Health-Care Cost Projections for
Diabetes and other Chronic Diseases:
The Current Context and Potential Enhancements

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I. Introduction

Policymakers are increasingly focused on the rising burden of chronic diseases in the United States, and rightfully so. Chronic diseases such as heart disease, diabetes, and Alzheimer's account for 75 percent of health care spending nationwide.[1] The onset of debilitating conditions, however, is not always an inevitability. According to the World Health Organization (WHO), 80 percent of heart disease and type 2 diabetes cases could be prevented through a combination of healthier diets, improved physical fitness, and no tobacco use. Similarly, WHO estimates that some 40 percent of cancer cases could also be prevented with healthier living.[2]

As awareness of the significant impact of chronic diseases on health and health care costs has grown, policymaker interest in exploring the role public policy might play in reducing the toll also has increased. Certainly, there is great public interest to find ways to ease the disease burden – and possibly the cost burden as well.

Indeed, when the issue of chronic disease prevention and treatment is raised in public policy discussions, inevitably the conversation turns rather quickly to costs – for patients and federal taxpayers alike. Some expect, not unreasonably, that an investment today might lead to reduce cost pressures tomorrow.

In that regard, policymaking in Congress relies heavily on independent, non-partisan estimates of the impact of proposed legislative changes. The ultimate feasibility and, accordingly, political viability of legislative proposals often rests on the determination of the budgetary impact these estimates project. The non-partisan Congressional Budget Office (CBO) produces the estimates of potential policy changes on the federal budget, as well as on the states, for Members of Congress.

Understandably, professional cost estimators are cautious regarding calls to alter the federal cost-estimating practices and budget processes, particularly given that the information is used for making often politically-charged decisions. However, it is important to examine possible opportunities to simultaneously increase the scientific rigor of cost estimates while enhancing the information provided to policymakers about their policy choices. Our improved understanding of epidemiology and the natural history of certain chronic diseases provides just such an opportunity.

This paper is an attempt to explain the context within which current cost-estimating for health policy proposals occurs. The paper also explores some possible enhancements that could, if done well and in the right context, provide policymakers with better information about certain of their health policy options. The document is intended as a resource for guiding a discussion on these issues among all interested parties.

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[1] Chronic diseases like heart disease, diabetes, and Alzheimer's account for 75% of health care spending. (CDC, Chronic Disease Overview - available at http://www.cdc.gov/NCCdphp/overview.htm).
[2] WHO, "10 Facts about Chronic Disease," available at http://www.who.int/features/factfiles/chp/10_en.html, accessed April 6, 2009.

To place this discussion in context, we examine not only the relationship between chronic disease on current and projected health care costs, but also the challenges associated with evaluating interventions to improve health status and measuring impact. Then, we describe and assess the current budget process and its relationship to the major health care programs, particularly Medicare. Finally, we explore opportunities to enhance modeling that might more fully capture the costs and savings associated with interventions to improve health. Specifically, we discuss enhancements:

- To incorporate data on current health status, health trends, and the epidemiology of certain chronic diseases into the assumptions upon which cost projections are based; and
- To capture both the full benefit and cost of programs that improve health status by looking beyond the normal 10-year scoring window.

II. Chronic Disease and Health Care Costs

The health policy community increasingly is aware that the cost associated with caring for those with chronic diseases is rising rapidly.

In fact, a large proportion of the American population is already living with chronic conditions. As shown in **Figure 1**, almost half of all Americans have some form of chronic illness and a greater number are projected to develop chronic conditions over the next few decades. Moreover, many Americans have more than one of these common ailments. By 2025, more than one in four people in America are expected to have two or more chronic illnesses.[3]

Figure 1 Percentage of the Population With Chronic Diseases, 1995-2030
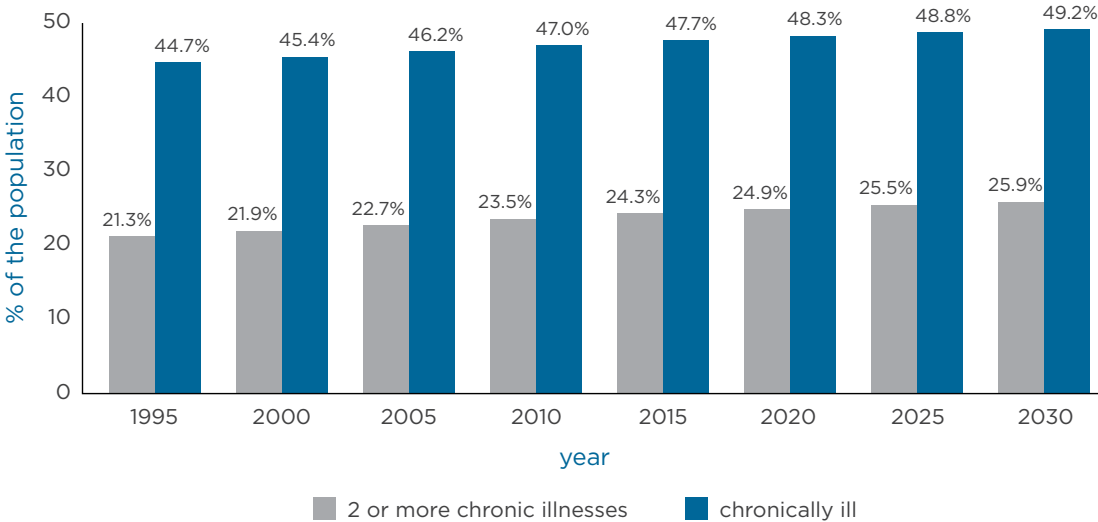

Source: Projections of Chronic Illness Prevalence and Cost Inflation. Wu, Shin-Yi and Anthony Green, RAND, October 2000.

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[3] Projections of Chronic Illness Prevalence and Cost Inflation, Wu, Shin-Yi and Anthony Green, RAND, October 2000.

For the Medicare population, the problem is already at hand. **Figure 2** shows how Medicare spending is dominated by spending on the chronically ill, especially those Medicare beneficiaries with five or more chronic illnesses. The chronically ill not only account for a very large percentage of Medicare spending, but also that percentage has grown over time. Some of this growth may be the result of better screening or other factors, but the stark reality is that any effort to improve the Medicare program and slow the growth in Medicare spending will be unsuccessful if it fails to deal with the dominance of chronic illness.

Figure 2 Percentage of Medicare Dollars Spent on Chronic Illness, 1987, 1997 and 2002
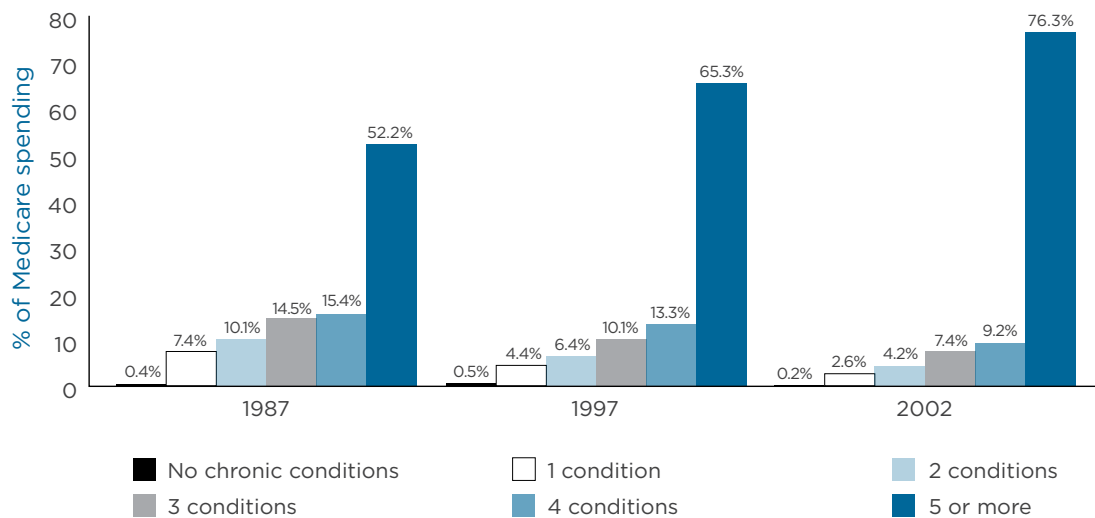
Source: K. Thorpe and D. Howard, "The Rise In Spending Among Medicare Beneficiaries: The Rise Of Chronic Disease Prevalence and Changes in Treatment Intensity, "*Health Affairs* (web exclusive August 22, 2006): p.378.

Recognizing these challenges, CBO has produced important analytical studies on the emerging issue of chronic disease costs.[4] In its 2005 study analyzing high-cost Medicare beneficiaries, CBO found that 5 percent of Medicare beneficiaries with the highest cost health care account for 43 percent of Medicare spending.[5] For these Medicare beneficiaries, health care spending averaged $63,000 a year. The bottom 50 percent of beneficiaries accounted for only 4 percent of spending, with an average cost of $550 per year. These findings are remarkably consistent with spending for the overall US population over the last 40 years. In 1970, the top 5 percent of the US population accounted for 50 percent of total spending.[6] The concentration of spending among a small proportion of beneficiaries has naturally generated interest in finding ways to target policy changes on these significant centers of spending activity.

[4] In addition to cost estimates, CBO generates other analyses that provide additional findings and explore new issues. Through this work,
CBO sometimes shows its early thinking on a subject, prior to the production of any actual cost estimates for Congress.
[5] High-Cost Medicare Beneficiaries, Congressional Budget Office, May 2005. CBO relied on longitudinal claims data from the Centers for Medicare and Medicaid Services (CMS) for its analysis.
[6] M.L. Berk and A.C. Monheit, "The Concentration of Health Expenditures: Revisited," Health Affairs (Mar/Apr 2001): 9-18.

The CBO analysis also found that three-quarters of high-cost beneficiaries have a major chronic condition (asthma, chronic obstructive pulmonary disease, chronic renal failure, congestive heart failure, coronary artery disease, diabetes, or senility). Although high-cost beneficiaries are more likely to have a chronic disease or condition, not all beneficiaries with a chronic condition are high cost. For instance, a number of chronic conditions were found to be highly prevalent among high-cost beneficiaries, and considerably less prevalent among low-cost beneficiaries. However, because the number of low-cost beneficiaries is three times as large as the number of high-cost beneficiaries, large numbers of low-cost beneficiaries have less severe symptoms from several chronic conditions. So, while diabetes is nearly twice as prevalent among high-cost beneficiaries as it is among low-cost ones, the actual number of low-cost beneficiaries with diabetes greatly exceeds the number of high-cost beneficiaries with that condition. This finding will have implications for how CBO assesses the targeting of interventions to improve prevention, treatment and control of these high-cost chronic conditions.

Chronic diseases develop over time – often long periods of time. Without intervention, the health status of the person affected typically progresses from a period of escalating risks of developing a disease to early, often symptom-free stages of illness. Continued progression leads to the recognition of symptoms and/or a clinical diagnosis followed by disease progression and the development of complications. Ultimately, death from the disease itself or associated complications may result. Across this continuum of disease development and progression, there may be opportunities to reduce risks, delay or avoid disease onset, and slow or prevent disease progression and the development of complications.

"Prevention" is a blanket term often used to capture the opportunities to intervene, but important distinctions exist depending on the stage of disease progression at which the preventive intervention is aimed. Primary prevention is the preemptive behavior that seeks to avert disease before it develops – for example, encouraging smoking cessation or physical fitness. Secondary prevention is the early detection of disease before symptoms appear, with the aim of preventing or curing it.[7] Examples include mammography and cholesterol screening for people at risk. Tertiary prevention is an attempt to stop or limit the progression of disease that is already present.[8] Examples include foot exams and managing blood glucose levels for people with diabetes and controlling blood pressure for people with hypertension.

Importantly, there could be very different levels of empirical evidence on the effectiveness of such interventions. For instance, although tertiary preventive interventions may come later in the progression of a disease, the direct relationship between such interventions and avoidance of costly complications might be clearer than with a more population-based primary prevention program.

The complete costs or savings of preventive efforts of all types also depend on the interaction between the time it takes for the risk of disease to manifest and progress and the timing of the intervention. This interaction between the "natural history" of the disease and the timing of the intervention is particularly salient as there is often a significant time lag between the act of prevention and the realization of a possible health benefit.

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[7] Encyclopedia Britannica. 2009. Encyclopedia Britannica Online. 23 Apr. 2009 <http://www.britannica.com/EBchecked/topic/531785/secondary-prevention>.
[8] Encyclopedia Britannica. 2009. Encyclopedia Britannica Online. 23 Apr. 2009 <http://www.britannica.com/EBchecked/topic/588492/tertiary-prevention>.

III. The Context for Federal Cost Estimating for Chronic Diseases

The Process of Developing Cost Estimates

Nonpartisan cost-estimating is essential to the legislative process. As official scorekeeper to the Congress, CBO's cost estimates frequently can be the difference between speedy passage of a low-cost idea and the shelving of a proposal found to be too expensive to be affordable within current budget realities. Policymakers need to know who will be affected by any change and whether the change will cost money, save money or be budget-neutral.

CBO is one of the federal government's most respected analytical institutions, and for good reason. The agency employs a highly professional staff with substantial expertise in health care policy. Its recent health care publications have included many useful insights into the strengths and weaknesses of the current health care system, which have helped inform policymakers of the challenges ahead. CBO's efforts to provide long-term projections of health care costs have been particularly useful – and eye-opening. CBO is providing a steady stream of reports to help policymakers understand the challenge presented by rising health care costs.

Both the House and the Senate have standing rules requiring bills reported to the respective chambers to be analyzed for cost implications by CBO.[9] Congress requires cost estimates for taxes or mandatory spending bills project costs over a ten-year period.[10] Changes in health policy are projected for the same time period as a wide range of very different policies, including farm program amendments, tax policy changes, and changes in unemployment benefits.

To address the complex challenges in determining the effect of health policy changes, the CBO has developed rigorous methods to develop their estimates. They incorporate assumptions based upon predicted timeframes for implementation, the extent of adoption within the patient and provider community, and the effect of those policy changes on federal programs over the 10-year budgetary window.

In providing the estimated budgetary impact of a proposed new law, CBO first has to estimate the impact of current law. This estimated level for the budget provides a "baseline" or benchmark against which CBO measures the incremental effects of a new policy. The "score" is the difference between the amount of spending projected in the baseline and the amount that would occur if the scored legislation were enacted.

Cost estimating can be either immensely complex or extremely simple. The cost estimate for increasing the Medicare payment rate for diabetes test strip from $5.00 to $5.25 is a relatively straightforward exercise. Estimating how health plans, pharmaceutical manufacturers, physicians and patients would all respond to a unique new set of incentives in the Medicare Part D drug benefit was immensely complex.

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[9] *CBO's Role in the Budget Process.* CBO 2009, http://www.cbo.gov/aboutcbo/budgetprocess.shtml.
[10] 2 U.S.C. § 602 (Congressional Budget and Impoundment Control Act of 1974), sets the budgetary window at 5 years. 2 U.S.C. § 658 limits the window for which CBO can produce budgetary estimates of the effect of new appropriations at 10 years. U.S. Code: http://uscode.house.gov/search/criteria.shtml.

The professional judgment of the CBO staff drives the choice of an analytical approach, assumptions used, and any other key aspects of the cost estimates. In general, the staff attempts to assign costs based both on the expected direct implication of a change in policy and on the possible changes in behavior associated with each proposal.

With respect to health care costs projections, current CBO cost estimating practices represent state-of-the-art of modeling and data analysis, particularly given the history of how Medicare and Medicaid have evolved. Consequently, CBO's cost estimating has been built primarily around assessment of the implications of various changes in provider payment structures in the Medicare and Medicaid programs.

For Medicare and Medicare baseline expenditures, the CBO relies upon different economic and demographic variables to estimate the number of people receiving services, the cost of those services, and both increases in the costs of medical care and the number of people receiving benefits.

Modeling to Predict Effects of Large Scale Implementation

CBO is also tasked with projecting the large-scale implementation of policy changes that may have been tried in clinical trials, pilot programs, demonstration projects or otherwise implemented on a different scale than the policy change would involve. Extrapolating results is needed for two basic reasons. First, clinical trials and other studies are rarely conducted over long enough periods of time to see major changes in patients' health. With notable exceptions (e.g. United Kingdom Prospective Diabetes Study), researchers are unable to undertake and sustain long-term clinical trials because of the needs of research careers and the instability of research funding. A second and highly related issue is that clinical trials have typically focused on intermediate outcomes such as change in glucose or blood pressure levels, but not on long-term outcomes such as the development of a chronic disease or complications. As a result, the findings of trials that alter intermediate outcomes need to be extrapolated to understand their long-term implications.

To determine the effect of policy changes and using data from smaller programs to project larger scale policy changes, CBO has developed sophisticated modeling strategies.

A Closer Look at Existing Epidemiological Models and Their Possible Contribution to Cost Estimating: Diabetes Studies/Models

As a costly, long-term disease common among Medicare beneficiaries, diabetes is perhaps the best candidate to demonstrate the potential contribution epidemiological modeling can make to cost estimating in particular and policymaking in general. Over the past decade, diabetes prevention and care have been evaluated routinely using cost-effectiveness analysis techniques to assess their economic value. Because of the long-term nature of the development of diabetes and its complications, it has been necessary in these analyses to utilize disease simulation models that combine epidemiological data and clinical trial data. Disease simulation models allow analysts to more easily extrapolate clinical trial findings over the lifetime of patients.

A consistent history of findings is available from the major models of diabetes complications. The first major model of diabetes complications was a type 1 diabetes model developed by the Diabetes Control and Complications Trial Research Group. The model used DCCT trial data to project the lifetime benefits and costs of intensive glucose control in type 1 diabetes. The analysts found that intensive control was highly cost-effective in this population.[11]

This model then was adapted for use by a team led by the head of NIDDK to evaluate the value of different therapies in type 2 diabetes.[12,13] It helped to illustrate the long-term cost-effectiveness of intensive glucose control applying DCCT data to the lives of patients with type 2 diabetes. These results were confirmed later with the arrival of United Kingdom Prospective Diabetes Study (UKPDS) data, which illustrated the benefits of intensive glucose control in type 2 diabetes. The model also was used to evaluate the value of screening for diabetes, a diabetes prevention strategy.

The CDC/RTI model of diabetes complications later was developed using the NIH model structure in combination with published UKPDS results.[14] This model was designed to simultaneously evaluate the economic value of intensive glucose control, intensive blood pressure control, and intensive cholesterol control if the entire population of diabetes patients actually adopted these therapies. The analysis showed that intensive glucose control and cholesterol control were cost-effective, while intensive blood pressure control was actually a cost-saving therapy. The model also was used to evaluate the economic value of diabetes prevention in individuals with pre-diabetes (impaired fasting glucose or impaired glucose tolerance) and found that a lifestyle intervention for preventing diabetes was highly cost-effective.[15]

More recently the UKPDS group has developed a comprehensive model of diabetes complications that is based entirely on the UKPDS data.[16] At its core, the model predicts the risk of developing specific diabetes-related complications, diabetes-related mortality, and overall life expectancy of people living with type 2 diabetes based on risk factors such as glucose and blood pressure. The model can be used to project the long-term health benefits of altering these risk factors. This model has been used to calculate the incremental net annual cost of implementing intensive control of blood glucose and blood pressure to all people with diagnosed type 2 diabetes in England (€100.5 million). The UKPDS group has made its model publicly available for use by researchers and policy analysts.

Other models of diabetes complications have been developed by other academic and industry groups.[17] One of the most notable models is the Archimedes model developed by David Eddy.[18] The model differs from the other complication models in that it sets out to account for basic cellular and organ functioning in the body as it predicts the risks of complications. Most complication

[11] The Diabetes Control and Complications Trial Research Group. Lifetime benefits and costs of intensive therapy as practiced in the Diabetes Control and Complications Trial. JAMA 1996;276:1409-15.
[12] Eastman RC, Javitt JC, Herman WH, et al. Model of complications of NIDDM: II. Analysis of the health benefits and cost-effectiveness of treating NIDDM with the goal of normal glycemia. Diabetes Care 1997;20(5):735-44.
[13] Eastman RC, Javitt JC, Herman WH, et al. Model of complications of NIDDM: I. Model construction and assumptions. Diabetes Care 1997;20(5):725-34.
[14] The CDC Diabetes Cost-effectiveness Group. Cost-effectiveness of intensive glycemic control, intensified hypertension control, and serum cholesterol level reduction, for type 2 diabetes. JAMA 2002;287(19):2542-51.
[15] Herman WH, Hoerger TJ, Brandle M, et al. The cost-effectiveness of lifestyle modification or metformin in preventing type 2 diabetes in adults with impaired glucose tolerance. Ann Intern Med 2005;142:323-32.
[16] Gray A, Clarke P, Farmer A, et al. Implementing intensive control of blood glucose concentration and blood pressure in type 2 diabetes in England: cost analysis (UKPDS 63). BMJ 2002;325:860-5.
[17] Palmer AJ, Roze S, Valentine WJ, et al. The CORE diabetes model: projecting long-term clinical outcomes, costs and cost-effectiveness of interventions in diabetes mellitus (type 1 and 2) to support clinical and reimbursement decision-making. Curr Med Res Opin 2004;20(Suppl.1):S5-S26.
[18] Eddy DM, Schlessinger L. Validation of the Archimedes Diabetes Model. Diabetes Care 2003;26(11):3102-10.

models account for the risks of complications by using directly observed epidemiological or clinical trial data.

In some contexts, such as early estimates of potential spending from a prescription drug benefit, different models have yielded very different results. But that is generally not the case with models aimed at predicting the complications which will follow from poorly managed diabetes. The outputs of these models closely track each other, despite differences in model assumptions and inputs. For instance, a recent conference convened to compare the performance of various diabetes models found that their predictions for cardiovascular complications were very similar.[19]

Potential Implications of Diabetes Simulation Models

In other nations diabetes simulation models already are being used by policymakers to guide public health decisions and public health spending. For example, the UKPDS model already is being used for health care planning in the United Kingdom at the national and regional level. In addition, the provincial government of Ontario in Canada and the Mexican government have commissioned analyses that have used the UKPDS model.

In the U.S. context, the simulation models might be used to supplement current estimates with more health-status data based on number of prevalent cases of diabetes over time. In terms of assessing specific health care proposals, these models might play a role in projecting the overall cost-implications of tertiary prevention programs as well as chronic care management programs given the long-term impact of such programs.

CBO's Long-Term Health Projections

Though the Congress requires cost estimates for taxes or mandatory spending bills to project costs over a ten-year period, CBO has built the capacity to make long-term budgetary projections. While not used for official scoring of proposals, these projections have typically been used in testimony, speeches and a series of reports in recent years, including *The Long-Term Outlook for Health Care Spending*, published in November 2007, and *The Long-Term Budget Outlook*, published in December 2007. These long-term cost projections have been cited extensively to better inform Congress about the expected dramatic growth in Social Security, Medicare, and Medicaid programs.

CBO has spent the better part of a decade building a sophisticated microsimulation capacity for Social Security projections and proposal estimation. The model is aimed specifically at assessing the dynamic behavioral effects associated with altered financial incentives in the program over the long-run – namely seventy-five years. CBO's Social Security model "generates realistic demographic and economic outcomes for a representative sample of the population and then applies tax and benefit rules to that sample in order to draw inferences about the effects of various policy alternatives."[20]

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[19] The Mount Hood 4 Modeling Group, "Computer Modeling of Diabetes and Its Complications," Diabetes Care 30 no. 6 (2007): 1638-1646.
[20] Projecting Labor Force Participation and Earnings in CBO's Long-Term Microsimulation Model, Congressional Budget Office, October 2006.

CBO describes their model as – "A microsimulation model starts with individual data from a representative sample of the population and projects demographic and economic outcomes for that sample through time. In CBOLT [Congressional Budget Office Long-Term projection], the basic demographic processes include fertility, educational attainment, marital transitions, marital partner assignments, and eventual death,"[21]

CBO estimates earnings, for instance, by calculating the predicted labor force participation, hours worked, unemployment status, and wages based on the age, educational level, marital status, birth cohort, number of children in school, and disability status. Incorporated into the equations are permanent and transitory shocks that affect the wages an individual would expect.

To provide a form of confidence interval around its projections, CBO uses a *Monte Carlo* estimating technique.[22] First, CBO develops functions that relate the input variables (such as age, educational achievement, etc.) to the output (unemployment, for instance). Then, CBO determines a probability for each outcome based on each set of inputs. The final step is assigning random numbers to each input set, which are used to assign outcomes by probability. Repeating this procedure allows CBO to produce probability distributions of various outcomes for each set of inputs.[23]

Although the main focus of the model is Social Security, in a conversation with the authors, CBO analysts explained that it has begun to add health inputs and outputs to its model, but it knows it will take some time before a workable approach to modeling long-term health outcome trends is ready for use.

In this longer term modeling, if CBO assumed current health spending growth rates, 100 percent of the American economy would be consumed on health care. At the same time, they do not want to make too strong an assumption that Congress will act to slow growth and thus leave Congress the impression that the spending trend will slow on its own, so no Congressional actions is required. They attempt to strike a balance assuming instead that private and public participants in health care will have to pursue cost-cutting to slow spending growth below the rates seen in the past. Even with this moderate set of assumptions, CBO still sees dramatic increases in health costs in the future, with total public and private spending on health increasing from 15 percent of GDP today and 49 percent in 2082 (see **Figure 3**).

Figure 3 CBO's 75-Year Projections for Total National Health Spending
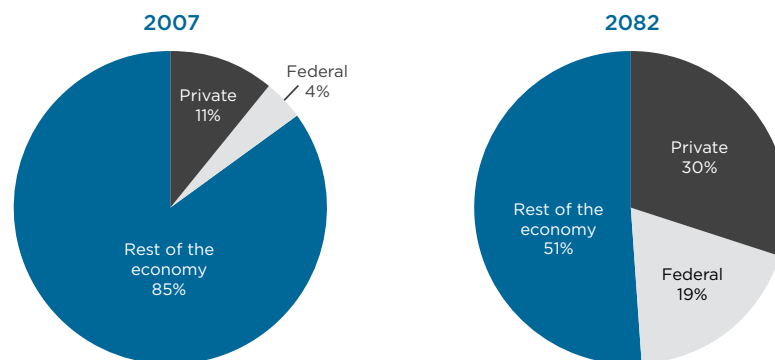
Source: *The Long-Term Outlook for Health Care Spending*, Congressional Budget Office, December 2007.

[21] ibid
[22] A statistical technique used to approximate the probability of specific outcome.
[23] Quantifying Uncertainty in the Analysis of Long-Term Social Security Projections, Congressional Budget Office, November 2005.

IV. Discussion: Exploring Possible Cost Estimating Improvements

Professional cost estimators are cautious regarding calls to alter the federal cost-estimating practices and budget processes, which is understandable given the implications their estimates bear on the fate of policy proposals and their need to remain non-partisan. While caution is certainly understandable, it is important to both consider and pursue opportunities to enhance the quality of information provided to policymakers.

a. Reflection of best epidemiologic trend data in baseline estimates

In forming the basis for determining how changes to health policy will affect federal spending, the baseline assumptions of costs should to the extent possible reflect the current and future health status of the population. This is particularly relevant today in the context of obesity trends, which are alarming and will likely have a significant impact on spending under current law.

According to the CDC, almost 60 percent of adults in America are overweight and 34 percent are obese. Among adults (aged 40-59), many of whom will enter Medicare over the next decade, obesity prevalence is 40 percent.[24] Research on obesity among Medicare beneficiaries has shown that obese Medicare beneficiaries incur significantly higher lifetime medical costs than their normal weight peers.[25] Researchers found that obese seventy-year olds will live about as long as those of normal weight, but will spend $39,000 more on healthcare.[26] Obese beneficiaries also experienced almost three years more years of disability than their normal weight peers, two years of which involved moderate to severe levels of disability.[27] The stark difference in disability levels led the authors to conclude that the costs of disability may contribute an even greater difference than the overall costs of obesity.

Baseline estimates are important because they indicate both what will happen under current law and are the measurements against which a new policy is assessed. Thus, it is important in the case of chronic illness to ensure that baseline estimates fully reflect the health risk associated with current societal trends. In particular, obesity trends could have a significant impact on policies aimed at heading off or improving the management of diabetes, heart disease, and other obesity-related chronic conditions.

b. Extending the Budget Window in Selected Instances

Given the lengthy, natural course of chronic diseases and the difference in time between a health care intervention and realizing its impact, measuring the results of some interventions requires a longer-term perspective. In the area of health care policy for chronic illnesses, a 10–year cost projection period may not be long enough to make sound policy because it does not fully capture the health outcome and cost implications of certain alternative policy scenarios.

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[24] CDC National Center for Health Statistics, "Obesity Among Adults in the United States – No Change Since 2003-2004," Nov. 2007.

[25] D Lakdawalla, D Goldman, & B Shang, "The Health and Cost Consequences of Obesity Among the Elderly," Health Affairs 2005; W5:R30-R41; Z Yang & A Hall, "The Financial Burden of Overweight and Obesity among Elderly Americans: The Dynamics of Weight, Longevity, and Health Care Cost," Health Services Research Journal 2008;43(3):849-68.

[26] D Lakdawalla, D Goldman, & B Shang, "The Health and Cost Consequences of Obesity Among the Elderly," Health Affairs 2005; W5:R30-R41.

[27] Defined as three of more activities of daily living limitations or institutionalization. D Lakdawalla, D Goldman, & B Shang, "The Health and Cost Consequences of Obesity Among the Elderly," Health Affairs 2005; W5:R30-R41.

Type 2 diabetes mellitus provides a prototypical example of this phenomenon. Diabetes results from the progressive failure of the body to regulate insulin and process blood glucose. The early stages are often asymptomatic, making detection and accordingly acting to avoid the realization of escalating risks of developing diabetes difficult. Full onset of type 2 diabetes can progress toward the development of the range of complications related to diabetes. These complications include kidney disease (e.g., end-stage renal disease), stoke, blindness, heart disease and amputation. Type 2 diabetes typically develops in middle-aged or older individuals, many of whom may have been in the early, symptom-free stages for several years. Given the lack of symptoms in the early stages, a person affected may not seek care and receive an actual diagnosis of diabetes for years.[28]

It can also take many years before the complications of diabetes appear. This long time period has the advantage of offering many opportunities to slow or avoid the onset of the disease, its progression, and the development of complications. However, as a result of this lengthy natural history, the positive effects of improved prevention, treatment and control of diabetes also often take time to show any positive and significant effects. In clinical trials sponsored by the National Institutes of Health (NIH) of intensive glucose control, it has been found to require up to 9 years of therapy before reductions in complications and therefore reductions in spending are realized.

But when they are, in fact, realized, the improvements are dramatic and highly consequential in health status and cost terms. As shown in **Figure 4**, within the first ten years of an aggressive intervention, the amount of health care costs averted from an intensive protocol compared to a conventional one is rather small – only about $400 in the tenth year. However, from there, the costs averted grow dramatically, reaching more than $2000 per year per person by year twenty.

Cost estimates used in the Congressional budget process which cover only ten years cannot capture much of this information.

Figure 4 **The Budget Window and Disease Progression**
Type 2 Diabetes and Glucose Control Efforts, Average Annual Costs
Averted from Complications - 2007 $
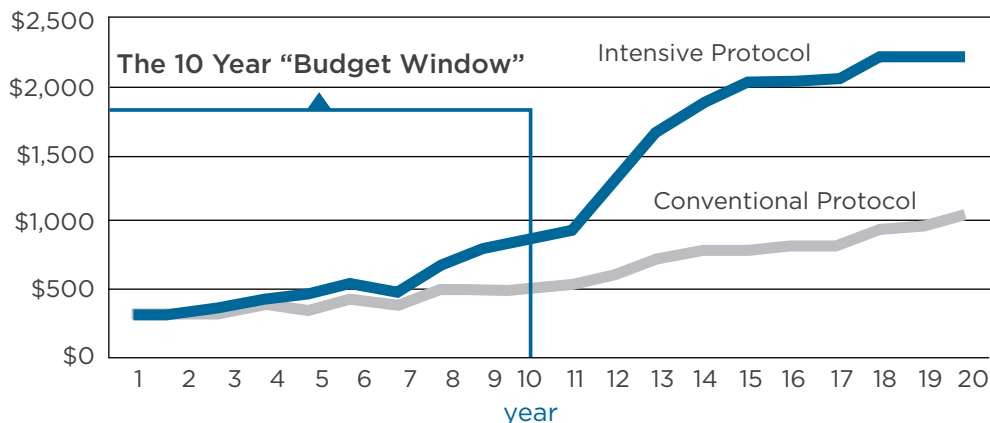
Source: National Changing Diabetes Programs: Federal Health Care Cost Estimating: A Look at Current Practice and the Implications for Assessing Chronic Disease Prevention Proposals

[28] Federal Health Care Cost Estimating: A Look at Current Practice and the Implications for Assessing Chronic Disease Prevention Proposals, O'Grady MJ,, Capretta J., Huang E. (forthcoming) - Based on model parameter estimates from NIH's DCCT project (The Diabetes Control and Complications Trial Research Group. Lifetime benefits and costs of intensive therapy as practiced in the Diabetes Control and Complications Trial. JAMA 1996;276:1409-15). The National Changing Diabetes Program, Novo Nordisk Inc.

In contrast to the timing of treatment effect for intensive glucose control, other components of diabetes care such as intensive blood pressure and cholesterol control have far shorter time to treatment effects. This timing of treatment effects has important implications for studies evaluating the costs associated with efforts to prevent diabetes and/or improve the delivery of diabetes care.

Who bears the costs and who enjoys the savings is also affected by this interaction between the "natural history" of the disease and the timing of the intervention. For the typical middle-aged working individual who develops Type 2 diabetes, the initial costs of treatment fall on the patient's insurer, typically an employer or Medicaid and on the patient themselves as either cost sharing for the insured and full costs for the uninsured. Complications may develop well after retirement and after the individual becomes Medicare eligible.

If prevention and treatment inventions *are* implemented, employers and/or Medicaid will bear much of the costs of the interventions. Employers and/or Medicaid also will reap much of the savings that occur prior to Medicare eligibility. After Medicare becomes the primary insurer, employers and/or Medicaid will typically become the secondary payer. While employers and/or Medicaid will see some of the savings from these interventions, Medicare will see the majority of the savings.

If prevention and treatment inventions *are not* implemented, employers and/or Medicaid save the costs of the interventions, and incur most of the costs of complications prior to Medicare eligibility and a smaller percentage after Medicare eligibility. Ultimately, however, Medicare will bear most of the burden of the costs of complications that develop late in life.

Apart from consideration of the natural history of disease, it may be important to reconsider the traditional budgetary timeframe simply because of the potential threat of the long-term health care cost problems for the economy. As the CBO Director and the Comptroller General of the United States have stated, the most important threat to the nation's economic strength over the long run is the coming explosion in governmental health care spending in the Medicare and Medicaid programs. But today's budget process does not provide a full perspective on the problem.

Long-term cost-estimates need not be done for all legislation, however. It could be that Congress maintains a ten-year perspective for most legislation but gets longer-term estimates when the policy and data call for it. For instance, in the case of chronic diseases, cost estimates could be provided beyond ten years when the modeling capacity is viewed as sufficiently robust to capture the health and cost consequences over a somewhat longer period of time, such as twenty-five years.

Once a modeling capacity is in place for certain conditions, the budgetary context could be examined to determine how to the information might be used within the existing budget enforcement regime. For instance, Congress could consider using special rules under the pay-as-you-go procedure to capture budget information beyond ten years, when warranted.

Conclusion

In coming decades, the country will be facing very different health care problems than those we confronted in the last century. While science and technology have made dramatic advances in health and longevity, we still face dramatic increases in chronic disease burden in the future if no policy changes are made.

In this context, it is inevitable that policymakers will become increasingly interested in pursuing policies that can both prevent the expected rise in disease burden and head off expensive public commitments to care for the chronically ill.

Current cost estimating practices and the budget process they inform both provide important safeguards for ensuring a disciplined budget process. These practices, by and large, should remain in place as they exist today, if not with additional safeguards to further encourage restraint.

Nonetheless, to make sound policy, lawmakers and others in the policy process need sound information, and today's methods and procedures may not work as well as needed in the context of certain efforts to prevent costly complications chronic diseases. Being able to capture the impact of current health status trends and the growing prevalence of chronic disease in policy efforts to improve health would provide lawmakers with valuable information.

Sound policymaking for diabetes interventions and other chronic conditions with similar natural histories is likely to require cost estimates beyond ten years. These estimates will also need to incorporate the latest, most rigorous evidence from clinical medicine regarding the health status changes that might be expected from various interventions.

Current cost estimating practices will need to be re-tooled to help policymakers carefully examine such questions. The possible avenues for improved estimating presented in this paper should be explored aggressively to determine if they would add valuable information and thus improve policy.

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