

The Cost and Benefits of Treating Type 2 Diabetes Mellitus as a Chronic Condition

Robert D. Lieberthal

March 1, 2005

Copyright 2005 by the Society of Actuaries.

All rights reserved by the Society of Actuaries. Permission is granted to make brief excerpts for a published review. Permission is also granted to make limited numbers of copies of items in this monograph for personal, internal, classroom or other instructional use, on condition that the foregoing copyright notice is used so as to give reasonable notice of the Society's copyright. This consent for free limited copying without prior consent of the Society does not extend to making copies for general distribution, for advertising or promotional purposes, for inclusion in new collective works or for resale.

Abstract

Diabetes mellitus type 2 is an excellent model for assessing the setup of medical coverage in the U.S. health care system. It is a chronic disease that has genetic, behavioral and other medical causes, and causes many complications over the long term. While it is widespread in the U.S. population, it tends to affect certain demographic groups at an above-average rate. Given these factors that assist in identifying potential sufferers, as well as its long latency period, it is a prime candidate for targeted preventive treatment as a chronic disease with a combination of medication and lifestyle changes. However, the nature of the onset of symptoms is such that treatment under a chronic model is expensive and time-consuming in the short term to patients, providers and others in the health care system, while the long-term benefits accrue almost entirely to the patient. Thus, patients would benefit from the shift to a chronic care model where they could choose to bear the costs of preventive care under consumer-directed health care (CDHC) coverage. Payers, providers and patients would all benefit from the customer satisfaction associated with consumer choice. The most important benefits to the patient would be lower morbidity and mortality. The most important benefits to employers would be better alignment between the benefits they pay for and the return they receive in enhanced employee productivity. The most important benefit to insurance companies would be the ability to focus on insurance—paying out for a relatively small number of catastrophic claims.

1. Introduction

In its call for papers, the Society expressed a desire to take “a fresh look at the issues related to the ‘acute care focus’ and the challenges of providing coordinated care for chronic conditions in the U.S.” One disease, which is widely acknowledged to require a chronic outlook if the medical standard of “best practice” is to be met, is type 2 diabetes mellitus (which this paper will refer to as “diabetes”). This disease is a particularly good model because it is one that can be ameliorated by the kind of “common sense” approaches that are not strictly limited to the domain of the medical and health insurance fields: for example, eating well, exercising and not smoking. This article serves as a review of the medical literature around the treatment of diabetes, an exploration of how medical standards interact with economic realities and a review of how consumer-directed health care (CDHC), a hot topic in the health practice area, may be able to address some of these concerns.

2. Materials and Methods

This paper relied on a literature review of currently available medical and public health journals, as well as medical price lists, pharmaceutical information and other data sources for medical information. The author’s experience in actuarial practice was generally sufficient for economic, actuarial and benefits design issues, and to the extent that it was not, outside sources were obtained.

3. Discussion and Results

3.1 Medical Information

3.1.1 Background

Diabetes is a chronic progressive condition characterized by hyperglycemia and caused by abnormalities in the production and/or action of insulin. It has been estimated that diabetes affects approximately 18 million Americans, of whom 5 million are undiagnosed individuals. The causes of this condition are multifactorial and include age, genetic predisposition, obesity and lifestyle. The complications of diabetes include hypertension, coronary artery disease, stroke, blindness, kidney disease and peripheral neuropathy. The treatment of diabetes and its complications represent a substantial percentage of health care expenditure in the United States.

The medical standard for the treatment of diabetes consists of primary and secondary prevention, and primary and secondary treatment. Primary prevention includes interventions such as an appropriate diet and exercise, which are not generally regarded as medical treatment nor intended solely for the treatment of diabetes. Secondary prevention represents preventive interventions that are specific for diabetes, such as diabetes self management and education (DSME) programs. Interventions regarded as primary and secondary prevention are indicated regardless of the severity or stage of progression of the diabetes and are not associated with adverse side effects.

The primary goal of treatment for diabetes is the control of hyperglycemia. This is usually achieved by the use of one or a combination of a range of oral agents that act by stimulating insulin secretion by the pancreas. When oral agents used alone are not effective enough, the administration of various forms of insulin can be used to control hyperglycemia.. These primary interventions, however, are associated with side effects which range from mild to serious. For example, oral antidiabetic medications that contain metformin (such as Glucovance®) can induce lactic acidosis. Insulin-based products (such as Lantus®) can occasionally cause severe hypoglycemia, insulin-induced coma and death. In addition to diabetes-specific treatments, diabetics may also require treatment for the aforementioned complications of the disease.

3.1.2 Barriers to Treatment

Early treatment of diabetes can increase the efficacy of interventions, especially with respect to preventive measures. The lack of encouragement and inadequate insurance coverage for screening procedures or annual physicals represent major barriers to timely diagnosis of the disease. These problems that delay diagnosis account for the large number of people in the United States that have undiagnosed diabetes. Undiagnosed cases of diabetes are usually asymptomatic, since the development of symptoms often leads to appropriate testing, diagnosis and treatment. The CDC Diabetes Cost-Effectiveness Study Group determined that the most cost-effective practice would be to target high-risk patients for screening, rather than to use a minimum age as the only indication to begin screening. However, this recommendation does not address the problem of how screening and testing procedures should be covered financially.

Diabetes is one of many diseases in which genetic factors play a causal (though not a determining) role in the pathogenesis of the disease. The rapid pace at which the understanding of the genetic basis of disease is evolving may ultimately lead to more accurate ways of screening patients for diabetes. Furthermore, the increased understanding of the genetics of diabetes will lead to more sophisticated treatment of

diabetes. For example, it is possible that the information from genetic testing may eventually facilitate a choice of treatment that is most effective and also least likely to cause side effects in the individual patient. However, the development of genetics-based approaches to the management of diabetes, especially those involving personalization of care, is likely to increase the cost of care. In addition, genetic testing that is predictive of the future development of diabetes could potentially allow insurance companies to refuse health coverage to high-risk individuals, a possibility the U.S. government is currently addressing. Despite these pitfalls, if genetics-based approaches are developed in the future that substantially improve the life expectancy of diabetics, they may have to be used regardless of cost and other problems.

Provider experience and resource constraints are barriers to providing optimal treatment. For example, there is evidence that more experienced practitioners or diabetes specialists can obtain superior outcomes. This may be a function of the practitioners' level of experience with diabetes or their practices being situated in a diabetes clinic rather than a general practitioner setting. Almost all practitioners, including general practitioners and specialists, are subject to the time constraints inherent in the managed-care approach to health care, which often results in preventive testing and exercise receiving a relatively low priority by the physician. Essentially, resources such as physician time as well as money and access to specialists are restricted in order to hold down costs. Diabetes is not unique in this regard, but is rather an example of how the health care system often chooses a pound of cure over an ounce of prevention.

Another important barrier to optimal treatment of diabetes is a lack of compliance by patients. Studies of diet, exercise and cessation of smoking programs all demonstrate the difficulties in changing the lifestyle of patients in the long term. The availability of effective pharmaceutical products, while certainly lifesaving, could also play a role in decreasing patients' willingness to follow the long-term lifestyle changes that diabetes management should entail, especially if drugs are covered by insurance while diabetes disease management programs (DDMPs) are not. Furthermore, a study recently indicated that literacy levels had a significant impact on treatment outcomes, even within an intensive diabetes management program. All of these problems, and the inherent complication of modern medicine, might lead to the conclusion that patients should have less, not more, responsibility for their own care. However, the continuing trend away from "paternalistic" medicine, combined with the fact that patients have more to gain in the long term from a chronic-care approach to diabetes care than their employers or insurers, provides the strongest argument for motivating patients to do as much as possible to control their own health. Ideally, this would involve the patients viewing their diabetes as a chronic disorder that requires long-term management and

changes in lifestyle, and insurers, employers and providers providing effective incentives to achieve this chronic-care model.

3.1.3 Rationale for the Chronic-Care Approach

Asymptomatic diabetes should be treated as a chronic disorder since this approach has been shown to result in a reduction in mortality and morbidity. The goal of such treatment is to keep the diabetic individual asymptomatic for as long as possible through the control of blood glucose levels. In order to achieve this, an individual has to commit to long-term changes in lifestyle that include dietary restrictions, regular exercise and cessation of tobacco use. This proactive, chronic outlook model may avoid or minimize advanced interventions that may otherwise become necessary if treatment is delayed until symptoms develop. However, given the fact that the average per capita cost for a diabetic is roughly double that of a demographically equivalent non-diabetic counterpart, and the fact that diabetes is not generally an end-of-life disease, the cost savings using the chronic outlook model can be substantial. Additionally, the gain to a potential or asymptomatic diabetic in quality-adjusted life years (QALYs) is very high.

TABLE 1
Cost of Selected Primary and Secondary Interventions

Treatment	Frequency	Risks	Cost
Lifestyle Adjustment			
Prescriptive exercise	One-time setup, monitoring	None	Part of annual physical
Diabetes disease management program	Three-year intervention	None	\$2,780
American Lung Association Freedom from Smoking® program	One-time course	None	Free
OPTIFAST Weight loss program	Weekly	None	\$1,800 – 2,000 for 3 months
Testing Supplies			
Accu-Chek Advantage Diabetes Monitoring Kit	One-time purchase	None	\$66
Accu-Chek Softclix Lancets	2–4 times daily	None	\$13/month

Diabetics who have already developed insulin resistance can still benefit from a chronic outlook toward their diabetes. The behavioral and testing changes, as well as monitoring procedures, described above are still medically indicated. While primary treatments, such as pharmaceuticals and insulin, are not necessarily cost-effective, costs could be saved by the use of generic forms of oral agents when available. From an actuarial standpoint, once a diabetic suffers a heart attack, stroke, or other acute medical incident, the present value of the prevention of further incidents becomes higher, as they are more likely to occur in the future. One example of this phenomenon is bariatric surgery – “surgery for morbid obesity”. Though this form of surgery is not often used for diabetics at present and is expensive (see Table 2) it could be worth the \$3,000–\$5,000 claims for the savings that could be achieved in the long term (7–10 years) (see section 3.2). Dialysis, bariatric surgery and organ transplant, acute treatments that lead to additional years of life with a quality adjustment of much less than 1.0, still have a high marginal value for the individual since the alternative is often death. These more involved primary and secondary treatments, however, have high costs, can be more difficult to obtain and are not nearly as successful as prevention or pharmaceuticals.

TABLE 2
Cost of Selected Primary, Secondary and Tertiary Interventions

Treatment	Frequency	Risks	Cost
Prescription Medication			
Glucovance®	Daily	Lactic acidosis	\$75/month
Glyburide-Metformin (generic glucovance)	Daily	Lactic acidosis	\$56/month
Insulin (injectable)	Daily	Hypoglycemia	\$30/vial
Cozaar	Daily	Various side effects	\$60/month
Surgery/Outpatient Procedures			
Bariatric surgery	One time	Pain, complications, death	\$25,000
Hemodialysis	Twice weekly	Low blood pressure, muscle cramps	\$45,000–50,000/year
Kidney Transplantation	One time	Complications, organ rejection, death	\$100,000 (first-year costs)

3.2 Economic Issues—Externalities

Given the fact that many of the above treatments are expensive to insurers but beneficial to the patients, the economics of many elective procedures can mismatch costs and benefits, creating externalities. Take the following example. A 45-year-old patient suffering from severe diabetes and morbid obesity undergoes bariatric surgery. The surgery costs \$30,000, is paid for by an insurer or an employer, and results in a \$5,000 reduction in annual per capita expenditures on the individual due to significantly less severe diabetes. The present value of the \$5,000 annual savings at a 5 percent discount rate is \$62,000, representing a \$32,000 return on the investment if the employer or insurance company that paid for the procedure retains this individual for 20 years. However, with the addition of a 10 percent annual termination decrement, either from employment or the particular insurance carrier, the present value for the payer falls to \$29,000—less than the cost of the surgery. While this is a fairly simplistic example, it illustrates how a procedure that is very worthwhile in terms of return on investment and from the point of view of improved health of the individual can look at first glance like an unviable procedure to a third-party payer.

3.3 Consumer-Directed Health Care

3.3.1 CDHC—The Rationale

One way in which diabetes could be managed more closely to the medical standard of care as possible is by utilizing a consumer-directed health care (CDHC) model to align the beneficiary of care more closely with the costs. Broadly defined, CDHC is a model by which participants take a more direct responsibility for their care by having direct control over the purchasing of services below a catastrophic limit. The idea behind CDHC is not just to lower premiums for insurance (though this certainly occurs), but to give consumers choice of care and responsibility for the outcome. This largely untested idea may give individuals the necessary financial impetus to give up smoking, for example, much in the same way that the taxes on tobacco have. For the sake of simplicity, this paper will focus on the CDHC plan design on high-deductible health plans (HDHP) with integrated or associated health savings accounts (HSAs), in line with the latest promulgations from the Treasury department.

3.3.2 CDHC—Applicability to Treatment of Diabetes

CDHC could allow individuals to ensure that they were getting appropriate treatment for diabetes by increasing their likelihood of getting preventive care. Ideally, individuals who are members of high-risk groups would have a higher likelihood to get tested for diabetes. Such individuals would have an incentive to do so, because if they allowed their diabetes to reach an acute stage, they could face significant below-the-deductible costs. Once diagnosed with diabetes, they could pay for a diabetes self-management education or a medical weight loss program out of their HSA. Often these treatments are not covered by insurance or Medicare. Finally, many have contended that, in general, putting purchasing power in the hands of consumers will lead to their demanding higher quality service. In the case of diabetes, higher quality would mean a chronic-care model of treatment, for example ensuring that all diabetics get a “prescription” for exercise.

The benefits of CDHC for employers and insurers result from their being able to focus on core competencies. Many companies’ costs have been greatly expanded by the cost of health care benefits, as well as the necessity to add human resource functions that are outside the scope of business, such as self-insuring their healthcare benefit. CDHC will allow them to relegate this role back to insurers or to greatly reduce the amount of administration they or their third-party administrators have to do, as well as offering the chance for significantly lower premiums. Insurers will gain a similar benefit by being able to focus on their core competency—insurance. By not having to deal with

high volumes of low-cost “maintenance” (i.e., non-catastrophic) claims, they can focus on the job of dealing with catastrophic claims. Further, they can make use of sophisticated techniques already developed in property & casualty lines such as car insurance, which are based on annual premiums, a similar level of deductible, and where relatively few insured generate most of the claims.

3.3.3 CDHC – Drawbacks

There are particular drawbacks to CDHC as it relates to diabetes. One is that it may be unrealistic for a large percentage, perhaps the majority, of individuals. The uninsured, those on Medicaid and Medicare, and those with insurance but low incomes, may not have the resources to participate in CDHC. For those individuals, especially those in government health programs, the continuing trend towards quality improvement, pay for performance, and individual choice could still be encouraged. Another financial issue is that many of the aforementioned treatments are based on high short-term costs to derive long-term benefits. Even those on middle class incomes may lack the resources to take up these treatments. Also, there is the evidence that shows that high deductibles may lead to the deferral of treatment, exactly the opposite of the chronic-care model. Whether this is a deferral of necessary treatment or that without incremental medical value is not yet conclusively shown. But it is clear that disease management and wellness programs involve significant commitments, and that the temptation or necessity to defer treatment may be strong.

Another continuing barrier to CDHC and the chronic-care model is the fact that the acute-care model puts some of its greatest burden on the public health system rather than individuals. Individuals, whether insured or uninsured, that choose unhealthy lifestyles may develop diabetes around the same time they become eligible for Medicare. This may be creating a moral hazard which prevents treating diabetes via the chronic model and increases long-term costs. Further, hospitals are under a mandate to treat all emergency patients, so the burden of those not receiving proper preventive care again falls on the government (i.e., the general population) and hospitals. This is one argument for the extremely tax-advantaged status of HSAs, but this may still allow for a severe burden to hospitals and Medicare from underinsured populations.

4. Conclusions

Diabetes mellitus is easy to detect, is caused and exacerbated to a large degree by an unhealthy lifestyle, and has a long lag time from onset to symptoms and then to the development of complications. Given these attributes, diabetes is a prime candidate for a chronic-care model. This would include large scale, targeted screening of at-risk

groups, recognition by all groups in the health care system that more needs to be done to prevent diabetes and proper utilization of different tools to delay or prevent serious symptoms and complications. Further, these developments could be encouraged by enrolling individuals in CDHC plans that facilitate individuals directly paying for the health care that our system affords them, especially preventive treatments that derive long-term health and financial benefits to the individual.

Notes

Acknowledgments: The author would like to acknowledge the New York Public Library and the New York Academy of Medicine for affording him crucial access to medical, scientific and public health journals through EBSCO and PubMed, respectively. The author would also like to acknowledge PricewaterhouseCoopers LLP, which afforded him access to the Factiva database of business-related publications.

Author information: Robert D. Lieberthal is a senior associate and actuarial student in PricewaterhouseCoopers LLP's Global Human Resource Services (GHR) group. He is a member of the retirement practice who works with defined benefit plans, post-retiree medical insurance, and other employee benefits issues. Currently, he is working as an Analyst in PwC's Health Research Institute (HRI). He can be reached via e-mail at robert.lieberthal@us.pwc.com.

References

- American Diabetes Association. 2003. Economic costs of diabetes in the U.S. in 2002. *Diabetes Care* 26: 917-932.
- American Health Line. Senate approves bill prohibiting practice. *American Health Line*, Feb. 18, 2005.
- Aventis. *Lantus*® [Internet]. Aventis, August, 2004 [cited February 24 2005]. Available from <http://www.fda.gov/cder/foi/label/2004/21081s0111bl.pdf>.
- Best's Review. Failure to communicate. *Best's Review*, December 1 2004.
- Bristol-Myers Squibb. *Glucophage*® (Metformin Hydrochloride Tablets) [Internet]. 2002 [cited July 2002]. Available from http://www.bristolmyers.com/cgi-bin/anybin.pl?sql=select%20PPI%20from%20TB_PRODUCT_PPI%20where%20PI_SEQ=52&key=PPI.
- Buchwald, H., Avidor, Y., Braunwald, E., Jensen, M.D., Pories, W., Fahrbach, K. and Schoelles, K. 2004. Bariatric surgery: A systematic review and meta-analysis. *Journal of the American Medical Association* 292(14): 1724-37.
- CDC Diabetes Cost-Effectiveness Study Group. 1998. The cost-effectiveness of screening for type 2 diabetes. *Journal of the American Medical Association* 280(20): 1757-63.
- Centers for Medicare and Medicaid Services. *Reimbursement for facility dialysis services* [Internet]. 2005 [cited February 26 2005]. Available from http://www.cms.hhs.gov/manuals/29_rdf/rd400.asp.
- CVS.com. *Cvs/Pharmacy* [Internet]. 2005 [cited February 24 2005]. Available from www.cvs.com.
- Davis, K. 2005. *High deductible health plans and health savings accounts: For better or worse?: The Commonwealth Fund*, 2005.
- De Berardis, G., Pellegrini, F., Franciosi, M., Belfiglio, M., Di Nardo, B., Greenfield, S., Kaplan, S.H., Rossi, M.C., Sacco, M., Tognoni, G., Valentini, M. and Nicolucci, A. 2004. Quality of care and outcomes in type 2 diabetic patients: A comparison between general practice and diabetes clinics. *Diabetes Care* 27(2): 398-406.

- Diabetes Care. 2005. Standards of medical care in diabetes (position statement). *Diabetes Care* 28(1).
- Diabetes Prevention Program Research Group. 2003. Costs associated with the primary prevention of type 2 diabetes mellitus in the diabetes prevention program. *Diabetes Care* 26: 36-47.
- Funnell, M.M. and Kruger, D.F. 2004. Type 2 diabetes: Treat to target. *Nurse Pract* 29(1): 11-5, 19-23; quiz 23-5.
- Hirsch, J.M. 2005. Doctors fight fat with prescriptions ordering specific exercise routines. *Associated Press Writer* 19(31).
- Hobson, K. Doctors vanish from view. *U.S. News & World Report*, January 31, 2005, 48.
- Jun, H.J., Subramanian, S V, Gortmaker, S. and Kawachi, I. 2004. Socioeconomic disadvantage, parenting responsibility, and women's smoking in the United States. *American Journal of Public Health* 94(12): 2170.
- Manuel, D.G. and Schultz, S.E.. 2004. Health-related quality of life and health-adjusted life expectancy of people with diabetes in Ontario, Canada, 1996-1997. *Diabetes Care* 27(2): 407-414.
- National Kidney Foundation. *Organ donation statistics* [Internet]. 2005 [cited February 26 2005]. Available from http://www.nkfk.org/organ_donation/donationstats.htm.
- Obesity Fitness & Wellness Week. 2005. Type 2 diabetes; lifestyle changes especially effective at preventing diabetes in older adults. *Obesity, Fitness & Wellness Week* 1514.
- Rothman, R., Malone, R., Bryant, B., Horlen, C., DeWalt, D. and Pignone, M.. 2004. The relationship between literacy and glycemic control in a diabetes disease-management program. *Diabetes Educyion* 30(2): 263-73.
- Thiesen, Kathleen. Bariatric surgery: Separating fat from fiction. 2005. *National Underwriter Life & Health-Financial Services Edition*, January 10.
- Thorpe, K.E., Florence, C.S. and Joski, P. 2004. Which medical conditions account for the rise in health care spending? *Health Affairs (Millwood)*.

- Tsai, A.G. and Wadden, T.A. Systematic review: An evaluation of major commercial weight loss programs in the United States. 2005. *Annals of Internal Medicine Philadelphia* 142(1): 56-66.
- U.S. Department of Health and Human Services. Actual causes of death in the United States, 2000. In *Chronic Disease Prevention*, 1. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2000.
- — —. *National diabetes fact sheet: General information and national estimates on diabetes in the United States* [Fact sheet]. Centers for Disease Control and Prevention, 2004, 2004. Available from http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2003.pdf.
- — —. Reducing tobacco use: A report of the surgeon general. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2000.
- U.S. Treasury Department. *All about HSAs* [Internet]. U.S. Treasury Department, 2004 [cited August 18 2004]. Available from <http://www.treasury.gov/offices/public-affairs/hsa/pdf/hsa-basics.pdf>.
- Weedon, M.N., Owen, K. R., Shields, B., Hitman, G. Walker, M., McCarthy, M. I., Love-Gregory, L.D., Permutt, M.A., Hattersley, A.T. and Frayling, T. M. 2004. Common variants of the hepatocyte nuclear factor-4alpha P2 promoter are associated with type 2 diabetes in the U.K. population. *Diabetes* 53(11): 3002-6.