introduction: A Rediscovery

Education forms a unique dimension of social status, with qualities that make it especially important to health. It influences health in ways that are varied, present at all stages of adult life, cumulative, self-amplifying, and uniformly positive. Educational attainment marks social status at the beginning of adulthood, functioning as the main bridge between the status of one generation and the next, and also as the main avenue of upward mobility. It precedes the other acquired social statuses and substantially influences them, including occupation and occupational status, earnings, personal and household income and wealth, and freedom from economic hardship. Education creates desirable outcomes because it trains individuals to acquire, evaluate, and use information. It teaches individuals to tap the power of knowledge. Education develops the learned effectiveness that enables self-direction toward any and all values sought, including health.

For decades American health sciences acted as if social status had no great bearing on health. The ascendance of clinical medicine within a culture of individualism probably accounts for that omission. At the heart of it, American culture rejects the class and caste systems that many of our ancestors escaped or overcame. Americans might respect the abilities and contributions of aristocrats like Thomas Jefferson and George Washington, but they take inspiration from the achievements of self-made individuals like Ben Franklin and George Washington Carver. This orientation at times becomes a reluctance to face facts about gradations of advantage, wealth, power, prestige, or ability. We remember the cautionary stories about this reluctance told to us when we were studying sociology in graduate school. Jerry Myers, one of our professors then, told us about his own days as assistant in the late 1950s to August Hollingshead and Fritz Redlich, who were writing a book titled *Social Class and Mental Illness* (Hollingshead and Redlich 1958). Myers did fieldwork and data analyses for the project. He told us that, prior to publication, Hollingshead and Redlich expected scholarly criticism for describing mental illness in the context of community and class culture. Their approach departed greatly from the Freudian analyses of intrapsychic processes and close family relationships that dominated

psychiatric literature then. Instead they were barraged with editorial and public umbrage over the book's delineation of social strata in New Haven, Connecticut. Apparently the idea that social classes existed in New Haven offended many, to whom it sounded misleading, provocative, and un-American.

The national ideals of equality and individualism may have enhanced the ascendance of clinical medicine, with its ideal of the physician acting as agent scientist on behalf of each individual patient and seeking to identify a specific disease as the proximate cause of the individual's symptoms and signs. Regardless of social background, everyone with, say, tuberculosis has the same disease requiring the same treatment. A case might involve a strain of the bacillus resistant to specific antibiotics, and some individuals may have allergies or other conditions that rule out specific treatments. Such details refer to the disease and the individual as organism and not to the person, much less to the person's social status. Once the disease has been identified, the medical procedures indicated are essentially the same for everyone. That fits nicely with the ideals of equality and individualism. In clinical medicine the individual's social background and standing easily get relegated to a minor role. Perhaps they make the physician lean toward the diagnosis of a disease that is relatively common among persons with social attributes similar to those of the patient. Perhaps they make the physician see compliance with a demanding, unpleasant, or expensive regimen as more or less likely. Nevertheless, the clinical setting and the physician's role as agent for the individual who comes there obscure the role of social status in regulating the risk, severity, and consequence of disease. A river of disease and disability flows through the clinic daily. Realistically, clinical medicine cannot do much to change a patient's social status or personal history that led to the episode at hand.

Medicine's traditional focus on the distinct causes of specific diseases deflects attention from forces that create more or less disease of many kinds. Much of contemporary medical culture originated in the scientific breakthroughs of the nineteenth century, particularly the discovery of microorganisms as causes of disease. Those discoveries led medicine to seek a unique necessary cause for each distinct disease. Remove that cause and you prevent or cure the disease. So, for example, the spirochete *Treponema pallidum* causes syphilis, a disease that progresses through three stages characterized by local formation of chancres, ulcerous skin eruptions, and systemic infection leading to general paresis. Killing the spirochete with extracts from the blue *Penicillium* mold cures the disease. Avoiding exposure to the organism through sexual discretion or the use of condoms prevents the disease. Regardless of a person's social background and standing, they will not get the disease without infection by the organism, and treatment that kills the organism cures the disease.

The logic and power of many infectious-disease examples crystallized twentieth-century medicine's organization around the search for the distinctive causes of specific diseases. Those same concepts and assumptions that propelled advances in the fight against infectious disease became early obstacles to understanding and controlling many chronic diseases. For example, researchers and physicians often were reluctant to accept that cigarette smoking caused a specific disease because smoking seemed correlated with many different diseases but not essential for any one of them, including heart disease, stroke, emphysema, chronic bronchitis, and several types of cancer. Richard Doll's demonstration of the unusually high correlation between cigarette smoking and lung cancer helped give legitimacy to its role as a cause of disease. Even so, the complexity of smoking's effects created much confusion, because no single one acts as the sole necessary cause. Smoking prompts the production of mucus, paralyzes the cilia that normally clear the mucus, and delivers a tar containing fifteen or more cancer-causing substances. In the process it degrades the structure and function of the lungs, giving the smoker's blood too little oxygen and too much carbon dioxide, creating inflamed regions pooling mucus, meanwhile depressing the activity of the immune system's macrophages, thereby greatly increasing the risk of lung infection. Confusion over the variety of smoking's effects was compounded by confusion over the variety of causes contributing to each smoking-related disease. To this day smoking kills more Americans through heart disease than through lung cancer. Smoking is only one of several major factors contributing to heart disease, along with the high blood pressure and high fractions of circulating low-density cholesterol that result most often from exercising too little and eating too much. Eliminating smoking would not eliminate heart disease, although it would cut the rates considerably. Eliminating smoking would not even eliminate lung cancer, although it would come close.

Chronic disease research over the last half of the twentieth century forced science to think differently about the causes of disease. Despite the institutional and cultural forces focusing medical research and theory on distinctive proximate causes of specific diseases, researchers were forced to look over their shoulders, back toward more distant causes of many diseases. Some turned their orientation a full 180 degrees, looking for the origins of that river of disease and disability flowing daily through the clinics. Researchers who head back up that stream rediscover the effect of social status on health.

American sociology, epidemiology, and public health said surprisingly little about the effects of social status on health for decades. Partly that is because the effects are so pervasive that socially oriented health scientists take them for granted. A sociologist studying the effects of undesirable

and uncontrollable events on health, for example, would recognize that such events probably happen more often to lower-status individuals. The researcher would take precautions to avoid mistaking other effects of low status among individuals experiencing undesirable and uncontrollable events for effects of the events themselves. Typically that would involve statistical adjustments for education, occupational status, and household income. Those adjustments would mathematically correct for any differences in health across levels of events that might actually result from other health effects of the status differences. Social scientists refer to the procedure as estimating the effects (in this case, of stressful life events) holding social status constant. An epidemiologist studying the effect of sedentary lifestyle on heart disease or a public health scientist studying the effect of condom use on rates of sexually transmitted disease would take similar precautions. There is nothing wrong with this. Indeed, good scientific practice demands it. Every once in a while, though, the scientists should remember why they need to make these adjustments and should consider the implications. Researchers habitually make such adjustments because social status affects just about everything that affects health.

Perhaps health scientists had an additional reason for paying little attention to the effects of social status on health: the unexamined assumption that those effects soon would vanish. During the twentieth century the advanced industrial nations made enormous progress in public health programs that benefit all citizens, especially workers and the poor. Everyone benefits from public supplies of monitored and treated water, the testing and regulating of private wells, public sanitary sewers and sewage treatment, regulation of private septic systems, removal of trash and garbage to sanitary landfills or incinerators, rat control, mosquito control, fire control, flood control, safety standards for buildings, environmental and occupational health and safety standards and programs, transportation safety standards and agencies, the regulation of food purity and vitamin content, the evaluation and regulation of product safety, the evaluation and regulation of dangerous medical interventions, programs that mandate or promote vaccination against childhood infectious diseases, and agencies that scan ceaselessly for the outbreaks of epidemics, combating them as early as possible. Health scientists know the value and effectiveness of these systems. Perhaps that knowledge encouraged a complacent assumption that the disparities in health across social strata were fading and would soon vanish. In the United States it took a long while before researchers began to question that assumption and examine the evidence for or against. The results were a surprise and a wake-up call: although mortality rates are going down, the differences in mortality rates across social strata are growing. At first the American researchers suspected that the absence of a U.S. national medical care system might explain the disparities. However

studies in Canada and England also found substantial and growing differences in mortality rates across social strata. Some countries such as Sweden apparently have enhanced average life expectancy at birth by constraining the range of socioeconomic differences. To our knowledge, though, no country has eliminated the effects on health of the differences in social status that exist.

In the United States the growing recognition of persistent socioeconomic disparities in health led several of the National Institutes of Health to outline research needed on the topic. In 1998 the institutes announced a program to encourage and support research on "Socioeconomic Status and Health Across the Life Course." The announcement makes the following observation, summarizing the core issues well:

The relationship between socioeconomic status (SES) and physical and mental health, morbidity, disability, and mortality has been long and extensively documented. While the overall relationship of SES to mortality may attenuate in older ages, socioeconomic position continues to be linked to the prevalence of disability and chronic and degenerative diseases, including cardiovascular disease, many cancers, and Alzheimer's disease. Low SES may result in poor physical and/or mental health by operating through various psychosocial mechanisms such as poor or "risky" health-related behaviors, social exclusion, prolonged and/or heightened stress, loss of sense of control, and low self-esteem as well as through differential access to proper nutrition and to health and social services. In turn, these psychosocial mechanisms may lead to physiological changes such as raised cortisol, altered blood-pressure response, and decreased immunity that place individuals at risk for adverse health and functioning outcomes. (National Institutes of Health 1998)

That program announcement was followed a few years later by a request for applications from researchers for funding to study the biological and behavioral mechanisms that link social and physical environments to health disparities (National Institutes of Health 2000). Together those documents outline research that the U.S. national health institutes would like to see over the coming decades. They herald a renewed and explicit attention to the effects of social standing on health.

Our own interest in the effects of social status on health predates the announcements described above. In many ways, this book and those announcements grew out of the same crystallizing realizations. Much of the material in this book reports the results of our ongoing national survey of aging, social status, and the sense of control over one's own life, begun in 1993 and funded by the National Institute on Aging. Some of it reports the results of our other projects, particularly a statewide Illinois survey in 1995 and 1998 of community, crime, and health across the life course,

funded by the National Institute of Mental Health. Much of the material, though, goes well beyond merely reporting our results. In the chapters that follow we report what we think, beyond what we have observed. Much of the material represents our best answers, as of 2003, to the scientific questions that stimulated the program announcement and request for applications mentioned above. We expect that this book will be one of many by scientists from various fields contributing their observations and thoughts on why and how social status affects health. In giving our best current answers we draw on findings and ideas from many sciences, including demography, economics, social psychology, biopsychology, medicine, human physiology and endocrinology, and cellular molecular biology. At heart we are survey researchers trying to understand why and how social status affects health, and why education apparently acts as the core aspect of social status with an enduring, consistent, and growing effect on health.

CHAPTER PREVIEWS

Chapter 1 summarizes the main elements of our view of *education as learned effectiveness* that enables self-direction toward health. It introduces the concept from economics of human capital, which is the productive capacity developed, embodied, and stocked in human beings themselves. Education develops human capital by helping individuals become more effective. The real skills, abilities, and resources developed through education help individuals achieve a variety of personally valued ends, including health. Education makes individuals better at acquiring or creating effective means. The chapter delineates education as a distinct aspect of socioeconomic status. We argue against the common practice of treating education, occupation, and economic well-being as merely three manifestations of a single dimension of social status. Understanding how social status affects health requires a careful differentiation among its elements, looking at the relationships among them and at their distinctive connections to health. Chapter 1 ends by arguing that education acts as a root cause of good health, because it gives people the resources to control and shape their own lives in ways that protect and foster health, regardless of the kinds of health risks faced in their time and place.

Chapter 2 describes the *association between education and health*. We begin by defining health as the word appears in English and American usage, both common and scientific. For our purposes we define health as feeling sound, well, vigorous, and physically able to do things that most people ordinarily can do. We continue the standard practice of using the word health to mean three distinct things depending on context: a dimension

graded from very negative (unhealthy) to ideally positive (very healthy), an individual's current status or place on that dimension, or the apex of that dimension—the ideal state of health. Next we describe how social scientists measure health in surveys of the general population. We point out that surveys need to compare general levels of health across social categories or strata. Unlike clinicians, survey researchers do not need a detailed description of each individual's biological status that reveals the distinctive nature of that person's problems. Likewise, unlike clinical researchers, we do not need large sets of measures that reveal average differences across treatment groups in the progress of a specific disease or condition. Instead, survey researchers need measures of health that are plain, comparable, concise, general, and common. We describe the five types of health measures used in surveys: individual reports of subjective health, physical impairment, vitality and well-being, diagnosis of serious chronic disease, and expected longevity. We describe the strengths and weaknesses of each type of measure, and show how each correlates with education. Health, by any definition and by any measure, increases with the level of education.

Chapter 3 describes the relationships among *education, personal control, lifestyle, and health*. We restate our view that education improves health because it increases effective agency, enhancing a sense of personal control that encourages and enables a healthy lifestyle. We begin the chapter by reviewing the theory of human capital and its relationship to education. Formal education develops skills and abilities of general value. An individual who acquires an education can use it to solve a wide range of problems. Some are the problems of productivity that concern employers and economists. Some are problems in which economic prosperity is one of several means toward a more basic end. Health is one of those basic ends.

Next in Chapter 3 we describe how education helps individuals to design and assemble a healthy lifestyle, summarizing the beneficial effects of education on smoking, exercise, overweight, and drinking. Education encourages and helps individuals to assemble a set of habits and ways that are not necessarily related except as effective means toward health. Purposeful individuals weave together a healthy lifestyle from otherwise incoherent or diametric practices allocated by subcultural forces. Usually, individuals tend to do whatever others like them do, particularly if it distinguishes the people they identify with from the ones they do not. Some of those things make health better and some make it worse. For example, men exercise more frequently than women, but women restrict body weight more closely than men; young adults smoke more than older adults, but also exercise more. Individuals putting together a healthy lifestyle must adopt the healthy habits of men and women, young and old. In doing so they create positive correlations among traits that otherwise are unrelated or even negatively correlated.

In the rest of Chapter 3 we show how the sense of control over one's own life links education to a healthy lifestyle. We define what we mean by the sense of control, showing how we measure it and how it relates to other concepts such as locus of control, self-efficacy, helplessness, and subjective alienation. The sense of personal control is a learned, generalized expectation that outcomes are contingent on one's own choices and actions. We describe how education boosts the sense of control, and how that in turn shapes a healthy lifestyle. We present statistical models integrating these elements and showing how they articulate to connect education to health.

Chapter 4 details the complex of relationships among *education, socioeconomic status, and health*. In it we show how education acts as the preeminent aspect of social status that affects health. The chapter has two main parts, detailing education's impact on health through economic resources and through productive activities. In the first section, on economic resources, we begin by describing important aspects of education's effect on household income. Notably, the average increase in household income associated with an additional year of education gets larger at higher levels of education. In our data the average household income increases by an additional 11 percent for each additional year of education. We think this compounding exists because each newly acquired ability multiplies the effectiveness of previously acquired ones. Empirically, education increases household income largely by increasing the likelihood of employment and of marriage (often to someone who is employed), and by increasing both personal earnings and other household income.

Although education's effect on income compounds, income's effect on health follows a law of diminishing returns. Additional income of, say, \$5,000 improves the average level of health considerably among persons with incomes in the bottom third, but it has little or no effect on health among persons in the top third of household income. As always, each additional dollar makes the biggest difference to individuals who get the fewest dollars. We argue that education's interaction with income accounts for much of income's diminishing incremental effect. Education moderates the effect of income on health. Higher education reduces the harm associated with lower income and conversely reduces the health gains from higher income. In essence, the well-educated tend to be healthy regardless of income. Because persons with high incomes tend to be well-educated, differences among them in income have little effect on health. On the other end, persons with low incomes tend to have low levels of education, leaving them more vulnerable to the health effects of differences in income. This is an example of what we call structural amplification, a phenomenon that Chapter 6 describes in detail.

Chapter 4 goes on to show how education operates as an effective substitute for income on multiple levels. Economic hardship, in the form of difficulty paying bills and buying food, clothes, medical care, or other household necessities, mediates much of lower income's association with poorer health. Education moderates the effect of income on economic hardship. The well-educated tend to avoid economic hardship at all levels of income. Low income increases the risk of economic hardship mostly among the poorly educated. Once again, we see a pattern of structural amplification. Low education makes individuals more likely to have low income and less able to avoid economic hardship given low income.

Household composition partly explains why low income creates greater economic hardship for the poorly educated than for the well-educated. Other things being equal, persons raising children and persons without partners experience more economic hardship at any given level of income. The combination, raising children without a partner, greatly magnifies the risk of economic hardship. By our estimates, an unmarried person raising a family needs 2.3 times more income than two married persons raising the same number of children in order to have the same low risk of economic hardship. Better-educated individuals generally have fewer children and begin raising them later in life when jobs are more secure and better paid and relationships are more mature and stable.

We continue Chapter 4's section on economic resources by arguing that material privation and risky exposures probably account for only part of the effects that low income and economic hardship have on health. In wealthy countries such as the United States, few families go without the basic minimum of food, clothing, and shelter needed to stay alive and functioning, even when experiencing economic hardship. When extreme privation does occur it generally comes and goes as an episode rather than forming a persistent damaging and lethal status. More commonly, low income and economic hardship limit housing options to dilapidated buildings, frequently in squalid and threatening neighborhoods. We list many ways that personal and neighborhood poverty expose individuals to biological, chemical, and physical risks of illness, disease, and impairment. Economic hardship, however, typically means something other than a leaky roof or rats in the walls. Even for the great majority of adults in their comfortable homes and decent neighborhoods, economic hardship is a taste of inadequacy and failure laced with a threat that what one has may be lost. Biomedical research shows that threatening situations produce physiological responses that impair health in several ways: by creating symptoms experienced as illness, by increasing susceptibility to pathogens and pathological conditions, and by accelerating the degradation of critical physiological systems. Economic hardship poses a direct threat to the

well-being of oneself and one's family. As a result, people exposed to economic hardship probably experience frequent, intense, and prolonged activation of the physiological stress response, with negative consequences for their health.

We go on to argue in Chapter 4 that greater access to medical care does not account for the association of economic well-being with better health. We argue that health is not a commodity that can be sold or bought. Although difficulty paying for medicine or medical care is one indication of the economic hardship that erodes health, it is the hardship and the circumstances that give rise to it, rather than the lack of medical care, that cause the health problems. Aggregate measures of health such as life expectancy or infant mortality mostly depend on social and economic resources such as average levels of education and gross domestic product per capita rather than on the prevalence of medical resources such as doctors and hospitals per capita. Many countries such as Great Britain and Canada instituted national health care systems providing universal access to treatment. Doing so reversed the social gradient in the use of services, but did not reduce the socioeconomic gradient in health and survival. Despite the absence of universal medical coverage in the United States, lower-status Americans also now use more medical services than higher-status individuals do. In the United States as well as elsewhere, this has not diminished socioeconomic differences in health.

Like it or not, health is not something that can be bought. People cannot just buy medical services that make them and their families healthy. Businesses cannot just buy medical services that make their employees healthy. Governments cannot just buy medical services that make their citizens healthy. Some of the clearest evidence of this comes from research examining the effect of medical insurance on health. Perhaps the best kept secret of American health science is that having medical insurance does not measurably improve health. The existing studies compare individuals in three broad categories: those with private medical insurance provided as a benefit of current or past employment (including the spouse's) or purchased directly (including supplements to Medicare), those with public insurance from Medicaid (which goes primarily to the poor or medically indigent) or Medicare (available to seniors) with no private supplement, and no medical insurance. All of the studies find essentially the same thing. People with private medical insurance have the best health, those with only public medical insurance have the worst, and those with no medical insurance are in between but close to the privately insured. This pattern holds for the full range of health measures, from subjective health to mortality rates.

The better health seen among individuals with private medical insurance results entirely from their high levels of education, employment,

marriage, and economic well-being, which preserve and improve health directly and also increase the likelihood of having private medical insurance. Our results find no differences between those with private medical insurance and those with no medical insurance in their changes in subjective health, physical impairment, and diagnosed chronic conditions over a three-year period. In other words, private medical insurance shows no sign of preserving or improving health. The one benefit of medical insurance that we could find is that it helps protect the household from economic hardship. That small and indirect beneficial effect is not large enough to account for a significant share of the effects that education and income have on health.

We end Chapter 4's section on economic resources by looking at the sense of control as a mediator and amplifier of income's effect on health. Money cannot buy health, but it can reinforce a sense of control that encourages healthy behavior and makes things seem less threatening. Not surprisingly, greater household income increases the sense of directing and regulating one's own life. A sense of control over one's own life improves health two ways. The most important is that it encourages efforts to find ways of staying healthy. When people feel effective and able, they believe they can find things to do that will create a long and healthy life. That in turn encourages them to discover healthy ways of living and to change themselves and their lives to be healthier. The second way a sense of control improves health is by making life seem less threatening. In humans, perceived threats to well-being, status, self-esteem, marriage, friendship, and so on stimulate the body's response to physical attack. Individuals with a firm sense of control feel confident of their ability to judge risks accurately and deal with threats effectively. Events and situations seem more benign to individuals who believe they can avoid most problems and correct or manage the rest. Other things being equal, that perception reduces the triggering of physiological alarm.

Health and the sense of control have what causal analysts call a deviation-amplifying reciprocal effect. A strong sense of control improves health and functioning, and good health and functioning strengthen the sense of control. Unfortunately this works both ways. A weak sense of control degrades health and functioning, which further weakens the sense of control. Over time these reciprocal effects push individuals in different directions. That has two consequences. It enlarges the differences among individuals in health and in the sense of control. It also increasingly combines poor health with a low sense of control in some individuals and good health with a high sense of control in others. The deviation-amplifying reciprocal effect enlarges the disparity among individuals while making some of them the beneficiaries of multiple advantages and others the bearers of multiple disadvantages.

Economic well-being forms a major link between education and health, but the nature of that connection is not what it might seem. Ability and effectiveness create the link, more than money itself. Income enhances the ability to achieve ends, but the well-educated with low income can achieve the same outcomes through other means. Economic resources and economic well-being constitute a major path from education to health. They in turn link to education through employment, occupation, and work, which influence health through additional pathways.

The second part of Chapter 4 looks at productive activities as links between education and health. The biggest misconception about social status and health is that money is what counts. Paid work contributes to health in various ways. Higher levels of education lead to jobs that are more rewarding in themselves, as well as better paid. Moreover, higher education changes the nature of pay from compensation for sacrificed autonomy to reward for productive creativity. Prosperity, autonomy, and creativity all contribute to health, and all characterize the work of the well-educated.

We begin the section on productive activities by describing the four kinds of measures social scientists use when studying productive activities. *Employment status* refers to categories of labor force participation or nonparticipation: employed full-time, employed part-time, keeping house, retired, unable to work because of a disability, temporarily unemployed or laid off, in school, in the military, or in an institution (generally a prison or asylum). Individuals with paid jobs or looking for paid jobs (other than the military) are considered in the labor force. *Occupations* are official categories of paid activity with distinctive requirements and demands, such as cook, elementary school teacher, medical assistant, or cab driver. *Occupational status* generally refers to the occupation's prestige implied by the average levels of education and income of persons in the occupation. More broadly, occupations are graded along a variety of dimensions that describe aggregate conditions, such as the typical degree of danger, physical labor, environmental extremes, repetitiveness, closeness of supervision, or complexity of work with people, data, or things. *Work* is an activity directed toward production or accomplishment. The work a person does may pay well, poorly, or not at all. It may be varied, engaging, and enjoyable, or repetitious, tedious, and oppressive. It can be high, low, or middling in a chain of command, or not in one at all. Most importantly, work can be self-expressing, or self-suppressing. Some people see work as the things they would not do if they did not have to. Others see it as the way they create things of value.

In the rest of Chapter 4 we detail the relationship of education and health to each measure of productive activity, beginning with employment status. Education brings more people into the labor force, and keeps more people in, at the highest level of participation: full-time employment. The

increases in full-time employment across levels of education require corresponding decreases in the other categories. Three other categories account for most of those decreases: keeping house, unemployment, and inability to work. Education's positive impact on full-time employment and negative impact on unemployment combine to reduce the unemployment rate, which is the fraction of persons in the labor market but not currently employed.

Full-time employment and better health go together, but why? There are two possibilities: causation and selection. In causation, something about employment status affects health. For example, full-time employment may promote health through economic well-being and independence, personal development, and healthier lifestyle. In selection, health influences the employment status individuals can be in or choose to be in. In our research we find evidence of both causation and selection in the relationship between employment and health. We find that full-time employment helps to create and maintain the higher levels of health and functioning that make full-time employment more likely and more stable. Employment in the United States today typically does *not* act like a "meat grinder," taking in healthy young workers, wearing them out at an accelerated rate, and then ejecting them old and used-up before their time. Employment and health have something like a symbiotic relationship: each helps create the conditions beneficial to the other.

Next we describe occupation as a link between education and health. The more arduous, dangerous, and unpleasant an occupation, the lower the average education of persons doing it for a living. Even so, differences in those qualities of occupations account for very little of the differences in health across levels of education. Partly that is because hazardous occupations often require physical activity that benefits health. Mostly, though, it reflects the success of occupational health and safety regulations and practices. Even though some occupations are much riskier than others, the overall levels of occupational risk are so low that differences in health associated with occupations generally vanish against the background of health differences created by other socioeconomic forces. Workplaces today are remarkably safe. While some of this reflects the shift from industrial to service occupations, much of it reflects the precautions taken in stable, indoor work sites such as factories, warehouses, stores, hospitals, and offices. In terms of fatalities, today's twenty riskiest occupations mostly involve outdoor work at changing locations using vehicles or power tools. Today's factories and offices create so little risk to life that, for most occupations, the workers face greater risks to life at home, and much greater risks on the way to and from home.

We find that, with one exception, the qualities of occupations measured by the federal government do not account for differences among workers

in their health after adjustment for individual qualities such as age, sex, education, earnings, household income, and history of unemployment and economic hardship. We find only one occupational attribute that consistently predicts individual differences in health, apparently because it measures the occupational constraints on individual productive creativity: the percentage of workers in an occupation who must perform repetitive work, doing the same thing according to a set procedure, sequence, or pace.

We conclude the section on productive activities by describing the qualities of work that promote health: autonomy and creativity. Work is physical or mental effort or activity directed toward the production or accomplishment of something. Employment is paid work. Employment almost always trades some degree of freedom for income. In a market economy everyone needs money to get things they require or want, and most people must work for the money. The balance in that trade depends as much on the amount of freedom given up, and the burden of the work, as it does on the pay. Often when people think of the burden of work they think of time spent, physical and mental strain endured, risk taken, and harm suffered. The true burden lies in the denial of self-expression and the inhibition of autonomous action—the stifling of free will. Humans need to work, and not just because they need the money. Directing physical and mental effort toward production and accomplishment is to humans what running is to horses. Work is so deeply enmeshed in our species' mode of survival that humans do it in the absence of immediate need, like a riderless horse galloping for no reason except the desire to run and the joy of doing it. Humans take pleasure in work, and must do it to be whole, hale, and healthy. The burden of employment results from the loss of independent choice and self-generated action. Education lifts this burden. It minimizes the loss of independence, maximizes the opportunity for creative self-expression, and transforms pay from compensation for surrendered freedom to reward for productive accomplishment.

We end Chapter 4 by stating our four main conclusions about socioeconomic status and health. First, health does benefit from economic well-being. Destitution, privation, and the exposures and strains of dilapidated housing in decaying and threatening neighborhoods account for some of the health problems found near the bottom of the economic ladder. Far more of it comes from repeated or prolonged economic hardship, which undermines health by evoking dread and hopelessness, stimulating physiological responses felt as sickness that also reduce the effectiveness of the immune system and degrade other critical systems through a variety of mechanisms. Second, education greatly moderates the association between economic resources and health. The effectiveness learned through education, and the confidence based on that effectiveness, operate as an alternative resource that substitutes for money if money is in short supply. Higher

levels of education make individuals less dependent on money for solutions to their problems while also reducing the likelihood of problems and increasing the reserves and flows of money available to address them. Third, money cannot buy health. Some amount of money is necessary, but no amount is sufficient. Health is not a commodity. No product or service one can buy will provide it. Individuals who deliberately try to prevent health problems generally will be healthier than those who let the problems develop and then rely on medical intervention for remedies. Finally, productive self-expression nourishes health. Creative work challenges the mind, exercising and developing it. Education makes workers better able to find engaging, enjoyable, and challenging things to do that others reward.

Chapter 5 looks at *education, interpersonal relationships, and health*. We begin the chapter by documenting the positive effect of education on marriage and social support. Education increases the probability of being married, largely by decreasing the probability of being divorced. The better-educated also have a lower probability of being widowed by any given age because their partners tend to be better-educated too and thus live longer. The well-educated enjoy greater marital stability because they marry later in adulthood under more favorable economic conditions, and because they have happier and more satisfying marriages. The well-educated have more supportive and equitable relationships than those with less education because schooling helps partners understand and negotiate with each other, see more than one side of an issue, and respond flexibly with attempts to understand the other's position and to arrange something that is mutually satisfactory. In addition, education helps individuals avoid the interpersonal strains produced by economic hardship. Education increases household income, but also reduces economic hardship substantially for other reasons too. In particular, the better-educated delay parenthood and have smaller families, and also manage better within the limits of the household's income.

Marriage protects health and decreases mortality rates. Compared to married people, the single, divorced, and widowed have more physical health problems, including more acute conditions, chronic conditions, days of disability, physical impairment, poor subjective health, and higher mortality rates from coronary heart disease, stroke, pneumonia, many kinds of cancer, cirrhosis of the liver, automobile accidents, homicide, and suicide, all of which are leading causes of death. Why does marriage improve health? Lower economic hardship seems to be the main reason. Married persons have higher household income and lower rates of economic hardship at any given level of household income, particularly when there are dependent children in the household. Married persons also have greater perceived social support, which indirectly improves health by

reducing depression and anxiety. They also have a more orderly lifestyle than the nonmarried, which benefits their health. Married persons are less likely to smoke and to drink heavily, and the men in particular are less likely to go out to bars, get in fights, drive drunk, drive too fast, take illegal drugs, engage in risky sports, get in trouble with the law, or be sexually promiscuous. Unfortunately, married persons do not exercise or control body weight as much as others, which cancels some of the health benefits of marriage. Married persons do go to the doctor for checkups and screening tests more regularly than others, but there is no indication that doing so improves their health much. Overall, the health benefits of marriage mostly come from improved economic well-being and a safe and orderly lifestyle.

In Chapter 6 we describe education's health effects relating to *age and cumulative advantage*. Education's varied and enduring consequences produce health advantages for the better educated that accumulate and grow over the life course. To fully understand education's positive impact on health one must envision that benefit unfolding across the lifetime. Education's health-related effects are present at every age. They accumulate and compound over a lifetime, producing ever larger health differences between persons with different levels of education who entered adulthood about the same time. A cumulative advantage is a benefit acquired by successive addition. Education's cumulative health advantage rests on three underlying phenomena: permeation, accumulation, and amplification. In the other chapters of this book we discuss a range of things influenced by education that in turn affect health, including habits, interpersonal relationships, family responsibilities, employment, occupational exposures and opportunities, economic sufficiency and security, neighborhood qualities, autonomous and creative activities, and a sense of controlling one's own life. In Chapter 6 we define and describe the other two forces behind education's cumulative advantages: accumulation and amplification.

Accumulation refers to gathering many smaller effects into a larger one. Some accumulations benefit health and others harm it. Education tends to speed or advance the beneficial accumulations and slow or delay the detrimental ones. Accumulation occurs when consequences, once present, tend to stay present. The health-related consequences of education accumulate on many levels. We give examples from the socioeconomic (job experience and seniority, percentage pay raises, wealth) and behavioral (habits such as smoking or exercising, beliefs such as perceived control over one's own life, personal relationships) to the biological (body fat, blood pressure levels, cholesterol levels, insulin resistance, aerobic capacity, joint deterioration, arterial fatty plaque) The socioeconomic and behavioral accumulations necessarily influence health through biological mechanisms. Some undesirable biological accumulations get defined as diseases or medical condi-

tions when they progress beyond a clearly dangerous point. Some undesirable accumulations eventually provoke damaging and deadly crises such as embolism, fibrillation, heart failure, infarction, hemorrhage, stroke, shock, or respiratory arrest.

Most of the better-understood biological accumulators influenced by education reflect elements of health lifestyle such as smoking, diet, and exercise. However differences in the levels of stress over the lifetime probably influence biological accumulators directly apart from health lifestyle. As used here, the word "stress" refers to a specific neuroendocrine reaction, called the stress response, to external events or conditions, called stressors. Much current biobehavioral research examines "allostatic load," which is the impact of intense, recurring, or chronic stress on neuroendocrine accumulators that influence health. The changes represent learned, habitual responses of the hypothalamus-pituitary-adrenal axis that expose the entire body to hormones such as epinephrine, aldosterone, and cortisol. That exposure over time affects the state of accumulators such as resting blood pressure, body fat, and insulin resistance. Education reduces allostatic load by giving individuals the skills, resources, standing, and confidence to master their own lives and cope with its challenges effectively and efficiently.

Education's amplifying effects form the third element of cumulative advantage. In Chapter 6 we next describe how those consequences often influence each other or regulate each other's effects on health. Feedback amplification occurs when the current state of a system produces effects that lead to more changes in the same direction. For example, body fat makes individuals less inclined to exercise, and the less they exercise the faster they accumulate fat. On the other hand, regular exercise slows the accumulation of fat, and a trimmer body makes exercise more enjoyable. Over time, deviation-amplifying feedback has two effects. First, the differences among individuals grow. Second, the beneficial accumulations get increasingly paired in some individuals, whereas their detrimental opposites get increasingly paired in others.

The feedback between physical functioning and the sense of control over one's own life amplifies one of the most important links between education and health. A low sense of control increases the accumulation of impairments, and impairments decrease the sense of control. That "double-negative" feedback magnifies over the life course the advantage in sense of control and in physical functioning enjoyed by the better-educated. It increasingly concentrates good physical functioning and a firm sense of personal control together in the better-educated, while concentrating physical impairment and a weak sense of control together in the less well-educated. It also amplifies the effects of short-term random shocks to each of the two accumulators. The effects of psychosocial crises