PREVENTION'S POTENTIAL FOR SLOWING THE GROWTH OF MEDICAL SPENDING

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As the debate builds about how to reform the U.S. health care system, an old and appealing theme revives with it: Prevention is the way to bring ever-rising expenditures for medical care under control. If we spent more on prevention, we could spend less overall. The logic seems unassailable: Prevent the disease, prevent the cost. People are healthier and the medical system saves money.

A radio ad that aired a few years ago offered the example of a man faced with bypass surgery. The cost of the surgery was high, then around $50,000. Wouldn't it have been better, the ad asked, if he had avoided the need for surgery with prevention – by losing weight, quitting smoking, exercising, taking medications to reduce his blood pressure and cholesterol? Better for his health and cheaper for the medical system?

If that man could have been identified years earlier and given an inexpensive pill that was 100% effective in preventing heart disease, the answer would be yes. Prevention is, however, rarely so simple. Medical science can only identify those at risk of future heart disease, a much larger group than those who will someday be candidates for bypass surgery. Prevention has to be delivered to all the people at risk, often repeatedly over many years, in order to prevent some of them from developing disease. Some will develop disease anyway, since prevention is not 100% effective, and some would not have developed it even without prevention.

Evaluating the claim that prevention reduces medical spending is more complicated than it appears at first glance. Costs that look small when considered per person, or per year, start to mount up. The result is that prevention can cost more than it saves.

How to Evaluate Cost Savings

Although prevention is often discussed as though it were a single uniform commodity, it takes many forms: vaccines that prevent disease completely; medications that reduce the risk of developing disease; screening tests that detect disease at an early stage when treatment is more effective; and lifestyle changes – smoking cessation, exercise, diet – that keep people healthy longer. The term is even used to describe interventions that prevent or control the consequences of disease once it is already established.

To determine whether a preventive intervention reduces medical spending, the medical costs required to provide it are compared with the medical costs that would be necessary if it were not provided. To evaluate a vaccine, compare the costs of vaccination, including treatment of its side effects and the few cases of disease that occur in spite of it, with the costs of treating all the cases of disease that would occur if no one were vaccinated. (Studies often label waiting until

disease develops "no intervention" or even "doing nothing," although it is hardly that.) To evaluate cholesterol-lowering medications, compare the costs of the drugs, and the extra tests and doctors' visits necessary for their proper use, with the savings in hospital and physicians' care for heart disease in future years. Effective preventive measures save some of the costs of treating disease, at the same time that they incur new costs for their provision.

Many studies examine whether the medical savings from prevention outweigh its medical costs, but they provide this information as part of a broader evaluation that looks at health outcomes as well as costs, presenting a variety of perspectives on both. As a result, it can be difficult to identify the numbers that show whether the intervention saves the health care system more than it costs. Studies of childhood vaccinations, for example, frequently estimate the savings in parents' time when their children are spared illness, and value that time at the wage rate. They may also value the children's future earnings. They then compare the medical costs of the vaccination with the medical savings, *and* the savings in parents' time and children's future earnings, and conclude that vaccination saves money. The results may be stated as a ratio: dollars saved to dollars spent.[1]

Clearly, the money being saved is not all in the medical sector – much of it is in the form of parents' time or children's future earnings. Often a vaccination strategy that saves money overall, when earnings are considered, costs the medical system more than it saves. The next section gives an example.

Vaccines

Childhood vaccinations have many features that contribute to savings. The risk of disease is high – nearly all children would get it if left unvaccinated, so each child vaccinated is a case of disease prevented. Vaccinations need be given only a few times in early childhood to prevent diseases that would otherwise occur a few years later. For many established vaccines, the cost per dose and the cost of administering them are low. And serious risks from the vaccine itself, while they exist, are very low.

A paper published in the *Journal of the American Medical Association* in 1994[2] estimated the costs and savings associated with the then-new varicella (chickenpox) vaccine. In the abstract, the authors stated that, when parents' time and children's future earnings were counted, the varicella vaccine "would save more than $5 for every dollar invested in vaccination." The next line noted, however, that the medical costs of the vaccine were greater than the medical savings. Considering only medical costs, the vaccine saved 90 cents for every dollar spent on it (Table 4, "health care payer's perspective"). That estimate assumed a private-sector price per dose of $35 (1990 dollars), about $75 in 2007. The current private-sector cost per dose is $75.[3]

A 1998 analysis estimated medical costs and savings from rotavirus vaccine, as well as earnings lost by parents and other caregivers.[4] Rotavirus is the most common cause of severe diarrhea in young children in the U.S. and a vaccine was under development. At $9 or less per dose (1996 dollars), equivalent to $14 or less in 2007, the vaccine would reduce medical spending. The current price per dose is $55 for the Centers for Disease Control and Prevention (CDC) and $67 for private sector purchasers.[3] Rotavirus vaccine may be a worthwhile investment in good health at that price, but it does not reduce medical spending.

Evaluations of the pneumococcal vaccine have shown that it can reduce medical costs in older adults. (Streptococcus pneumoniae causes pneumonia and other infections.) In people 65 or older vaccination reduced medical spending as long as the price per dose was less than $20 (1993 dollars), equivalent to $35 in 2007.[5] Vaccination can also reduce medical spending among high-risk people aged 50-64 (people with heart disease, emphysema, diabetes, and other chronic conditions), and, in some circumstances, in the general population aged 50-64 – especially among blacks, who suffer higher rates of invasive pneumococcal disease.[6] The cost of the vaccine and its administration was lower in the second analysis, $16 per person (1995 dollars), or about $25 in today's dollars. The 2007 cost per dose, which excludes costs of administration, is $15-17 to CDC and $26-29 for private sector purchasers.[3]

Vaccines are among the most cost-effective preventive interventions. Even when they do not save money, they prevent disease and death, and preserve health, at a much lower cost than many other medical interventions, either preventive or therapeutic. They sometimes reduce medical spending as well, but the examples cited indicate that spending reductions depend on a number of circumstances – disease risk in the population, vaccine effectiveness, price per dose – and cannot be assumed to happen as a matter of course.

Preventive Medications

The last 40 years have seen the rise of medications to control 'risk factors' for disease, especially risk factors for cardiovascular disease such as elevated blood pressure and cholesterol. Risk factors are not themselves diseases, but are associated with higher risk of developing disease. After clinical trials showed that medications could reduce blood pressure, and with it, strokes and heart attacks, national guidelines were developed to encourage their use.[7] Then other trials showed that lowering blood cholesterol with medication could prevent heart disease and guidelines for those medications followed.[8] In each case, the prevention process has two parts: people are first screened to discover their blood pressure or cholesterol levels; then, for those whose levels warrant it, medications are prescribed. Screening is conducted every year or every few years. Treatment, once begun, is supposed to continue indefinitely.

Evaluations sometimes examine screening, sometimes treatment, sometimes both. One of the earliest cost-effectiveness studies estimated medical costs and savings, and gains in health, from prescribing medication to lower blood pressure in people whose elevated pressures had already been identified by screening.[9] Even ignoring the costs of screening, the study found that medication added more to medical costs than it saved. The balance between costs and savings varied with the person's initial blood pressure. Among 50-year-old men, for example, costs were higher, and savings less, for men whose uncontrolled pressure was only modestly above the normal range, compared with men whose pressure was substantially elevated.

A later study found that blood pressure medications varied widely in the costs required to provide them and in the offsetting savings, depending on effectiveness and price.[10] Propranolol, one of the class of beta blockers, and hydrochlorothiazide, a diuretic, cost the least to provide even before savings, and saved the most – 46 cents for every dollar spent on propranolol, 30 cents for every dollar on hydrochlorothiazide. The most expensive medications saved 11-15 cents for every dollar spent on them. The authors wrote: "Savings offset a substantial proportion of treatment costs for hydrochlorothiazide and propranolol, but offset only a small proportion of costs for the more expensive agents."

Cholesterol-lowering medications – statins are the most common – yield similar conclusions. In most circumstances, they add substantially to medical costs, rather than reducing them. Typically, the savings in treatment are greater for people at higher risk of heart disease. If the risks are high enough, medication can be cost-saving.

Consider cost-effectiveness results as they are usually presented, in terms of the additional cost – costs minus savings – per year of healthy life gained from the intervention. (Years of healthy life are based on methods that adjust for poor health, summarizing health outcomes as an equivalent number of years of good health.) For low-risk men aged 45-54 – men whose only risks for heart disease are their gender and an LDL cholesterol in the 160-189 mg/dL range – the additional cost of statins in 1997 dollars is $270,000 per healthy year gained, about $400,000 in today's dollars.[11] For 45-54-year-old smokers with high blood pressure and poor HDL cholesterol, the additional cost per healthy year is much less, $57,000 in 1997 dollars, or about $85,000 in 2007. For men with heart disease, statins are even more cost-effective – less than $10,000 per healthy year in 1997, or less than $15,000 in 2007. (This study, correctly counting costs to all parties, included the cost of patients' time as well as medications, tests, and doctors' visits. Patients' time is not relevant to determining whether an intervention reduces medical spending, but it is only a small portion of total costs here – drug costs alone accounted for 90% of the total.)

A daily aspirin to prevent heart disease and stroke can save medical costs for men whose risk is high enough.[12] Aspirin is not without risk – no intervention is – but in 45-year-old men who do not smoke or have high blood pressure, but whose risk of heart disease or stroke is at least 5% over the next 10 years, the medical savings from taking aspirin are greater than its costs. Savings increase as the risk of disease increases. For women, especially women under 55, aspirin appears to reduce the risk of stroke but not heart attack; it is not cost-saving, and, because of its side effects, may not even be beneficial to health.[13]

Screening to Detect Disease Early

Screening, or early detection, is only useful if a condition can be treated more effectively when it is discovered early. For heart disease, screening makes treatment of risk factors possible, and new medications make it effective; evaluations have tended to focus on the medications rather than the screening. For other diseases, perhaps because the treatment for early disease is not so different from treatment for later disease, studies more often begin with screening and focus on evaluating the costs and health outcomes of screening people with different risks, of screening them more or less frequently, or of using different screening tests. Since screening is only successful if it leads to more effective treatment, understanding its medical costs and savings depends on tracing the complete path

of events. If the medical costs of screening and early treatment are less than those of treating when the disease declares itself through symptoms, screening reduces medical spending.

Screening identifies people who can benefit from early treatment. Many people must be screened – sometimes every year, sometimes every few years. Most will not have the disease. Moreover, screening tests are not perfect. Most positive results are false positives: the person does not have the disease and additional tests are required to confirm the facts. Thus substantial costs are incurred in sorting people who have the disease from those who do not. Studies of screening find that, like other preventive measures, it usually adds more to medical costs than it saves. The additional cost may be worthwhile, because it brings better health, but medical spending is not reduced.

How much medical costs increase depends, in part, on patients' risk. Screening targeted to high-risk groups is more cost-effective than general screening. Screening frequency and the cost of followup tests can also have a major impact on costs. Annual screening for cervical cancer, usually a slow-moving disease, adds greatly to medical costs, with little additional health benefit, compared to screening less often.[14] Studies agree that screening for colorectal cancer in adults aged 50 or older adds to medical costs and that the additional cost per healthy year of life gained is within the range of accepted medical practices; there are, however, several different screening tests, many ways to combine them, and no consensus on the most cost-effective ways.[15.16] Mammography to screen for breast cancer,[17-18] MRI screening for women with genetic mutations that put them at high risk for breast cancer,[19] screening for proteinuria to prevent chronic kidney disease,[20] screening for diabetes,[21] screening for HIV,[22] and screening for abdominal aortic aneurysms[23] all add more to medical expenditures than they save. Results from many of these studies are shown in the table at the end of this report.

Lifestyle Changes

Won't lifestyle changes – better diet, more exercise, smoking cessation, weight control – produce both better health and medical savings that exceed medical costs? Lifestyle change is often described as though it were costless and without risk. But it turns out that medical cost savings are hard to find even here. If the medical sector gets involved – identifying people who need to change their habits, advising, providing educational materials and aids such as nicotine replacement – medical costs can outweigh medical savings. Here again, effectiveness is important: these efforts are often only moderately successful and many people continue their poor habits despite them.

The Diabetes Prevention Study showed that lifestyle changes could substantially reduce the risk of developing diabetes.[24] Middle-aged overweight people whose

oral glucose tests put them at high risk of diabetes were randomly assigned to a lifestyle program or a control group. The program provided individually tailored diet and exercise plans, backed up by visits to a nutritionist and physical training sessions. Over the following four years, only 11% of those enrolled in the program developed diabetes, compared with 23% in the control group. Even so, the program added substantially to medical costs ("health plan" costs in the study).[25] Medical costs were $143,000 for each healthy year gained in 2000 dollars, $192,000 in 2007 dollars.

For smoking cessation programs, costs ranged from $2200-2300 per quitter (1995 dollars) for intensive group counseling to $7922 per quitter for minimal counseling by a physician with no nicotine replacement, a relatively ineffective approach.[26] Averaged over the various programs, the cost for each healthy year gained was low, about $5000 even in 2007 dollars. Though even they do not reduce medical spending, smoking cessation programs are a very cost-effective way to improve health.

Notice, however, what is not included in those numbers – the time of the smokers who are trying to quit. Since that time is not a cost to the medical sector, group counseling, which spreads the cost of people who receive paychecks over more patients, looks more cost-effective. When the time of patients was valued, individual counseling, which required fewer sessions, was the most cost-effective option. This is a point to keep in mind when changes in lifestyle are claimed to reduce medical spending. Lifestyle changes involve expenditures outside the medical sector and use people's time. The people who incur the expenditures and spend the time realize that they must take money and time from other uses. They make their choices based on the costs and benefits they see. Savings to the medical sector are more akin to cost shifting than true savings since, to produce them, additional resources must be spent outside the medical sector.

Summing Up

The table at the end of this report presents some of the choices evaluated by the studies cited throughout the text. It offers an overview of a wide range of common preventive practices. The dollar figures have been updated to 2007 with the medical care component of the consumer price index (the June 2007 index was used in place of the 2007 annual average).

As the table makes clear, it is impossible to generalize about preventive interventions as though they were all alike. In particular, the evidence does not support the commonly accepted idea that prevention always, or even usually, reduces medical costs – although it sometimes does. Most preventive interventions add more to medical costs than they save, at the same time that they improve health.

But even that statement needs to be made more specific. Preventive interventions need to be evaluated individually. Some, like smoking cessation programs, may be good investments almost regardless of how they are applied – they bring additional good health at a very reasonable cost. Other interventions are good investments when used selectively – targeted at those people who benefit most from them – but not such good investments when used for more broadly defined groups of people.

The debate over health reform inevitably involves a debate about national resources and how they should be used. The evidence from cost-effectiveness studies suggests that investing in prevention may be a good idea, but it will not remove the need to make choices about priorities. Cost-effectiveness studies can be helpful in setting those priorities. The numbers in the table, and in other good studies,[27] offer a starting point for discussing the priorities that best answer the needs and values of the American public.

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Table 1. Cost per healthy year and healthy years for $1 million

* Indicates study estimated life-years unadjusted for health.

	$/healthy year	Years/$1 million
Varicella (chickenpox) vaccine, pre-school children (2)*	$5,367	186
Blood pressure medication, aged 35-64, no heart disease (10)*		
propranolol (beta blocker)	$29,282	34
hydrochlorothiazide (diuretic)	$44,057	23
nifedipine (calcium channel blocker)	$84,890	12
prazosin hydrochloride (alpha blocker)	$166,288	6
Cholesterol-lowering medications (11)		
low-risk men 45-54	$402,238	2
high-risk men 45-54	$84,917	12
low-risk women 45-54	$923,657	1
high-risk women 45-54	$208,568	5
Aspirin to prevent heart disease (12)		
men 45, 10-year risk 2.5%	$11,528	87
men 45, 10-year risk 5.0% or higher	cost-saving	
Screening for cervical cancer (14)*		
every 3 years vs. no screening	$40,955	24
every 2 years vs. every 3	$1,292,688	0.8
annually vs. every 2 years	$3,277,294	0.3

	$/healthy year	Years/$1 million
Screening for colorectal cancer (15)*		
white men, sigmoidoscopy once at 55	$1,732	577
white men, sigmoidoscopy every 10 years vs. at 55	$21,366	47
Mammography (18)		
All women aged 50-79, every 2 years	$30,619	33
MRI for women with BRCA1(19)		
mammography alone	$20,494	49
mammography plus MRI	$514,660	2
Screening for proteinuria from age 50 (20)		
Normal blood pressure, no diabetes	$346,096	3
High blood pressure and diabetes	$22,787	44
Screening for diabetes (21)		
Aged 55 with high blood pressure vs. no screening	$51,211	20
All adults 55 vs. those with high blood pressure	$537,756	2
Screening once for HIV (22)		
Prevalence 1.0%	$34,713	29
Prevalence 0.1%	$68,412	15

	$/healthy year	Years/$1 million
Screening men 60-74 for abdominal aortic aneurysms (23)	$21,978	46
Diet/exercise to prevent diabetes in high-risk adults (25)	$191,635	5
Smoking cessation, average of 15 programs (26)	$5,221	192