CHAPTER

3

DO MORE MEDICAL EXPENDITURES PRODUCE BETTER HEALTH?

The United States spends more per capita on medical services than other countries, yet our health status is not proportionately better. In fact, many countries that have lower per capita medical expenditures also have lower infant mortality rates and higher life expectancies. Is our medical system less efficient at producing good health than these other countries, or are medical expenditures less important than other factors affecting health status?

Medical Services Versus Health

Medical services are often mistakenly considered synonymous with health. When policymakers talk of "healthcare" reform, they mean reform of the financing and delivery of medical services. Medical services consist of not only the diagnosis and treatment of illness, which can lead to improved health, but also the amelioration of pain and discomfort, reassurance of healthy but worried people, and heroic treatments for the terminally ill. One indication that the primary objective of government's medical spending is to treat illness—and not, more broadly, to improve the nation's health status—is that 21.0 percent of all medical expenditures ($766 billion in 2018) are spent on just 1 percent of the population.[1] Furthermore, 39.1 percent of those in that top 1 percent are older than 65 years. Increased medical expenditures, therefore, may have relatively little effect on a nation's health status.

Generally, the United States is acknowledged to have a technically superior medical system for treating acute illness. (For a brief but excellent discussion of criteria used to evaluate a country's health system, see Fuchs [1992].) All financing and payment incentives have been directed toward this goal, and physician training has emphasized treatment rather than prevention of illness. Public policy debates regarding medical services have been concerned with two issues: (1) equity—namely, whether everyone has access to medical services and how those services should be financed, and (2) efficiency—namely, whether medical services are produced efficiently. Knowing how to provide a medical treatment efficiently, however, is not the same as knowing how to produce health efficiently.

In contrast to policy regarding medical services, health policy has been less well defined. The goal of health policy presumably should be to improve

the population's health status or increase its life expectancy; consequently, we should be concerned with the most efficient ways to improve that status. Assuming policymakers recognize this goal, they should understand that devoting more resources to medical care is just one way to improve health and is unlikely to be the most efficient way to do so.

The more accurate the definition of health, the more difficult it is to measure. Health is a state of physical, mental, and social well-being. More simply, it is the absence of disease or injury. Empirically, it is defined by negative measures, such as mortality rates, work days lost to sickness, or life expectancy. Measures of health can be broad (such as age-adjusted mortality rates) or disease specific (such as neonatal infant mortality rates within the first 27 days of life and age-adjusted death rates from heart disease). The advantage of using such crude measures is that they are readily available and probably are correlated with more comprehensive definitions of health. Unavailability of morbidity or quality-of-life measures, however, does not mean they are unimportant or should be neglected in analyses.

Health Production Function

To determine the relative importance of medical expenditures in decreasing mortality rates, economists use the concept of *health production function*. A health production function examines the relative contribution of each factor that affects health to determine the most cost-effective way to improve health. For example, mortality rates are affected by use of medical services, environmental conditions (such as the amount of air and water pollution), education levels (which may indicate knowledge of disease prevention and an ability to use the medical system when needed), and lifestyle behaviors (such as smoking, alcohol and substance abuse, diet, and exercise).

Each of these determinants of health has differential effects. For example, medical expenditures may initially cause mortality rates to drop significantly, as when a hospital establishes the first neonatal intensive care unit (NICU) in its community. Beds will be limited, so the first low-birth-weight infants admitted to the NICU will be the most critically ill and most likely to benefit from medical care and continuous monitoring. As NICUs are added to the community, the neonatal infant mortality rate will decline by a smaller percentage. With a larger number of NICU beds, some beds may be unused or the infants admitted to those beds will not be as critically ill or high risk. Therefore, investment in *additional* NICU beds will have a smaller effect on infant mortality.

Exhibit 3.1 illustrates the relationship between increased medical expenditures and improvements in health status. Higher expenditures produce a curvilinear effect rather than a constant effect on improved health. The marginal (additional) improvement becomes smaller as more money is spent. As shown

in exhibit 3.1, an initial expenditure to improve health, moving from point A to point B, has a much larger marginal benefit (effect) than subsequent investments, such as moving from point C to point D. The increase from point H_1 to point H_2 is greater than the increase from H_3 to H_4.

This same curvilinear relationship holds for each determinant of health. Expenditures to decrease air pollution (such as installing smog-control devices on automobiles) would reduce the incidence of respiratory illness. Additional spending by automobile owners (such as having their smog-control devices tested once a year rather than every three years) would further reduce air pollution. The reduction in respiratory illness, however, would not be as great as that produced by the initial expenditure to install smog-control devices. The reduction in respiratory illness resulting from additional expenditures to control air pollution gradually declines.

Most people probably would agree that additional lives could be saved if more infants were admitted to NICUs (or respiratory illness further decreased if smog-control inspections were conducted more frequently). More intensive monitoring might save a patient's life. However, the same funds could be spent on prenatal care programs to decrease the number of low-birth-weight infants or on education programs to prevent teen pregnancy. The true "cost" of any program to decrease mortality is the number of lives that could have been saved if the same funds had been spent on another program.

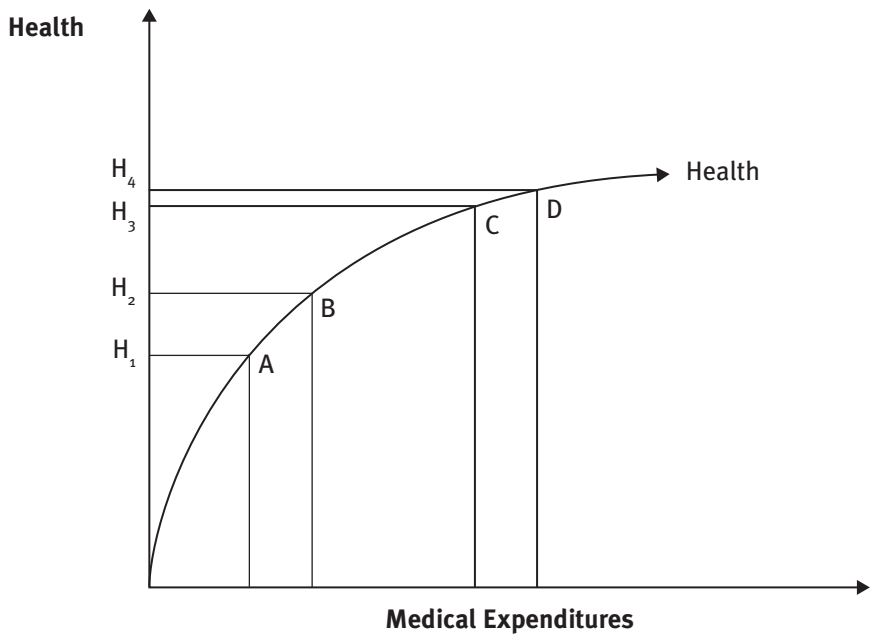

EXHIBIT 3.1 Effect of Increased Medical Expenditures on Health

Physicians, hospitals, dentists, and other healthcare professionals all want more government expenditures to decrease the unmet needs among their populations. However, the government cannot spend all that would be necessary to meet all medical, dental, mental, and other needs. To do so would mean forgoing the opportunity to address other needs (such as welfare and education) because resources are limited. At some point, saving all the lives that medical science is capable of saving becomes too costly in light of forgone opportunities. Reallocating the same funds to apprehend drunk drivers or improve highways might save even more lives.

Deciding which programs should be expanded to improve health status requires a calculation of the cost per life saved for each program that affects mortality rates. Looking at the curve in exhibit 3.1, assume that an additional medical expenditure of $1 million results in a movement from point H_3 to point H_4, or from point C to point D, saving 20 lives. The same $1 million spent on an education program to reduce smoking may result in a movement from H_1 to H_2, or from point A to point B, saving an additional 40 lives from lung cancer. The expenditure for the smoking reduction program results in a lower cost per life saved ($1 million ÷ 40 = $25,000) than the cost per life saved from spending the funds on more medical services ($1 million ÷ 20 = $50,000). Continued expenditures on smoking cessation programs result in a movement along the curve. After some point, fewer lung cancer deaths will be prevented and the cost per life saved will rise. A lower cost per life saved could then be achieved by spending additional funds on other programs (such as stronger enforcement of drunk driving laws).

Crucial to the calculation of cost per life saved is knowing (1) the marginal benefit of the program—that is, where the program (such as medical treatments or smoking cessation) lies on the curve shown in exhibit 3.1, and (2) the cost of expanding that program. The cost per life each program saves can be compared by dividing the cost of expanding each program by its marginal benefit.

The enormous and rapidly rising medical expenditures in the United States likely have placed the return on medical services beyond point D. Further improvements in health status from continued medical expenditures are very small. The cost of expanding medical treatments has also become expensive. Consequently, the cost per life saved through medical services is much higher than that for other programs.

Improving Health Status Cost-Effectively

Numerous empirical studies have found that additional expenditures on medical services are not the most cost-effective way to improve health status. Medical programs have a much higher cost per life saved than do nonmedical programs. Researchers

have concluded that changing lifestyle behaviors offers the greatest promise for reducing mortality rates at a much lower cost per life saved (Fuchs 1992).

The leading contributors to decreased mortality rates over the past 40 years have been the decline in neonatal infant deaths and heart disease–related deaths.

Neonatal Infant Mortality Rate

The neonatal mortality rate represents about two-thirds (67 percent in 2018) of the overall infant mortality rate; the decline in the overall rate has been attributed primarily to the decline in the neonatal rate (Centers for Disease Control and Prevention [CDC] 2017, 2020). For many years, the neonatal mortality rate had declined steadily; however, starting in the mid-1960s the rate began to plummet. As shown in exhibit 3.2, the rate for whites declined from 19.4 per 1,000 live births in 1950 to 3.0 in 2018, while the rate for African Americans declined from 27.8 in 1950 to 7.1 in 2018. During that period, more NICUs were established, government subsidies were provided for family planning services for low-income women, maternal and infant nutrition programs expanded, Medicaid was initiated and paid for obstetric services for low-income women, and abortion was legalized.

Corman and Grossman (1985) found that higher education levels and subsidized nutrition programs were the most important factors in reducing the neonatal mortality rate among whites. The availability of abortion, followed by more NICUs and higher education levels, were the most important factors among African Americans.

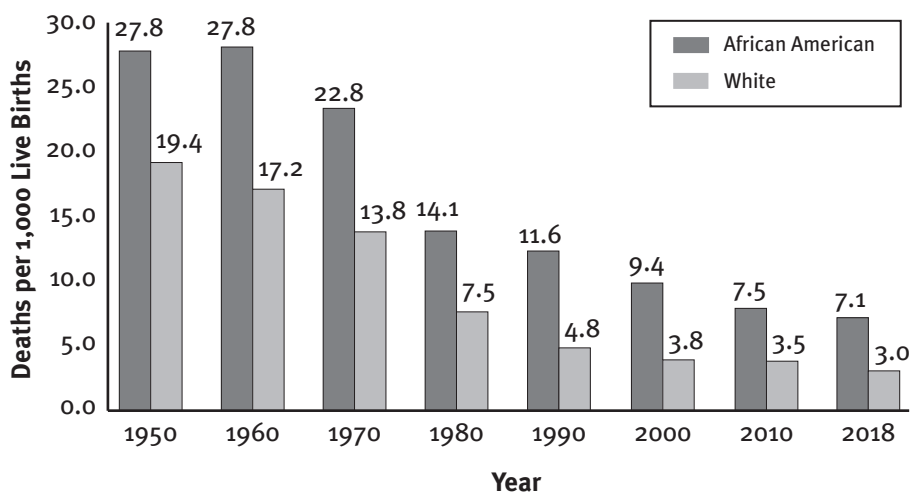

EXHIBIT 3.2 Neonatal Mortality Rates by Race, 1950–2018

Source: Data from Centers for Disease Control and Prevention (2017, table 2; 2020, table 1).

Simply knowing the reasons for the decline in neonatal mortality, however, is insufficient in deciding how to spend money to reduce deaths; it is important to know which programs are the most cost-effective. Joyce, Corman, and Grossman (1988) determined that, for whites, teenage family planning programs, NICUs, and prenatal care saved 0.6, 2.8, and 4.5 lives, respectively, per 1,000 additional participants. The corresponding costs of adding 1,000 participants to each of these programs (in 2019 dollars) were $300,000, $33,496,000, and $433,000, respectively. To determine the cost per life saved by expanding each of these programs, the cost of the program was divided by the number of lives saved. As shown in exhibit 3.3, the cost per life saved was $500,000 ($300,000 ÷ 0.6) for teenage family planning, $11,963,000 for NICUs, and $96,000 for prenatal care, the most cost-effective program.

Thus, reducing the potential number of women in high-risk pregnancies and the number of unwanted births (e.g., by providing teenage family planning programs and prenatal care) offers a greater potential for more favorable birth outcomes than investing in additional NICUs.

Heart Disease Mortality Rate

Cardiovascular disease is the leading cause of death in the United States. However, between 1970 and 2017, the mortality rate from heart disease decreased from 362 per 100,000 to 198.8 per 100,000, faster than the rate from any other cause (CDC 2018). Improvements in medical technology (such as coronary bypass surgery, coronary care units, angioplasty, and clot-dissolving drugs), as well as changes in lifestyle (such as smoking cessation, regular exercise, and a low-cholesterol diet) contributed to this decline.

One study estimated that the development and use of new treatment techniques over time accounted for about one-third of the decrease in cardiovascular disease–related deaths; the remaining two-thirds of this decline was attributed to preventive measures, such as new drugs to control hypertension and lower cholesterol levels and help with smoking cessation (Cutler and Kadiyala 2003; Levine et al. 2019). These lifestyle changes, however, are not seen

EXHIBIT 3.3 Cost per Life Saved Among Three Programs to Reduce Neonatal Mortality (Whites)

	Number of Lives Saved per 1,000 Additional Participants	Cost of Each Program per 1,000 Additional Participants[a]	Cost per Life Saved[a]
Teenage family planning	0.6	$300	$500
Neonatal ICUs	2.8	$33,496	$11,963
Prenatal care	4.5	$433	$96

Note: 2019 dollar calculations performed by the author using the CPI(U) inflation rate.

[a]2019 dollars, in thousands.

Source: Joyce, Corman, and Grossman (1988).

uniformly across the US population; those with more education are more likely to undertake them. Many other studies that examined deaths from heart disease have reached a similar conclusion: Lifestyle changes are more important—and much less expensive—than medical interventions in improving health.

Causes of Death by Age Group

Perhaps the clearest indication that lifestyle behavior is an important determinant of mortality is the causes of death by age group. As shown in exhibit 3.4, the top causes of death for young adults (aged 15–24 years) are accidents (particularly automobile), suicide, and homicide. For the middle-aged group (25–44 years), the major causes are accidents, suicide, cancer, heart disease,

EXHIBIT 3.4
Leading Causes of Death by Age Group, 2017

Age Group	Major Causes of Death	Deaths per 100,000
15–24	All causes	74.0
	Accident	31.1
	Suicide	14.5
	Homicide and legal intervention	11.3
	Cancer	3.2
	Heart disease	2.1
25–44	All causes	162.4
	Accident	56.2
	Suicide	17.7
	Cancer	16.8
	Heart disease	16.3
	Homicide and legal intervention	10.3
	Chronic liver disease/cirrhosis	4.5
45–64	All causes	642.6
	Cancer	182.6
	Heart disease	133.6
	Accident	56.7
	Pulmonary disease	26.8
	Chronic liver disease/cirrhosis	26.1
	Diabetes mellitus	25.3
	Cerebrovascular disease	21.2

Source: Data from Centers for Disease Control and Prevention (2018).

and homicide. For those in late middle age (45–64 years), cancer and heart disease are the leading causes of death.

After examining data by cause of death, Fuchs (1974, 46) concluded that medical services have a smaller effect on health than the way in which people live: "The greatest potential for reducing coronary disease, cancer, and the other major killers still lies in altering personal behavior."

Contributing Factors to the Increase in Life Expectancy 1990–2015

A more recent economic study examined the causes of the 3.3-year increase in life expectancy between 1990 and 2015. Buxbaum and colleagues (2020) estimated the relative importance of each of three major changes (and the components within each change category) responsible for the increase. The three broad categories were changes that occurred in public health measures, pharmaceuticals, and medical care (excluding changes in pharmaceuticals). Their analysis determined that over the 1990–2015 period, components within the three categories explained 85 percent (2.9 years) of the change in life expectancy, with public health measures accounting for the largest increase in life expectancy (44 percent).

The authors' definition of public health measures was similar to previous definitions of lifestyle factors and included such measures as greater use of seat belts, reduced smoking, and improved compliance with blood pressure and cholesterol medications. Unfortunately, some of these improvements were offset by increased diabetes, a greater increase in body weight, and opioid-related deaths. Although some behavioral changes were positive, others were not.

Pharmaceutical innovations, such as treatments for heart disease, hypertension, and cholesterol, were the second largest influence on greater life expectancy, accounting for 35 percent. Buxbaum et al. credit the importance of understanding the effect of public policies related to the price of drugs on pharmaceutical innovations. Medical care (excluding pharmaceuticals) was the smallest contributor to the increase in life expectancy, at 13 percent.

Relationship of Medical Care to Health over Time

The studies discussed in this chapter show that the marginal contribution of medical care to improved health is relatively small. Improvements in health status can be achieved in a less costly manner through changing lifestyle factors. Over time, however, major technological advances have occurred in medical care, such as new drugs to lower cholesterol and blood pressure, diagnostic imaging, less-invasive surgery, organ and tissue transplantations, and treatment for previously untreatable diseases. Few would deny that these advances have reduced mortality rates and increased life expectancy.

Cutler and Richardson (1999) reconciled these seemingly conflicting findings by separating medical care's effect *at a point in time* from its technological contribution *over time*. The authors illustrate the relationship between the total contribution of medical care to health and greater quantities of medical care (exhibit 3.5). Comprehensive health insurance and fee-for-service physician payments reduce both the patient's and the physician's incentive to be concerned with the cost of care, resulting in movement of the healthcare system to point A, where the marginal contribution of medical care to health is very small. Additional medical care expenditures enhance health, but at a decreasing rate.

Eventually, however, medical advances shift the health production function upward. The level of health has improved, and the number of patients treated has risen, but the marginal contribution of medical care is still low—at point B. Too many patients whose need for treatment is doubtful are treated with the new technology, or excess capacity occurs as too much of the new technology is made available. Thus, although medical care today is so much more effective than the care patients received years earlier, the healthcare delivery system remains inefficient; the marginal benefit of additional medical expenditures is low.

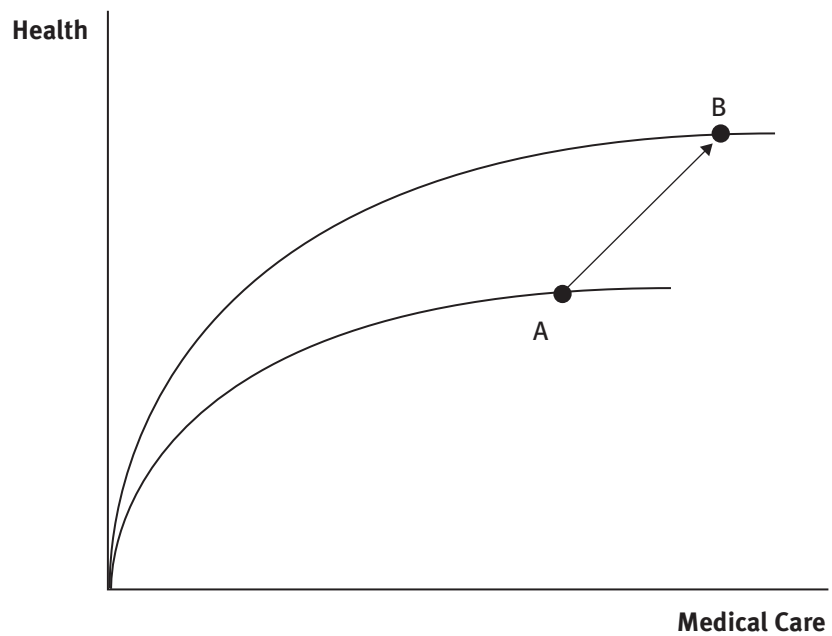

EXHIBIT 3.5 Relationship Between Medical Care and Health

Source: Reprinted from David Cutler and Elizabeth Richardson, "Your Money and Your Life: The Value of Health and What Affects It," in *Frontiers in Health Policy Research*, vol. 2, ed. Alan Garber (Cambridge, MA: MIT Press, 1999), 99–132, figure 5–6.

Incentives

It is generally acknowledged that preventing illness is better than having to treat it once it has occurred. Whether an elderly patient remembers to take their pills, has their blood pressure monitored, or ensures their apartment is fall safe can reduce costly emergency room visits and even a hospital stay. The current fee-for-service payment system, however, incentivizes healthcare providers to provide medical services versus preventive services, such as monitoring systems and home visits.

Insurers do include some preventive measures, such as breast exams and colonoscopies. However, health insurers do not reimburse many preventive measures affecting health and, ultimately, medical services. Unless these measures have a short-term payoff in reducing costly medical services, the insurer's financial incentive is not to provide them. (The benefits of preventive services with long-term payoffs may accrue to different insurers.) Neither fee-for-service payment nor strict, global hospital and physician budgets appropriately incentivize inclusion of social determinants of health in patient services.

By contrast, broader payment systems such as capitation and managed care are more likely to provide incentives for including social determinants of health. To provide preventive services, whose payoff is long term, capitated organizations must strive to satisfy their enrollees so they continue their enrollment over time. Government-subsidized patients also should not be forced to frequently switch to lower-cost insurers to maintain their full coverage.

Summary

If expenditures on medical services have been shown to be less cost-effective in reducing mortality rates than changes in lifestyle behavior, why does the United States spend a growing portion of its resources on medical care?

First, health insurance coverage has been comprehensive—with low deductibles and small copayments—so individuals have faced a very low out-of-pocket price when they went to the hospital or a specialist. Consequently, patients used more medical services than they would have if they had to pay a greater portion of the cost. The expression "the insurance will cover it" indicates patients' and providers' lack of incentive to be concerned about cost. The public also has had little incentive to compare prices among providers, because the costs incurred in searching for less expensive providers exceed any savings on already low copayments. Given these low copayments and the incentives inherent in fee-for-service payments to providers, it is not surprising that enormous resources are spent on treating patients in their last year of life.

The consequences of this behavior are rapidly rising medical expenditures and limited reductions in mortality rates.

Second, the primary objective of government medical expenditures has not been to improve health status and decrease mortality rates. Medicare benefits the elderly, and approximately half of Medicaid expenditures are spent for care of the elderly in nursing homes. The purpose of much government-funded medical care has been to help the aged finance their medical needs. Were the government's objective to improve the nation's health, the types of services financed and the age groups that would benefit most from those expenditures would be very different. (One factor to consider is that the aged have the highest voting participation rates of any age group and perhaps have become the most politically powerful group in US society.)

Although medical expenditures have a relatively small marginal effect on health, it would be incorrect to conclude that the government should limit all increases in medical spending. To an individual, additional medical services may be worth the extra cost even when they are not subsidized. As incomes go up, people are more willing to purchase medical services to relieve anxiety and pain—services that are not lifesaving but are entirely appropriate personal expenditures. From society's perspective, financing medical services for those with low income is also appropriate. As a society becomes wealthier, its members and government become more willing to spend on non-lifesaving medical treatments. These "consumption" versus "investment" types of medical expenditures are appropriate as long as everyone recognizes them for what they are.

When a government attempts to improve the health of its low-income populations (using the concept of health production function), expenditures should be directed toward the most cost-effective programs (that is, those that result in the lowest cost per life saved). Allocating funds in this manner achieves a greater reduction in mortality rates for a given total expenditure than is possible with any other allocation method. The health production function is used more often by employers and health plans that face financial pressures to reduce their medical costs.[2] Employers' use of health-risk appraisal questionnaires recognizes that employees' health can be improved less expensively by changes in lifestyle behavior. Incentives given to employees who stop smoking, lose weight, and exercise enable employers to retain a skilled workforce longer while reducing medical expenditures. Health plans' emphasis on reducing per capita medical costs has led them to identify high-risk groups that can benefit from measures to prevent illness and costly medical treatments.

The recognition by the government, employers, health plans, and individuals that resources are scarce and that their objective should be to improve health status rather than use additional medical services will lead to new approaches to enhance health. The health production function should clarify the trade-offs between different programs and improve the allocation of resources.

Discussion Questions

1. How can the health production function allocate funds to improve health status?
2. Why does the United States spend an ever-growing portion of its resources on medical services, although they are less cost-effective than other methods in improving health status?
3. How can employers use the health production function to decrease their employees' medical expenditures?
4. Describe the health production function in decreasing deaths from coronary heart disease.
5. Describe the health production function in decreasing deaths among young adults.

Notes

1. $766 billion = 21.0 percent × total national health expenditures of $3,649 billion. In 2018, 48.3 percent of total medical expenditures were for 5 percent of the population. The elderly represented 39.0 percent of those on whom a great amount of money was spent (E. Mitchell, Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, personal correspondence with the author, December 9, 2020).
2. See Chapter 22, "Comparative Effectiveness Research," for further discussion of cost-effectiveness applied to quality-adjusted life years.

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