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An Ounce of Prevention

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Benjamin Franklin (1735) advised that the marginal rate of substitution between prevention and cure had a constant value of –16, although he didn't put it in exactly those terms. Perhaps with Franklin's adage in mind, when discussions turn to the cost of health care, many advocate more resources for prevention.

In this paper, I look at prevention through an economic lens and make three main points. First, those advocating preventive measures are often asked how much money a given measure saves. This question is misguided. Instead, preventive measures can be thought of as insurance, with a certain cost in the present that may or may not pay off in the future. Although most medical preventive measures improve expected health, they do not save money. Various lifestyle and early childhood interventions, however, may both save money and improve health.

Second, preventive measures, including medical and lifestyle measures, are heterogeneous in their value, both across measures and within measure, across individuals. As a result, generalizations in everyday discourse about the value of prevention can be overly broad.

Third, health insurance coverage for medical preventive measures generally should be more extensive than coverage for the treatment of a medical condition, though full coverage of preventive services is not necessarily optimal.

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The COVID-19 pandemic has made prevention highly salient; virtually the entire world has engaged in various forms of preventive behavior, including partial shutdowns of the economy, sheltering in place, wearing face masks, and frequent handwashing. Such behavior is not surprising when there is no immunity against a pathogen that is rather easily transmissible and potentially fatal.

Here, however, I focus on preventive measures against chronic diseases rather than infectious diseases like COVID-19. Chronic diseases account for the great bulk of American health care spending; pre-pandemic, persons with one or more chronic diseases accounted for 90 percent of American health care spending, although they were only 60 percent of the population (Buttorff, Ruder, and Bauman 2017). The pandemic has surely increased the proportion of health spending on infectious disease, but at some point it will recede and the chronic diseases will remain. Examples of preventive measures that I have in mind, in the case of coronary heart disease, include having one's blood pressure and cholesterol checked regularly and starting treatment if abnormal, maintaining a healthy diet, getting regular exercise, and keeping one's weight at reasonable levels.

An Economic Formulation of Preventive Measures

I define prevention as a medical or behavioral action that on expectation reduces either the probability or the potential severity of ill health in the non-immediate future. (The qualification of "non-immediate" is meant to exclude medical treatments that simply alleviate a symptom or other condition in the immediate future, such as taking aspirin for a headache.) This definition includes what epidemiologists call primary prevention, meaning an activity that reduces the likelihood of the initial occurrence of a disease, like a flu shot (or other vaccinations) or avoiding crowds during a pandemic. It also includes what epidemiologists term secondary prevention or reducing the likelihood of recurrence or the future severity of a disease one already has: for example, taking a drug that lowers blood pressure to reduce the likelihood of a second heart attack, as well as screening programs such as mammography that are intended to detect disease at an early stage when treatment may be more successful. Moreover, this definition includes both medical interventions as well as what Ehrlich and Becker (1972) term self-protection, or, in this context, maintaining a healthy lifestyle.

Despite the widespread belief among the general public that medical preventive measures save money, they frequently do not. Even more important, whether a preventive measure is welfare-increasing does not depend on whether it saves money any more than the welfare judgement on whether or how to treat a disease such as cancer depends on whether it saves money. Both medical prevention and medical treatment sometime save money, but often neither do.

From an economic perspective, a preventive activity is effectively an insurance policy that requires some cost in the present for a future benefit with an expected

positive value.[1] As a basic analytical framework, imagine a utility function that depends on consumption and health over a number of time periods, with a discount factor applied in future time periods. This utility function is optimized subject to the present value of a lifetime income constraint. To keep matters simple, it is useful as a starting point to assume perfect capital markets, and to ignore time constraints, uncertainty about one's lifetime, and bequest motives. Because of several uncertainties described below, an expectation must be formed for the present value of this utility function.

Next, add to this framework a preventive action that may be taken in the present, which is costly in terms of money, time, clinical risk, and/or disutility such as pain or physical discomfort. Then, the question is whether the expected present value of this consumption-and-health utility function is higher when taking the preventive action in the present or not taking it.[2]

In this framework, the formation of expectations is meant to capture several dimensions of uncertainty about the preventive action. First, the expected value of a preventive action will generally depend upon the future state of the world: For example, is the type of prevalent flu in the flu season one that those responsible for formulating the annual flu vaccine guessed will occur? Second, even if the preventive measure lowers risk as intended, the event in question may still occur. For example, persons who successfully lower their blood pressure and reduce their risk of a heart attack may still have a heart attack. Third, with some probability, the preventive measure itself may have adverse effects, such as a reaction to a vaccine.

Whereas the intent of conventional insurance is to protect against financial risk or variation in income level, the intent of a preventive measure is to protect against health risk or variation in health level. Furthermore, because health and earnings capability are related, if a preventive measure reduces future sick time and/or raises future productivity, it could increase lifetime income and the future stream of consumption, just as the smoothing of consumption from conventional insurance could affect health states. The analogy from conventional insurance to preventive health care is not exact, however, because with conventional insurance, the most one can lose is the premium paid, while with preventive medicine, there is also the possibility that the costs could include an adverse health reaction.

This framework for thinking about preventive health care measures can account for competing risks. For example, preventing a cardiac event may allow an individual to survive but then later to develop dementia and incur related costs. If the discounted expected utility of living with dementia is deemed sufficiently low, the preventive measure might conceivably decrease welfare.

The economic perspective of prevention as insurance that may increase or decrease welfare differs from the perspective of many medical and public health

[1] For a more extensive discussion of many of the points made in this paper, see Phelps (1978) and Kenkel (2000).

[2] This setup is a simplified statement of Michael Grossman's (1972, 2000) classic model of the demand for health.

professionals. A primary goal of medical professionals is to alleviate suffering and the consequences of disease, often expressed without regard to resource constraints. For example, a modern version of the Hippocratic Oath, as formulated in 1964, says in part: "I will prevent disease whenever I can, for prevention is preferable to cure." The version of the Oath that contains this sentence is the most popular form of the Oath among American medical school graduates, with one-third of the graduates taking it (Hajar 2017).

Heterogeneity across Individuals

Decisions about whether a preventive measure increases utility will differ across individuals for various reasons including degree of risk aversion, age, and other individual background factors that can predict health outcomes.

For example, in making decisions about preventive medicine, the degree of risk aversion is relevant. It is quite possible that the expected net benefit of taking a preventive action could be negative for a risk-neutral individual but positive for a risk-averse individual. Individuals may also vary in their choice of discount rates.

Decisions about preventive measures, of course, are taken throughout an individual's lifetime. Thus, given a finite lifetime, expected net benefits of preventive measures fall with age. It is not surprising, therefore, that guidelines for the use of medical preventive services account for age. For example, the US Preventive Services Task Force (2018a) recommends against prostate cancer screening for men age 70 and over. And the US Preventive Services Task Force (2016) recommends biennial mammography for women only up to age 74, concluding that "the current evidence is insufficient to assess the balance of benefits and harms of screening mammography in women 75 and older."

Heterogeneity across individuals also matters in creating clinical guidelines. Those responsible for formulating them prefer to base the guidelines on clinical trial results, but heterogeneity across individuals may cause results in practice to differ from those of a clinical trial. Einav et al. (2019) point out that the population in a trial of a preventive measure, for example all females of a given age range, may differ in its risk distribution from those who choose to obtain a preventive measure such as mammography. For example, those who choose to obtain a mammography may have knowledge that they are personally more susceptible to breast cancer because of habits like smoking or background like family genetic history.

Heterogeneity among Clinical Measures of Effectiveness of Preventive Medicine

The utility-maximizing framework discussed here follows most of the American health economics literature in using standard welfare economics, which can also be translated into cost-benefit analysis comparing the costs of preventive medicine to

expectations of possible gains in consumption and health. Unfortunately, however, the empirical health economics literature has only scattered results that quantify the benefits of specific preventive measures. There is, however, an extensive public health literature that uses Quality Adjusted Life Years (QALYs) or Disability Adjusted Life Years (DALYs) to assess the value of various clinical preventive measures (Torrance 1986; Gold et al. 1996; Neumann et al. 2016). QALYs and DALYs are utility-weighted life expectancies that account for an individual's state of health or quality of life at each point in time, rather than simply expected length of life using stated-preference methods to elicit weights. A year of perfect health is weighted as one, death is weighted as zero, and a year spent with a chronic illness—including a range of conditions like hay fever, cancer in remission, or a specified level of disability—is given an intermediate value. In QALY terms, therefore, the usual life-expectancy measure assumes all remaining years are spent in perfect health. The cost-effectiveness of a preventive or treatment measure is its incremental cost per incremental QALY, relative to the next-best measure.

If the preventive measure does not save money and is financed from an insurance pool or is tax-financed, one faces the question of whether its health benefits are worth the cost. Here, the public health literature departs from standard welfare economics, which is based on preferences as revealed by an observed demand curve; that is, in standard welfare economics, an individual compares personally paying the costs of preventive care (broadly understood to include both monetary and non-monetary costs) with the expected personal benefits received in terms of future consumption and health. This approach will clearly depend on an individual's willingness to pay, which will vary with income.

In contrast, the public health literature typically gives QALYs and DALYs equal weight across persons and thus removes willingness to pay from the calculation of incremental cost per incremental QALY. In principle, one could weight persons according to a measure of social welfare (Saez and Stantcheva 2016), but this is usually not done in practice. The public health literature often rationalizes the use of equal weights on equity grounds, but one can also appeal to the extensive literature that questions the normative meaning of observed demand curves, much of which uses health care choices under uncertainty as examples (Handel and Kolstad 2015; Bhargava, Loewenstein, and Sydnor 2017; Ericson and Sydnor 2017; Handel and Schwartzstein 2018).

Having computed the incremental cost per incremental QALY for a given measure, the public health literature evaluates whether the measure should be implemented by determining if its incremental cost per incremental QALY falls below a specified dollar threshold. A common rule-of-thumb threshold in US studies is $100,000 per QALY, although this may well now be a lower bound; in 2020, a value of $150,000 or even $200,000 may be more realistic (Braithwaite et al. 2008).

The key points for my purposes, however, are the large variation in cost per QALY across various preventive measures found in the public health literature and the modest number of measures—about 20 percent—that both improve health and reduce cost (Cohen, Neumann, and Weinstein 2008). Vaccination is a well-known

Table 1
Examples of Cost-Effectiveness Ratios of Selected Preventive Measures
(in 2006 dollars)

Cost-Saving	Polypill versus individual prescriptions and their rate of usage of up to four medications from recommended medication classes for secondary prevention of cardiovascular disease
Cost < $100,000/QALY	Newborn screening for medium-chain acyl-coenzyme A dehydrogenase deficiency, $160/QALY
	High intensity smoking-relapse program, $190/QALY
	Intensive tobacco use prevention program for 7th and 8th graders, $23,000/QALY
Cost between $100,000–$1,000,000/QALY	Screening all 65-year olds with hypertension for diabetes, $590,000/QALY
Cost > $1,000,000/QALY	Antibiotic prophylaxis (amoxicillin) for children with moderate cardiac lesions who are undergoing urinary catheterization, $10,000,000/QALY

Source: These examples were drawn on June 15, 2020 from the 100 publicly accessible values of the registry of cost-effectiveness studies maintained by the Center for the Evaluation of Value and Risk in Health at Tufts Medical Center, http://healtheconomics.tuftsmedicalcenter.org/cear2n/search/ratio0.aspx. As of June 2020, the entire Tufts registry contained results of over 20,000 cost-effectiveness studies, but the public website only shows the 100 that have been most recently added.

example of a measure that improves health and reduces cost. It is typically inexpensive, causes few adverse events, and can confer immunity for many years. The development of the polio vaccine, for example, was one of the great public health triumphs of the 20th century. In the late 1940s, polio crippled 35,000 Americans annually; because of vaccination, it was eradicated in the United States in 1979 (Centers for Disease Control and Prevention 2020). Vaccination also differs from many other preventive measures because of the external benefit it confers on the unvaccinated ("herd immunity"). Another example of a preventive measure that saves money and improves health is a "polypill"—a single pill with several active ingredients for secondary prevention of heart disease versus single prescriptions for various agents (Gaziano et al. 2019).

The remaining 80 percent of preventive measures do not save money. Table 1 shows a few examples of preventive measures. The majority of all preventive measures—about 60 percent of them—provide health benefits at a cost of less than $100,000/QALY (2006 dollars). Another 10 percent of measures cost between $100,000 and $1,000,000 per QALY; those measures with costs near the lower end of this range might pass the common rules of thumb of cost-effectiveness described above. The remaining 10 percent of preventive measures studied in the literature either worsen expected health or, if they improve it, cost more than $1,000,000 per QALY.

An important caveat is that the published ratios for cost-per-QALY shown in Table 1 are average rather than marginal or incremental values. However, the use of average values for policy purposes is mitigated to some degree because many of the measures are both studied and described as being conditioned on observables such as age, sex, and prior disease history, and within those subgroups, the expected benefit may be approximately constant.

Errors in Screening Procedures

Many common preventive procedures, like mammography, screen a population for evidence of disease. Errors in such measures can be large enough to make them welfare-decreasing, at least among certain subgroups. Errors can be both false positives (known as "Type 1" errors), in which a screening test may signal disease when it is not present, or false negatives (known as "Type 2" errors), in which a screening test may fail to detect disease when it is present.

For example, in one large observational study, mammography gave an abnormal result 11.6 percent of the time but had a false positive rate of 95.6 percent (2007–2013 data) (Lehman et al. 2017).[3] False positive rates depend heavily on the true prevalence of the disease in the sample studied. Other studies with different populations give lower but still relatively high false positive rates for mammography (Nelson et al. 2016). Using the 95.6 percent figure, however, suggests that for every 1,000 women screened, mammography would signal that further investigation was indicated for 116 of them, but 111 of those 116 women would not actually have breast cancer. The likelihood of a false positive together with remaining life expectancy is one reason that US Preventive Services Task Force (2016) concluded that evidence was insufficient to recommend screening mammography for women 75 and older.

A screening test does not generally diagnose the illness but merely suggests its presence. If the screening test is positive, the next step is either to repeat the test or carry out a diagnostic test or procedure. Repeating the test is more attractive the higher the false positive rate, the lower the cost of the test, and the greater the independence between the results of the two tests. In the mammography example, a

[3]Of 1,682,504 mammograms in the Lehman et al. (2017) study, 194,668 had an interpretation of an abnormality (0.116 = 194,668/1,682,504). Among the 194,668 women who screened positive, there were 8,529 true positives and 186,140 false positives. The false positive rate was therefore 0.956 = 186,140/194,668. Among the 1,487,836 women who screened negative, there were 1,283 false negatives and 1,486,663 true negatives. In epidemiologic jargon, the "sensitivity" of mammography (equal to the ratio of screen positive/true positive), was 86.9 percent and the "specificity" (equal to the screen negative/true negative) was 88.9 percent. The "true prevalence" in the population (equal to the true positive rate plus the false negative rate) was (8,529 + 1,283)/1,682,504 = 0.0058 percent. The calculation that 111 of the 116 women who screened positive for breast cancer did not actually have it is 111 = (186,140/194,668) × 116. The false negative rate was 1,283/1,487,836.

common follow-up diagnostic procedure is a biopsy, which of course has non-trivial expense and can result in medical complications.

Continuing the results from the large observational study of mammography (Lehman et al. 2017), 884 of the 1,000 women screened would have had a negative test. In the study, mammography had a false negative rate of 0.09 percent, so using expected values, one of those 884 women would actually have breast cancer. Both because of the possibility of false negatives and even more because of the probability of a woman's developing detectable breast cancer in a given time interval after a negative screen, periodic testing is desirable. More frequent testing, however, increases the number of women experiencing false positives. Hubbard et al. (2011) and Nelson et al. (2016) calculate that among women who hypothetically would have had annual screening mammography for a decade, 61 percent would have had at least one false positive screening and that biennial (every two years) testing would lower this rate to 42 percent. As noted above, the US Preventive Services Task Force (2016) recommends biennial testing for women 50–74.

In sum, the optimal screening frequency depends on several parameters, especially the true prevalence in the population, the frequency and cost of Type 1 and Type 2 errors, the cost of the test itself, and the probability and value of successful prevention or treatment if the screening test is positive. A sufficiently high false positive rate can make the value of a screening test negative, depending on the cost of the test, the cost and potential adverse health consequences of any follow-up procedures from a positive test, and whether treating the disease can be just as successful if the disease is detected at a later time when a person has symptoms.

Insurance Coverage of Preventive Services

At one time, it was common to hear arguments that clinical preventive services were not insurable because they were "not a random variable and hence not an 'insurable risk'" (Zweifel and Breyer 1997). Zweifel and Breyer give the example that "it is hardly conceivable that a health insurer would ever cover expenditure on items such as . . . atomizers that help to prevent respiratory disorders;" a similar point could be made about a flu shot or mammography. There are, however, both economic efficiency and behavioral arguments for many preventive measures.

Standard Efficiency Arguments

A textbook example of the efficiency argument for clinical preventive services is the externality from vaccination against a contagious disease mentioned above. The externality is the rationale for compulsory measles vaccination (Oster 2018). In part, because of the externality, billions of dollars are being invested in 2020 to develop a vaccine for COVID-19.

Even if the contagion argument is not relevant, however, there are standard efficiency arguments for not only insuring preventive services but subsidizing them to a greater degree than treatment services. Assume that certain kinds of

prevention do in fact reduce the likelihood of disease and thus the demand for treatment; in other words, preventive services substitute for treatment services. Also assume that an individual's insurance premiums or taxes are negligibly affected by their personal use of preventive and treatment services, as is generally the case. In this setting, preventive services should be at least partially insured. Otherwise individuals, by not accounting for the financial consequences of the reduction in their future use of treatment services, will under consume preventive services relative to a social optimum (Ellis and Manning 2007; Goldman and Philipson 2007).

Although this argument does not imply that full insurance is optimal, the 2010 Patient Protection and Affordable Care Act made all preventive services rated A and B by the US Preventive Services Task Force free for public insurance plans as well as the great majority of private insurance plans (the exceptions are so-called grandfathered private plans, but few of those remain). An A rating means the service has a high certainty of substantial net benefit, while a B rating means it has a moderate certainty of substantial net benefit or high certainty of moderate to substantial net benefit (US Preventive Services Task Force 2018b).

The logic of less cost-sharing for preventive services also implies that drugs to treat a chronic disease such as diabetes should face less cost-sharing than drugs to reduce a transient problem such as itching or pain from a sprain or minor burn, because failure to take the diabetic drug could lead to exacerbations of the disease that would be costly to treat, whereas a transient problem would resolve with time and not require further treatment. In practice, however, insurance policies generally do not differentiate cost-sharing for drugs according to the potential consequences of noncompliance. This has led to proposals to make medications that treat serious chronic diseases such as diabetes and cardiac conditions free to the consumer to forestall downstream adverse events, under a philosophy of "value-based insurance design" (Chernew et al. 2008). Some steps in this direction have been taken by Medicare Advantage plans (Starc and Town 2018).

Behavioral Considerations

Behavioral considerations offer another—and likely more powerful—rationale for insurance coverage of preventive activities. Failure to engage in preventive activities is a standard example in the hyperbolic discounting literature. Every day, I may eat a cookie and plan to exercise tomorrow, rather than the other way around. In this situation, decisions are not time-consistent, and people will later experience regret that they did not take certain actions at earlier times.

It is clear that time inconsistency can be an issue in health-related decisions, like smoking. In a classic paper in this genre, Gruber and Koszegi (2001) begin from the rational addiction model of Becker and Murphy (1988), in which tobacco use is individually rational if individual decisions are time consistent. Gruber and Koszegi show that if individual decisions are not time-consistent, one can make a case for much higher excise taxes than taxes that simply equal the external costs because those high taxes will reduce the "internalities" experienced from smoking

by a time-inconsistent individual. The evidence for time-inconsistent behavior is not conclusive, but in the case of smoking, some support for the hypothesis can be found in the regret expressed by many addicted smokers—many of whom initiated tobacco use in adolescence before the legal age for smoking—and the corresponding demand for aids to quit smoking.

However, the evidence on whether more extensive insurance coverage overcomes the issue of time inconsistency by reducing the up-front cost for preventive measures suggests that reducing out-of-pocket cost is not the main barrier. In one randomized trial, insured patients who had suffered a heart attack received free access to four types of drugs to reduce the likelihood of a second and possibly fatal heart attack. Meanwhile, the control group continued on their existing insurance plan with their usual copayment for drugs (Choudhry et al. 2011). Rates of adherence increased with free drugs but only by about 5 percentage points. Even more strikingly, over one-half of the population in both the treatment and control groups did not comply with prescriptions for the drugs, despite the potentially dire consequences of noncompliance. These findings echoed those from the RAND Health Insurance Experiment; in that study, when both preventive and treatment services were free, rates of compliance with preventive guidelines were around 10 percentage points higher than when services were costly to the patient, but compliance was still well under half for adult males, although it was higher for females (Newhouse and the Insurance Experiment Group 1993).

Behavioral considerations may shape the structure of dental insurance, the most common form of which is a group policy with relatively low annual benefit limits. Dental insurance almost always, however, covers prophylaxis (teeth cleaning). Thus, rather than offering much protection against expensive dental procedures, dental insurance can be seen as a nudge to seek preventive care. One can only speculate as to why dental insurance has such low limits, but one possibility is that because dental insurance was and remains mainly provided by dental societies (Delta Dental), and dentists may well have wanted a mechanism to encourage patients to seek care through an untaxed employer-provided fringe benefit, while still having the freedom to price expensive dental procedures.[4] Although the Patient Protection and Affordable Care Act of 2010 banned annual and lifetime upper limits on payouts from medical insurance, it did not apply those limits to dental insurance.

[4]Data from the RAND Health Insurance Experiment (Newhouse and the Insurance Experiment Group 1993) show that the probability of using diagnostic and preventive dental services in a year is 15 percentage points higher when care is free than when it is costly. My own view is that the current situation is a low-level equilibrium trap; because dental insurance is mostly employment-based, any individual employer that offered more generous dental insurance benefits (for example, for orthodontia), could well be selected against in the labor market. Cabral (2017) has shown that individuals can time their dental expenditures, which potentially creates a selection problem in individual markets, but timing should not be much of an issue for self-insured employers with relatively low employee turnover (such an employer doesn't much care whether the dental work is done in December or January), and many such employers offer dental insurance to employees and their dependents.

Table 2
American Death Rates from the Ten Leading Causes of Death in 1900 and 2016
(deaths per 10,000 population)

1900 Causes of Death/10,000		*2016 Causes of Death/10,000*	
Influenza and pneumonia	202.2	Diseases of the heart	16.6
Tuberculosis	194.4	Malignant Neoplasms (cancer)	15.6
Diarrhea, Enteritis, and ulceration of the intestines	142.7	Unintentional injuries	4.7
Diseases of the heart	137.4	Chronic lower respiratory diseases	4.1
Intracranial lesions of vascular origin	106.9	Cerebrovascular diseases	3.8
Nephritis	88.6	Alzheimer's disease	3.0
All accidents	72.3	Diabetes mellitus	2.1
Cancer and other malignant tumors	64.0	Suicide	1.4
Senility	50.2	Nephritis, nephrotic syndrome, and nephrosis	1.3
Diphtheria	40.3	Influenza and pneumonia	1.1

Source: https://www.cdc.gov/nchs/data/dvs/lead1900_98.pdf and https://www.cdc.gov/nchs/hus/contents2017.htm#Table, Table 17. The 1900 data are from eleven death-reporting states, mostly in the Northeast, plus the District of Columbia. The specific states can be found in Table 1.04 in Appendix II of https://www.cdc.gov/nchs/data/misc/usvss.pdf.

Non-Clinical Preventive Interventions

Over the course of the 20th century, there was a remarkable shift in the leading causes of death from acute to chronic diseases, as illustrated in Table 2 by the ten leading causes of death in the United States in 1900 and 2016. In 1900, the three leading causes of death were attributable to infectious disease, and two of those three are not even among the top ten causes in recent years. Influenza and pneumonia, the leading cause of death in 1900, was the tenth leading cause in 2016, and death rates from it have fallen by a factor of 200. (Deaths from pneumonia will be higher in 2020 because of COVID-19, but once the pandemic recedes, the causes of death should again be similar to those shown in Table 2.) Many of the chronic diseases that are among the current leading causes of death are influenced by lifestyle and health habits, including tobacco use, diet, exercise, and substance misuse. While rates of smoking have fallen, the ongoing, worsening obesity epidemic suggests that policy efforts to improve diet and exercise have had at best modest effects (Cutler, Glaeser, and Shapiro 2003; Ward et al. 2019).

Clinical preventive care plays a role in addressing these health issues, perhaps especially in the case of screening for cancer, high blood pressure, high cholesterol, and depression. Some of the most significant preventive interventions to improve health status in the 20th and 21st century, however, have been nonmedical.

Taxing or Regulating Goods with High Health Costs

The flip side of subsidizing preventive medical services is taxing unhealthy goods or services to reduce their use. Public policies to alter lifestyles and health habits have a mixed track record. The most successful are likely the increased cigarette taxes and laws and regulations prohibiting smoking in public places that have played a central role in the percentage of cigarette smokers falling from 42 percent in 1965 to 16 percent in 2016 among Americans age 18 and over (Chaloupka and Warner 2000; National Center for Health Statistics 2018). That large decline in smoking has played a major role in the fall of death rates from lung cancer among males—roughly a factor of two since 1990. Lung cancer rates among females have also begun to decline but to a lesser extent because female smoking rates declined later than rates among males (Siegel, Miller, and Jemal 2020).

Externalities are a standard rationale for tobacco excise taxes. Their value can be quantified by assuming two cohorts that differ only in that one begins to smoke at age 20, while the other does not, and then calculating the present value of external costs in the two cohorts. Assume both cohorts pay a common payroll tax to finance both health insurance and a pension. On one side, tobacco users impose costs on non-users because taxes must be higher to finance their additional health costs. On the other side, tobacco users subsidize non-users in a pension system because their lower life expectancy means that they collect less in pension benefits when or if they become eligible. The undiscounted difference in pension benefits between the two cohorts is substantial, but because the pension benefits are zero for the first 40+ years after smoking is assumed to begin, they are heavily discounted with a typical discount rate. A lower discount rate will make the long-term pension effects look larger, and the reverse is also true. Using 1980s American data, the two effects were equal at a real discount rate of a little over 3 percent (Manning et al. 1989). Coincidentally, the 3 percent real rate is the rate the two Panels on Cost-Effectiveness in Health and Medicine have recommended be used in cost-effectiveness studies (Gold et al. 1996; Neumann et al. 2016). As mentioned above, however, if individuals are time-inconsistent, the optimal tax is much higher because of the size of the "internality."

Analogous to tobacco, sugar-sweetened beverages have been linked to obesity, cardiovascular disease, and diabetes, which increase health care costs, and some localities have begun to tax them. In this journal, Alcott, Lockwood, and Taubinsky (2019) thoroughly discuss the issues around taxation of sugar-sweetened beverages.

Alcohol also imposes external and internal costs, but the case for a tax to improve economic efficiency is more complicated than for tobacco because alcohol in moderation may have beneficial health effects. As a result, the magnitude of an optimal efficient tax on alcohol is uncertain (Manning et al. 1989; Pogue and Sgontz 1989). In addition to the external costs involved in smoking, alcohol has large external costs both from driving while intoxicated and from its positive effect on violent crime (Chalfin, Hansen, and Ryley 2019).

Exercise and Workplace Wellness Programs

Workplace wellness programs are a form of employment-based subsidy to preventive activities that seek to promote healthy lifestyles among a firm's workers. Employers offering such programs may be motivated by selection concerns with respect to their labor force, a desire to increase the productivity of their labor force, workers' desire for a non-taxable fringe benefit, or some combination. Song and Baicker (2019) implemented a randomized trial of such a program at a large retail warehouse company. The trial consisted of eight modules implemented over 18 months emphasizing nutrition, physical activity, stress reduction, and prevention. Like subsidizing preventive care through health insurance, results suggested little effect on behavior. In the intervention group, somewhat more persons reported engaging in regular exercise (8 percentage points) and actively managing their weight (14 percentage points), but a large number of other pre-specified outcome measures did not differ significantly between the intervention and control groups. These included 27 self-reported measures of health outcomes and behaviors, including sleep quality and food choices; ten clinical markers, including cholesterol, blood pressure, and body mass index; 38 medical and pharmaceutical spending and utilization measures; and three employment outcomes, including absenteeism, job performance, and job tenure. Jones, Molitor, and Reif (2019) implemented a similar randomized trial among employees of the University of Illinois at Urbana-Champaign and, like Song and Baicker, found essentially null results.

Childhood Interventions

Many chronic diseases can be traced back to childhood deprivation. Childhood interventions with disadvantaged children, especially early childhood interventions, appear to have important effects not only on child health but also on health as an adult—especially for males (Heckman, Pinto, and Savelyev 2013; Campbell et al. 2014; Hendren and Sprung-Keyser 2019; García et al. 2020). For example, the Carolina Abcedarian Project involving children born between 1972 and 1977 provided cognitive and social stimulation throughout an eight-hour day as well as health care to a small randomized group of preschool, disadvantaged children age 0–5, and compared them with a control group. At a 30-year follow-up, the researchers obtained data on 19 of the original 29 treatment group males and nine of the original 23 control group males. Those with missing data, however, appeared to be missing at random. Despite the small numbers, several risk factors were markedly lower in the treatment group males around 30 years later, including obesity and hypertension, dyslipidemia (high cholesterol), and metabolic syndrome (a combination of obesity, cardiovascular disease, diabetes).

In a broader study, Goodman-Bacon (2018) has shown that the introduction of Medicaid a half-century ago reduced infant and child mortality. Hendren and Sprung-Keyser (2019), drawing on the work of Wherry, find positive effects of the more recent Medicaid expansions to cover older children; indeed, the effects from expanding Medicaid coverage in childhood are more than repaid by lower health care spending later in life. Hoynes, Schanzenbach, and Almond (2016) review a

considerable literature showing that malnutrition in utero or in early childhood leads to poorer adult health outcomes and go on to show that access to food stamps in utero or in early childhood reduces the prevalence of metabolic syndrome in adulthood. A thorough review of policies to reduce child poverty can be found in National Academies of Sciences, Engineering, and Medicine (2019).

The Supply of Preventive Services

The discussion up to this point has focused on demand for preventive measures or on justifications for their cost-effectiveness, but supply considerations are also relevant. For example, firms investing in research and development may tend to favor products to treat rather than to prevent disease.

One reason is that a firm will tend to prefer products that can be tested in a clinical trial with shorter durations because returns will come sooner; indeed, Budish, Roin, and Williams (2015) provide evidence that cancer clinical trials favor shorter-term projects. Moreover, such trials are more likely to be for agents designed to treat rather than to prevent various cancers because trials of treatment agents will typically need less time than those of prevention agents to establish whether an agent is efficacious. Even within trials of agents to treat cancer, the sample population will often be those with late-stage cancers because results will be available sooner. More generally, because trials of preventive agents are in healthy populations, they will likely take longer to show a response (or not) than a treatment for a sick person.

Kremer and Snyder (2015) illustrate how heterogeneity in a population's risk of contracting a disease also tends to favor trials of treatment agents rather than prevention agents. The intuition is simplest in the case of a monopolist deciding between two products that have the same research and development cost, show the same likelihood of success in development, are both perfectly effective, have no production cost or side effects, and are directed to a disease that results in the same harm for all who get the disease. The monopolist is assumed to know the distribution of risk in the population but not the risk of individual consumers. In the case of the treatment product, someone with the disease will be willing to pay up to the value of the harm the disease causes, while those who do not have the disease will not be willing to pay anything. In the case of the preventive product, consumers will pay up to their *expected* harm, but because of the varying risk among consumers, this amount will vary. The firm can choose to sell the preventive product only to higher-risk consumers at a price that equals their expected harm, in which case, lower-risk consumers will not buy, and the firm's revenue relative to the treatment case will be less. Alternatively, the firm can sell to all consumers at a price that equals the expected harm to low-risk consumers, but this generates less revenue than the treatment product because the firm sells the preventive product to the high-risk consumers at the price a low-risk consumer would pay. In the special case in which all consumers have the same risk of contracting the disease, the returns to the firm from the two types of products are equal.

Conclusion

Preventive activities are best viewed in conceptual terms as insurance where the payoff is a reduction in the likelihood of states of the world with lower utility. There are a vast array of preventive activities, with some purchased through the market, especially clinical interventions, some largely produced by the individual's time, such as exercise, and some publicly provided or subsidized. There is heterogeneity in value both across preventive measures as well as across individuals for a single measure.

The decision to bear the costs of preventive activity, like the decision to purchase conventional insurance, will not always pay off. In the case of conventional insurance, one may end up paying far more in premiums than one receives in claims. In the case of preventive decisions, one may pay the costs of clinical preventive care or shifts in personal habits, but still end up needing to be treated for the medical condition.

In public rhetoric, a common test applied to preventive activity is to ask whether it saves money, usually from avoided medical treatment, but this test is much too narrow because it omits potential future benefits of improved health and productivity. Only a minority of clinical preventive measures can be expected to save money in the narrow sense of reducing future health care spending, but many are worth their cost when expected gains from health and productivity are taken into account.

There are both standard efficiency and behavioral arguments for subsidizing preventive activities to a greater degree than treatment activities. The gist of the efficiency argument is that an individual ignores the cost imposed on others in the health insurance pool from not using preventive activities; the gist of the behavioral argument is hyperbolic discounting. But from a broad social perspective, some of the most important and high-payoff preventive activities may be outside clinical medicine, including policies such as cigarette taxes and smoking regulations as well as interventions to improve health and cognitive skills in early childhood, especially among disadvantaged children.

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