

Research Insights

■ The Economics of Prevention

Summary

Many believe that clinical prevention measures both improve health and save costs, and the Affordable Care Act of 2010 (ACA) requires Medicare and many private insurance plans to provide coverage without cost-sharing for a broad range of preventive health services. In fact, though, it is difficult to generalize about what impacts preventive interventions have on health and costs. Some interventions improve health and save costs, but most improve health and cost money, and a few do not even improve health. According to Peter Neumann, Sc.D., from Tufts Medical Center, one reason that clinical prevention usually costs money is that it is hard to target spending for prevention and money is therefore spent on people who do not get the benefits of spending. A second reason is that to the extent that people live longer because of prevention, they get other diseases during their lifetimes that cost money.

Some cutting-edge work related to the economics of prevention and treatment in health care is discussed in this issue brief: (a) an assessment of the impact of the U.S. Preventive Services Task Force's (USPSTF) 2008 recommendation against using the prostate-specific antigen (PSA) test to screen men age 75+ for prostate cancer (David Howard, Ph.D., Emory University); (b) modeling tradeoffs in the cost-effectiveness of alternative investments in the prevention and

treatment of cardiovascular disease (George Miller, Ph.D., Altarum Institute); and (c) the use of epidemiological modeling to predict the federal budgetary impact of a prevention program to prevent complications in diabetes (Michael O'Grady, Ph.D., National Opinion Research Center at the University of Chicago). According to Colin Baker, Ph.D., the National Institute on Aging (NIA) is interested in funding similar work pertaining to the economics and costs of preventing and treating Alzheimer's disease.

Introduction

Perhaps thinking of the old adage that “an ounce of prevention is worth a pound of cure,” many people believe that clinical prevention measures both improve health and save costs. Sometimes that belief is true, but more often it is not. In 2007, writing on the potential of prevention to bring ever-rising U.S. medical expenditures under control, Louise Russell noted that although prevention is often spoken about as if it were a single entity, in fact there are diverse interventions within the three broad categories of prevention.¹

- **Primary prevention—or measures intended to prevent the onset of a condition.** Examples include polio, influenza, pneumococcal immunizations, smoking cessation aids, daily aspirin to prevent heart attacks in older individuals at high risk, and diet and lifestyle changes to combat childhood obesity.

Genesis of this Brief:

This policy brief is drawn, in part, from a panel discussion on the economics of prevention held Tuesday, June 26, 2012, at AcademyHealth's 2012 Annual Research Meeting in Orlando, Florida. The panel was chaired by Peter J. Neumann, Sc.D., director of the Center for the Evaluation of Value and Risk in Health at the Institute for Clinical Research and Health Policy Studies at Tufts Medical Center and professor of medicine at Tufts University School of Medicine. Panelists were David Howard, Ph.D., associate professor of health policy and management at the School of Public Health at Emory University; George Miller, Ph.D., fellow at the Altarum Institute; and Michael O'Grady, Ph.D., formerly with at the National Opinion Research Centers (NORC) at the University of Chicago and now with the West Health Foundation. Following the presentations by these panelists, Colin Baker, Ph.D., program director of the Division of Behavioral and Social Research at the National Institute on Aging, National Institutes of Health, responded in the role of reactor.

- **Secondary prevention—or measures intended to detect disease in clinically asymptomatic people at an early stage when it is most treatable.** Examples include screening children for autism, screening for lipid disorders, screening for high blood pressure, screening for HIV in adults at high risk, screening for Type 2 diabetes in adults with high blood pressure, screening for depression, and screening men for prostate cancer using the prostate-specific antigen (PSA) test.
- **Tertiary prevention—or measures to slow the progression of a disease after it is clinically obvious and a diagnosis established.** Examples include a variety of medications, diet, and lifestyle changes that keep people with chronic conditions such as diabetes or heart disease healthy longer.

According to Russell, “[I]t is impossible to generalize about preventive interventions as though they were all alike”.² “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.”

In 2008, a review of data from the Tufts Medical Center Cost-Effectiveness Analysis Registry (www.cearegistry.org) yielded similar conclusions.³ “[A]lthough some preventive measures do save money, the vast majority reviewed in the health literature do not. Careful analyses of the costs and benefits of specific interventions, rather than broad generalizations, is critical.” The authors of the 2008 review suggest that research identifying which cost-saving or highly efficient preventive or treatment interventions are underused have the potential to lead to substantial improvements in health at an acceptable cost. The authors also note that the distribution of the cost-effectiveness of preventive interventions in the studies they reviewed is comparable to that of treatment interventions.

The Affordable Care Act of 2010 (ACA)⁴ requires Medicare and many private insurance plans to provide coverage without cost-sharing for a **broad range of preventive health services** that have received A or B recommendations from the U.S. Preventive Services Task Force (USPSTF):

- For children under age 18, preventive health services that many private insurance plans must cover under the ACA include regular pediatrician visits,⁵ autism screening for children at age 18 and 24 months, specified immunizations, vision and hearing screening, developmental assessments, immunizations, screening and counseling to address obesity, alcohol and drug assessments for adolescents, and many more primary and secondary preventive services.⁶
- For adults, preventive health services that Medicare and many private insurance plans must cover under the ACA include obesity screening and diet counseling, cholesterol and blood pressure screening, alcohol misuse screening and counseling, screening for HIV among adults at high risk, depression screening, tobacco-use counseling, colorectal cancer screening for adults over age 50, and many more primary, secondary, and tertiary preventive services.
 - Preventive services specific to women that must be covered include, among others, contraception (excluding abortifacient drugs), breastfeeding counseling and supplies for pregnant and nursing women, HIV and cervical cancer screening for sexually active women, and well-woman visits to obtain recommended preventive services for women under 65.
 - Preventive services specific to men that must be covered include, among others, one-time screening for abdominal aortic aneurysm for men of specified ages who have ever smoked.

Peter Neumann, Sc.D., from Tufts Medical Center, explains that one reason that prevention costs money is that it is hard to target spending for prevention and money is spent on prevention for people who do not get the benefits of such spending.⁷ Moreover, to the extent that people live longer because of prevention, they get other diseases during their lifetimes that cost money. As discussed below, these and other issues have been addressed by recent work related to the economics of prevention and treatment in health care: (a) an assessment of the impact of the USPSTF’s 2008 recommendation against using the PSA test to screen men age 75+ for prostate cancer (David Howard, Ph.D., Emory University); (b) modeling tradeoffs in the cost-effectiveness of alternative investments in the prevention and treatment of cardiovascular disease (George Miller, Ph.D., Altarum Institute; and (c) the use of epidemiological modeling to predict the federal budgetary impact of efforts to prevent complications in diabetes (Michael O’Grady, Ph.D., formerly with National Opinion Research Center at the University of Chicago now with the West Health Foundation). As noted below, Colin Baker, Ph.D., from the National Institute on Aging (NIA), reports that NIA is interested in funding similar work pertaining to the economics and costs of preventing and treating Alzheimer’s disease.

The Impact of the USPSTF’s Guidelines on the Use of the PSA Test to Screen for Prostate Cancer

Prostate cancer is the second most common cancer in men in the United States, following skin cancer. Unfortunately, the **PSA test** used to screen for prostate cancer leaves much to be desired. The test often suggests that prostate cancer is present when in fact it is not. In addition, there is uncertainty about which prostate cancers need to be treated, and for that reason, virtually all men who screen positive on the PSA test are treated. It is believed that about two-thirds of prostate tumors detected via PSA screening are over diagnosed (i.e., in the absence of PSA screening, the tumor would not have become clinically apparent during the patient’s remaining lifetime).

In 2011, the USPSTF reviewed the evidence on the benefits of using the PSA test to screen for prostate cancer and concluded that many men are harmed as a result of prostate cancer screening. For that reason, in May 2012, the USPSTF issued a [formal recommendation](#) encouraging doctors not to routinely administer the PSA test to screen for prostate cancer. A June 2012 editorial by Peter Bach, M.D., in the *New York Times* suggested that the USPSTF’s recommendation advising doctors to “do less” prostate cancer screening was unlikely to have much effect on clinical practice.⁸

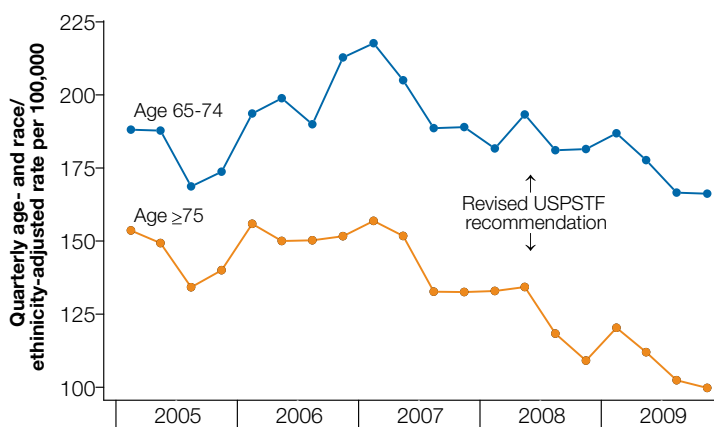
David Howard, Ph.D., and his colleagues decided to investigate whether a prior USPSTF recommendation regarding PSA screening had affected clinical practice.⁹ In 2008, the USPSTF recommended against screening men age 75+ for prostate cancer after concluding that the harms of screening for prostate cancer in these older men outweigh the benefits.

Using data from the Medicare Current Beneficiary Survey and linked claims, Howard and his colleagues estimated that the USPSTF’s 2008 recommendation caused PSA testing rates to decline by 6.5 percentage points among men age 75+ between 2006 and 2010; PSA testing rates among men ages 65 to 74 were unchanged during the same period.¹⁰ In addition, Howard estimated changes in the incidence rate of early-stage prostate tumors, as shown in Figure 1, most of which are detected via screening. Between 2007 and 2009, the incidence of early-stage prostate tumors among men age 75+ declined by 25 percent, while the incidence rates among men ages 65 to 74 dropped by only 15 percent.¹¹

The results from this work highlight the potential of USPSTF guidelines with “negative” recommendations—that is, recommendations NOT to use preventive interventions—to reduce the use of harmful, unnecessary, or low-value medical care. The study suggests that USPSTF’s negative recommendations can encourage health care providers to cut back on the use of preventive services that do not improve health, thereby also saving money.

The response of patients and physicians to the 2008 USPSTF prostate cancer screening recommendation stands in contrast to the response to the USPSTF 2009 breast cancer recommendation, not to perform routine mammography in women younger than age 50 or women age 75+. Mammography rates did not decline in these age groups after the release of the recommendation.¹² The USPSTF’s 2009 breast cancer screening recommendation has been quite controversial, and the ACA requires Medicare and private insurers to cover mammography based on the earlier USPSTF recommendation.

Figure 1: Trends in the Incidence of Early-Stage Prostate Tumors by Age Group, 2005 to 2009



Source: Analysis of SEER 18 registry data, Joy Howard et al. Rates are standardized by 5 Year age groups and race/ethnicity to the 2009 population.

Modeling Tradeoffs in Expenditures for the Prevention and Treatment of Cardiovascular Disease

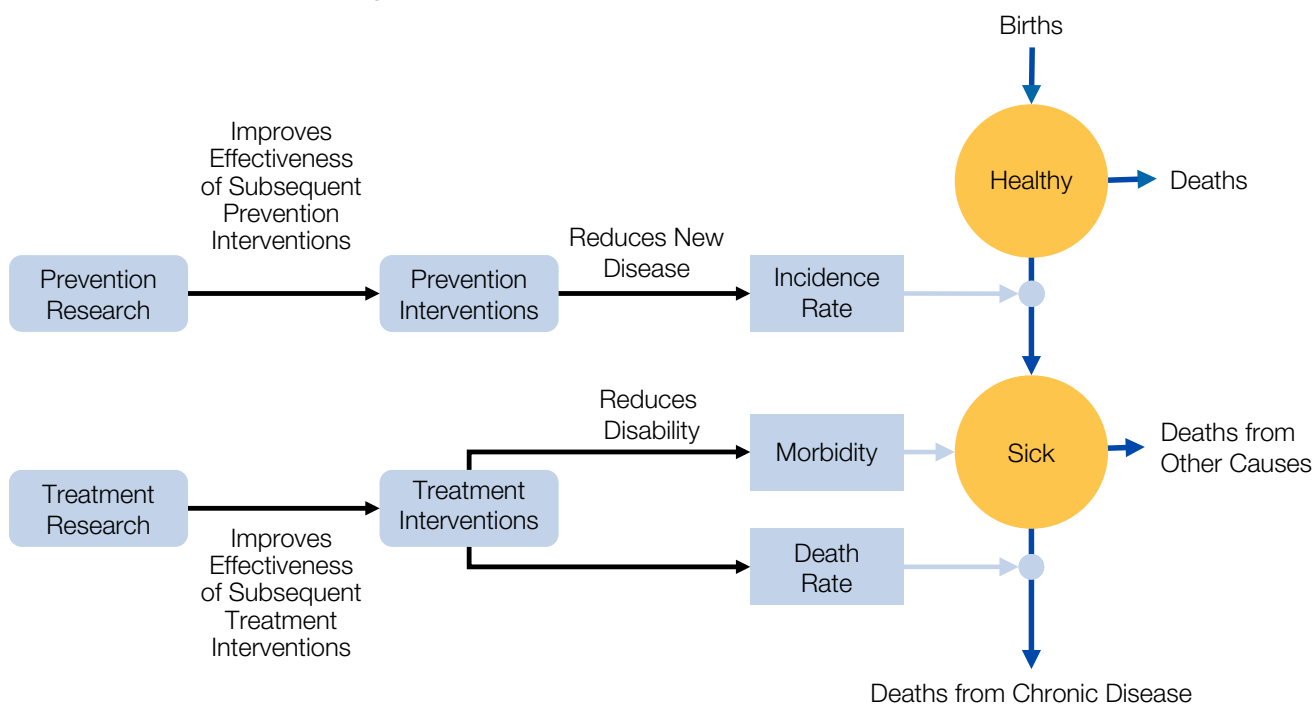
George Miller, Ph.D., at the Altarum Institute has found that—contrary to the conventional wisdom that only 3 percent of U.S. national health expenditures goes to prevention and that this is too little—national health expenditures on prevention in the United States exceed 8 percent.¹³ Furthermore, Miller’s work, like that of Cohen et al., suggests that the distribution of the cost-effectiveness of preventive measures is similar to that of treatment.

Such findings call into question the conventional wisdom about U.S. national expenditures on prevention. They also raise the question of whether there is anything that can be said generically about the optimum mix of spending between prevention and treatment. Several complications are encountered in addressing that question, including complex interactions in the effects of prevention and treatment and research, as well as methodological issues in cost-effectiveness analysis.

To estimate the cost-effectiveness of alternative spending streams for disease prevention and treatment, and for research into new treatment and prevention interventions. Miller and colleagues built a very simple, Markov model.¹⁴ As shown in Figure 2, the model relates a changing set of health states in a population over time as a function of four spending streams—spending on prevention research, prevention, treatment research, and treatment.

As part of the model, Miller developed equations to relate transition rates from one disease state to another to appropriately lagged spending on treatment, prevention, and research. The assumptions in the model were that interventions to prevent new disease reduce the rate at which people get sick after a 10-year lag; treatment interventions prevent morbidity and mortality; and research affects the

Figure 2: An Approach to Modeling Prevention-Treatment Tradeoffs



Source: Miller et al.

rate at which the interventions change the incidence of disease or death rates or morbidity rates after a 23-year lag for the research to come to fruition and to be put into practice.

Beginning with a cohort of 45-year-olds born in a healthy state, some of whom develop disease and die from cardiovascular disease or other conditions, Miller’s team applied the model to develop insights into the optimum mix of spending for prevention and treatment of cardiovascular disease, how prevention and treatment interact, and the role of research in the prevention-treatment tradeoff. The cost-effectiveness of alternative spending streams was computed in the model in a standard way, with population health represented in terms of quality-adjusted life years (QALYs) gained as a result of investments in prevention, treatment, and research on prevention or treatment.

The application of this Markov model led Miller’s team to make several observations about tradeoffs between and the optimal mix of spending on the prevention and treatment of cardiovascular disease:

- The cost-effectiveness of either the prevention or the treatment of cardiovascular disease varies with spending on the other one.
- The **optimal mix between prevention and treatment for cardiovascular disease** seems to be such that the United States might like to move some spending from treatment to prevention, although the cost-effectiveness and optimal mix depend on assumptions made about discount rates, time lags, and the analysis

time horizon. Discounting costs and effects at same rate (3 percent) unfairly penalizes prevention. With interest rates dropping, Miller suggested, perhaps a 2 percent discount rate should be used for prevention.

- A research breakthrough in either prevention or treatment for cardiovascular disease causes the overall effectiveness to increase, while the marginal cost-effectiveness of the area in which we do the research spending improves, and the marginal cost-effectiveness of the other area declines.

Modeling the Federal Budgetary Impacts of a Tertiary Prevention Program to Prevent Complications of Diabetes

According to Michael O’Grady, Ph.D., the Congressional Budget Office (CBO) normally uses a 10-year window in its federal budget projections, in part to avoid uncertainties related to technological change (e.g., the introduction of statins or beta blockers) that will make the budget projections completely wrong.¹³ One limitation of using a 10-year window is that this approach misses the often substantial effects of tertiary prevention initiatives in reducing federal expenditures that occur after 10 years. When modeling costs—for example, in the ACA of 2010 or the Medicare drug benefit—CBO usually does not take into account the effects on costs of the natural history of disease or other factors that health researchers use to model the epidemiological progression of disease and the effect of interventions to prevent or treat health conditions are generally not taken into account.

Figure 3: Using Clinical Information to Project Federal Health Care Spending on an Intervention to Delay or Avoid Complications of Diabetes

Entry Age Cohort	Number of patients entering treatment program each year	Baseline spending (no improvement intervention)	Improvement intervention spending	New spending plus cost of intervention	Net new spending
25-year effects (2009-2033)					
24-30 year old	60,000	\$167 billion	\$21 billion	\$161 billion	-\$6 billion
31-40 year old	60,000	\$145 billion	\$20 billion	\$145 billion	\$0 billion
41-50 year old	60,000	\$134 billion	\$19 billion	\$136 billion	\$2 billion
51-60 year old	80,000	\$153 billion	\$21 billion	\$159 billion	\$6 billion
61-64 year old	100,000	\$160 billion	\$21 billion	\$165 billion	\$5 billion
10-year effects (2009-2018)					
24-30 year old	60,000	\$21.0 billion	\$3.7 billion	\$22.1 billion	\$1.2 billion
31-40 year old	60,000	\$20.2 billion	\$3.7 billion	\$22.0 billion	\$1.9 billion
41-50 year old	60,000	\$20.7 billion	\$3.6 billion	\$22.1 billion	\$1.5 billion
51-60 year old	80,000	\$28.0 billion	\$4.5 billion	\$29.4 billion	\$1.4 billion
61-64 year old	100,000	\$34.9 billion	\$5.1 billion	\$36.5 billion	\$1.6 billion

Dollar amounts in 2007

Source: Michael O’Grady, NORC.

O’Grady and his colleagues set out to develop a model that would be useful to Congress in making budget decisions regarding future spending on tertiary prevention to delay or avoid the complications of diabetes. They used diabetes as a prototypical chronic condition for demonstrating what epidemiological modeling can do for cost estimating for two reasons. First, diabetes is a big and important problem. Second, because diabetes has been assessed in the United States and the United Kingdom and modeled extensively for two decades, the scientific base to work with in diabetes is well developed.

O’Grady and his research team began by developing two Markov models to predict the impact on federal expenditures of a program to prevent the major complications of diabetes. **One model** incorporated obesity data from the National Health and Nutritional Examination Survey to estimate the prevalence and incidence of diabetes (including undiagnosed diabetes). **The second model** estimated the prevalence and incidence of major complications — retinopathy, nephropathy, neuropathy, coronary heart disease, and stroke—among people with diabetes in the United States.

The researchers assumed roughly \$20 billion over 10 years in spending for a prototypical diabetes disease management program (i.e., emphasizing glucose control, blood pressure control, cholesterol control)—an amount that seemed politically realistic in Congress. By reverse engineering and running the intervention out 10 years and then 25 years, O’Grady and his colleagues found that \$20 billion would make it possible to offer a prototypical diabetes disease management program for about 60,000 patients entering treatment each year in each of three age cohorts (24- to 30-year-olds, 31- to 40-year-olds, 41- to 50-year-olds); for 80,000 patients entering treatment each year in the cohort of 51- to 60-year-olds, and 80,000 patients entering treatment each year in the cohort of 61- to 64-year-olds.

The O’Grady team’s model provided 10-year and 25-year U.S. federal budget projections for the diabetes improvement intervention spending to prevent the complications of diabetes among cohorts of patients of various ages and with various patient characteristics entering treatment each year. The projections are shown in Figure 3.

- Over 10 years, the model shows that federal outlays on the diabetes improvement intervention itself range from \$3.7 billion for the youngest cohort of patients (24- to 30-year-olds) to \$5.1 billion for the oldest cohort—a total of \$20.6 billion. When reductions in spending due to the prevention of complications associated with diabetes are taken into account, the intervention to prevent diabetes complications results in a net cost ranging from \$1.2 billion for the youngest cohort to \$1.6 billion for the oldest cohort—a total of \$7.6 billion dollars. From the standpoint of generating support for expenditures in Congress, it is much easier to get members of Congress to agree to spend \$7.6 billion for a preventive intervention than to an expenditure of \$20.6 billion.
- Over 25 years, the model shows that net federal spending following the implementation of the improvement intervention for the youngest cohort of diabetes patients was reduced by \$6 billion. Reducing complications from diabetes reduced underlying spending on diabetes in this cohort by about 18 percent, allowing the savings to cover the cost of the intervention and more. For diabetes patients 31 to 40 years old, expenditures and savings cancel each other out, and there are much better clinical outcomes, making this a good investment. For older patients with diabetes, the net cost of the intervention is higher, but the patients have better clinical outcomes.

Research the Economic Implications of Potential Prevention and Treatment of Alzheimer's Disease

Alzheimer's disease is a devastating condition that wreaks havoc on the health and finances of individuals and their families. People affected by Alzheimer's and other dementias eventually need not just health care, but a variety of long-term care services that are not covered by Medicare.

On May 15, 2012, in response to the National Alzheimer's Project Act, the Obama Administration delivered the first-ever [national strategy to address the growing problem of Alzheimer's disease](#).¹⁶ The National Institute on Aging (NIA), according to the director of NIA's Division of Behavioral and Social Research Colin Baker, Ph.D., is very interested in Alzheimer's disease and is considering new funding on economics and costs of Alzheimer's disease.¹⁷

One problem according to Baker is that there is no consensus on the prevalence of Alzheimer's disease. The Alzheimer's Association estimates that 5.4 million U.S. adults age 65 and older (13 percent) have Alzheimer's disease and another 200,000 people below age 65 have younger-onset Alzheimer's.¹⁸ This estimate comes from the Chicago Health and Aging Project. Other entities have come up with different estimates of the prevalence of Alzheimer's disease. Thus, for example, the Aging, Demographics, and Memory Study estimated that there were 2.3 million people with Alzheimer's in 2002, and the Chicago Health and Aging Project estimated about 4.5 million people with Alzheimer's in 2000.¹⁹

Changing the Trajectory of Alzheimer's Disease: A National Imperative, a May 2010 Alzheimer's Association report that presents information about the impact of Alzheimer's disease based on data from a model developed by The Lewin Group, suggests that delaying symptoms for five years would produce enormous potential savings.²⁰ According to Baker, however, even if there were a means of primary prevention such as a vaccine or medication along the lines of a statin for heart disease, the unit costs of treating many people to avert Alzheimer's could make the intervention enormously cost increasing.

Baker believes that modeling work on the economics of prevention and treatment of Alzheimer's disease along the lines of Miller's work on tradeoffs between prevention and treatment in cardiovascular disease, O'Grady's work in modeling the federal budgetary impacts of tertiary prevention in diabetes, and the CBO's 2012 study on the health and budgetary effects raising the federal excise tax on cigarettes to discourage smoking would be very useful in Alzheimer's disease.

About the Author

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