UnitedHealth®

Center for Health Reform & Modernization

The United States of Diabetes:

Challenges and opportunities in the decade ahead

Working Paper 5
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Preface

By the end of this decade, diabetes will likely affect 15 percent of American adults – that's around 39 million people. The human costs and economic consequences will be substantial.

But there is nothing inevitable about this trend. There is now a sufficiently large evidence base about interventions that can make a difference, ranging along the spectrum from lifestyle-related changes to cut obesity, through to targeted support for patients with diabetic-related complications.

Patients and their care providers will of course be central to that effort. But making a major impact on the prediabetes and diabetes epidemic will also require health plans and Medicare and Medicaid to engage in new ways. That will mean health plans acting not only as payers of health benefits, but as 'care system animators,' providing underlying data, technology and care management services. It will mean a focus not only on the 'flow' of health care consumption, but on managing the 'stock' of population health risk. And it will mean health plans using their resources and infrastructure to help scale nationally some of the most promising preventive care models that to date have struggled to expand beyond their initial pilot or demonstration status.

So diabetes is a prism through which to analyze broader changes needed in U.S. health care – whether it be strengthened primary care, new models of care coordination, behavioral 'nudges' for consumers, or the use of actionable information and well-designed payment incentives to stimulate improvements in the quality and appropriateness of care. What is needed now is concerted, national, multi-stakeholder action. In this working paper we seek to identify what some elements of that might look like and the savings opportunities doing so might represent.

This is the fifth in a series of working papers from the UnitedHealth Center for Health Reform & Modernization. Our published work to date has examined cost containment in Medicare; savings from using technology to remove administrative waste in U.S. healthcare; the future of Medicaid; and options for lowering the U.S. budget deficit.

In producing this diabetes paper, particular thanks go to Deneen Vojta M.D., Yiduo Zhang PhD., Paul Hogan, Jeanne De Sa, Ted Prospect, Tom Beauregard, Sandhya Agrawal, Lew Sandy, M.D., Deborah Sundal, Michael Ceballos and a number of other colleagues.

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Executive Summary

The United States of America is on track to become the United States of Diabetes. The epidemic of type 2 diabetes and its warning sign, prediabetes, is sweeping across the country. By 2020, an estimated 52 percent of the adult population will have diabetes or prediabetes. Yet shockingly, the vast majority—more than 90 percent—of people with prediabetes, and about a quarter of people with diabetes, are unaware of their condition.[1]

This will have major implications for people's health and life expectancy. It will also make a major contribution to out-of-control U.S. health care costs, placing growing strain on the budgets of families, employers, states and the federal government. This new study estimates that health spending associated with diabetes and prediabetes is about $194 billion this year (approximately seven percent of total U.S. health spending). That cost is projected to rise to $500 billion by 2020.

With the goal of generating discussion and action around curbing the prevalence of diabetes, this working paper offers specific proposals, which use proven and transformational prevention and early intervention models. Our work is based on evidence-based, practical solutions derived from scientific research, pilot programs, and our own experience serving employer-sponsored consumers, seniors and people with health benefits through the public sector.

This working paper includes new cost estimates for diabetes and prediabetes, which follow recently updated prevalence estimates from the U.S. Centers for Disease Control and Prevention (CDC), specifically:

Chapter 1 quantifies the prevalence and economic impact of prediabetes and diabetes. We present new projections on the prevalence of diabetes and related spending, by payer, expected for the next decade. Based on current trends, 52 percent of the U.S. adult population could have prediabetes or diabetes by 2020 – up from an estimated 40 percent today. As a result we project that over the next decade the nation may spend almost $3.4 trillion on diabetes-related care.

In Chapter 2, we focus on obesity and its relationship to diabetes. We discuss the range of public health initiatives underway to combat obesity as well as approaches deployed by health plans to reduce obesity through wellness programs. We also identify the opportunity to reduce by nearly 10 million the number of people who would develop prediabetes or diabetes over the next 10 years.

Chapter 3 discusses how early interventions for patients with prediabetes can reduce the onset of diabetes. We present evidence from pilot projects, along with a discussion of UnitedHealth Group's experience in scaling interventions nationally. We also present evidence of the opportunity to reduce by three million the number of people with prediabetes who would develop the full-blown disease over the next 10 years.

In Chapter 4, we discuss approaches that assist people with diabetes to control and manage the disease. To illustrate the potential for savings from better management of diabetes, we present data from UnitedHealthcare's commercial and Medicare programs, as well as other public and private health strategies.

Chapter 5 provides new estimates of the potential savings opportunity from improved diabetes prevention and care by scaling up the evidence-based models set out in Chapters two, three and four. On this basis:

- We estimate the nation could in theory save up to $250 billion in health care costs net of projected intervention costs (which is about 7.5 percent of estimated spending on diabetes and prediabetes) over the next 10 years if an intensive strategy was implemented at scale across the diabetes continuum engaging all at-risk individuals. In practice this would be hard to achieve, so the figure is illustrative of the size of the opportunity—and the costs of inaction.
- Of those savings, we estimate that $144 billion, or about 58 percent, might accrue to the federal government through savings in Medicare, Medicaid, and exchange subsidies.
- In addition, employers could see improvements in workforce productivity, and employees could see increased wages, together worth an estimated $239 billion over 10 years.

Chapter 6 concludes with key policy recommendations for action to reduce prediabetes and diabetes, including diabetes-related payment reform, changes to Medicare coverage policy, and wider deployment of health plans' new consumer engagement and care management technologies.

Key New Findings in this Working Paper Covering 2011–2020

Diabetes Costs and Prevalence Projections

Prevalence. Using the Cost of Diabetes Model and a Health Promotion Microsimulation Model, we produce prevalence and cost estimates for adults with prediabetes and diabetes over a 10-year time horizon. These baseline measures of diabetes prevalence in the U.S. population reflect historical trends and current research, and account for the changing composition and size of the adult population over time.	**By 2020:** 15% of adults will have diabetes and 37% will have prediabetes, compared with 12% and 28% today, respectively
Prevalence and Distribution by Source of Coverage. Though numerically most people with prediabetes and diabetes are privately insured, the percentage of people with these conditions is higher in Medicare and Medicaid, particularly among dual-eligibles (those eligible for both programs). About 40 percent of dual-eligibles have diabetes (including both diagnosed and undiagnosed cases) compared to 27 percent of the overall Medicare population. The population with prediabetes is also expected to grow across all sources of coverage.	**Distribution of adults with diabetes/ prediabetes by 2020:** **Private: 48%** **Medicare: 38%** **Medicaid: 6%** **Uninsured: 8%** **Total: 100%**
Spending by Source of Coverage. Total spending for Medicare beneficiaries (including dual-eligibles) on diabetes-related care — including amounts paid for by the government and by beneficiaries as an out-of-pocket expense — accounts for about 60 percent of all health system spending for people with diabetes and prediabetes. The federal share of diabetes-related spending will continue to grow as Medicare absorbs a greater aging population and as Medicaid expands in accordance with PPACA.	**2011-2020 spending:** Private: $1,033 billion Medicare: $2,041 billion Medicaid: $111 billion Uninsured: $166 billion

Note: Individuals covered by Medicare and Medicaid, known as dual-eligibles, are included in Medicare above.

Potential Net Savings Opportunity from Diabetes Interventions

Lifestyle Intervention for weight loss for people at risk of prediabetes and diabetes. This would provide synchronized, low, moderate and intense lifestyle intervention to promote weight loss among adults who have yet to develop prediabetes or diabetes. Modeled after our lifestyle coaching programs and weight management programs, a modest five percent weight loss might reduce the number of people with prediabetes by about 10 million by 2020.	**$45 billion** (Federal share = $23 billion)
Lifestyle Intervention for people with prediabetes using the Diabetes Prevention Program. Enrolling adults with prediabetes in the Diabetes Prevention Program — an intensive lifestyle intervention utilizing community-based coaches, a data-driven tracking system, and a large network of Ys and affiliates — could potentially reduce the number of individuals who move from prediabetes to diabetes by three million by the end of the decade.	**$105 billion** (Federal share = $61 billion)
Improved Medication Adherence for people with diabetes using the Asheville & Ten Cities Model. With a focus on patient self-management and educational tools, the Asheville and Ten Cities Model uses pharmacists to help patients improve compliance with their physicians' treatment program. Savings associated with the medical compliance intervention would accrue from a reduction in the number of diabetes-related complications and improved health status.	**$34 billion** (Federal share = $21 billion)
Intensive Diabetes Lifestyle Intervention. The Look AHEAD trial is an intensive long-term lifestyle intervention that has produced improvements in weight loss, A1c levels, blood pressure, HDL levels, and triglycerides. Implementing this intervention could reduce the risk of complications among people with diabetes, with resulting savings**.**	**$88 billion** (Federal share = $53 billion)
Illustrative savings opportunity from all initiatives, if fully implemented (net of implementation costs and overlap in savings results)	**$250 billion** (Federal share estimated to be $144 billion)

Chapter 1:
Prevalence and Economic Impact of Diabetes

What is Diabetes?

Diabetes is a chronic and disabling disease that affects nearly 27 million adults in America, and millions more worldwide. Normally, when foods containing starch or simple sugars are digested and absorbed into the blood through the intestines, a hormone called insulin helps the body to store these nutrients throughout the body for use later as a source of energy. In Type 1 diabetes, commonly referred to as insulin-dependent diabetes, the pancreas stops producing insulin which helps move sugar from the blood to the cells. In type 2 diabetes, the body tissues become resistant to insulin. Type 2 is also typically progressive over time and largely preventable through diet, weight management, and physical activity. (See Appendix A for more details.)

The onset of type 2 diabetes follows a natural progression, with individuals developing prediabetes many years before the onset of diabetes. Obesity, along with increasing age, is commonly the first step in the cascade from prediabetes and diabetes. While type 1 diabetes typically results in acute symptoms and is generally diagnosed shortly after its onset, prediabetes and type 2 diabetes are often a silent health problem, and may remain undetected for many years, without obvious signs or symptoms.

The vast majority of people with prediabetes (more than 90 percent) and about a quarter of people with diabetes are unaware of their health condition.[2] The average person with diabetes does not typically get diagnosed for four to seven years.[3] Yet, undiagnosed individuals with diabetes are at high risk for heart disease, stroke, kidney damage, blindness, and other complications. These problems may progress more rapidly in individuals not receiving appropriate medications or pursuing lifestyle changes.

The primary focus of treatment for diabetes is medical management of the complications of disease. The good news is that there are multiple opportunities to intervene and either prevent or control the disease. Effective early intervention in the disease life-cycle also can have a material effect on the costs associated with prediabetes and diabetes.

Prevalence and Costs of Prediabetes and Diabetes

Type 2 is the most common form of diabetes, affecting 26.5 million adults — that is more than 95 percent of all diagnosed adult cases of diabetes. A further 67 million are currently estimated to have prediabetes.[4]

The prevalence of type 2 diabetes has tripled since the 1980s.[5,6] Contributing factors include an aging population, increasing rates of obesity, a larger share of at-risk minority populations, and a longer lifespan among people with diabetes. New research from the Centers for Disease Control and Prevention (CDC) projects that the number of new diabetes cases each year will grow to about 15 per 1,000 people by 2050.[7] Assuming recent trends continue, the prevalence of diagnosed and undiagnosed diabetes will rise from approximately one in 10 adults today to between one in five and one in three adults by the middle of this century. *(Note: The CDC model used in this estimate approaches the long-run diabetes question differently and arrives at slightly higher prevalence estimates for the end of the decade than our more conservative approach. Its projection is based on annual diabetes incidence rates between 1980 and 2007, whereas our model used in this report is based on the clinical relationship between biometrics and person-level diabetes incidence, as well as effects of immigration and mortality.)*

In this chapter, we provide new estimates of the prevalence and cost of adults with prediabetes and diabetes over the next 10 years. We also provide a new breakdown of these estimates by primary source of health care coverage. Our objective is to establish a baseline measure of the growth of diabetes in the population based on historical trends and current research. Having a baseline measure then allows us to estimate the possible impact of various interventions at different points along the disease continuum.

To produce this analysis, we extended the "Cost of Diabetes Model" originally developed by the Lewin Group for a 2007 study for the American Diabetes Association (ADA).[8] The results of that model were used in the Health Promotion Microsimulation Model (HPMM) to construct savings estimates generated in this working paper. A microsimulation model is a widely-accepted analytic tool in developing long-run projections of prevalence and costs. Microsimulation models allow for tracking of changes over time that affect individuals with certain characteristics and medical claims experience, and also for individual behavioral responses to certain interventions. This is an especially useful tool for modeling disease states and effects of interventions affecting disease progression. (See Appendix B for more detailed information about both models.)

Estimated Prevalence and Health Care Costs of Adults with Diabetes

	Prevalence in Adult Population			Health Costs Attributable to Diabetes (in billions)		
	2007	2010 (estimate)	2020 (estimate)	2007	2010 (estimate)	2011-2020 (projection)
People with prediabetes	26.3%	28.4%	36.8%	$27	$34	$585
People with undiagnosed diabetes	2.9%	3.1 %	4.1 %	$12	$15	$253
People with type 1 diabetes	0.2%	0.2 %	0.2 %	$4	$5	$73
People with type 2 diabetes	7.6%	8.2 %	10.8 %	$110	$140	$2,439
Total[9]	37.0%	39.9%	51.9%	$153	$194	$3,351

Note: Numbers may not add to totals due to rounding.
Table 1.1; Source: UnitedHealth Group modeling, 2010

Table 1.1 and Figure 1.1 show detail on people with diabetes by type and the rise we project in the prevalence of type 2 diabetes during the next decade. Following current trends, about 15 percent of adults (39 million) are expected to have diabetes by 2020, compared to 12 percent in 2010. Only 28 million of them would likely be diagnosed. By 2020 we also project that almost 96 million people will have prediabetes — almost 37 percent of the adult population in that year (up from the 28 percent with prediabetes today).

Prevalence of Diabetes and Prediabetes in the Adult Population 2007–2020

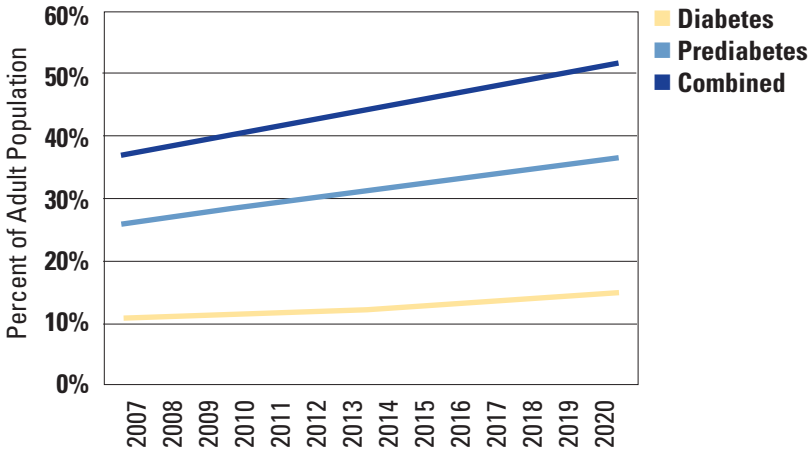


Figure 1.1; Source: UnitedHealth Group modeling, 2010

Health care costs attributable to prediabetes and diabetes for U.S. adults are expected to grow from approximately $194 billion in 2010, or seven percent of health spending, to almost $500 billion in 2020, or 10 percent of health spending. (Note that those spending figures are for costs of medical care *related* to prediabetes or diabetes — not *total* health spending by people with prediabetes or diabetes.)

Over the 2011–2020 period, national health spending on diabetes is estimated to be $3.4 trillion. More than 80 percent of this total is due to spending on diabetes for both people with diagnosed and undiagnosed diabetes. The remaining amount of almost $600 billion is for spending on prediabetes-related health care expenses.

Prevalence and Costs of Prediabetes and Diabetes by Primary Source of Coverage and Payer

In this section, we provide new estimates of diabetes prevalence and costs, according to an individual's primary source of health insurance coverage (Figure 1.2 and Table 1.2). Most people with diabetes and prediabetes are privately insured, but the prevalence rate is higher in Medicare and Medicaid, particularly for people dually eligible for those programs.

Estimated Prevalence and Health Care Costs Related to Prediabetes and Diabetes in Adults, by Individual's Primary Source of Coverage

	Prevalence (in millions, 2010 estimate)				Health Costs Attributable to Diabetes/Prediabetes (in billions)		
	Prediabetes	Diabetes	Total	All adults	2010 (estimated)	2011-2020 (projection)	2011-2020 % of Total
Privately Insured	32.8	9.8	42.6	126	$57	$1,033	31%
Medicare (ex dual-eligibles)	16.0	9.9	25.9	40	$89	$1,635	49%
Dual-eligibles	1.7	2.8	4.5	7	$22	$406	12%
Medicaid (ex dual-eligibles)	2.1	0.9	3.0	13	$4	$111	3%
Uninsured	14.2	3.6	17.8	49	$22	$166	5%
Total	**66.8**	**27.0**	**93.8**	**235**	**$194**	**$3,351**	**100%**

Table 1.2; Source: UnitedHealth Group modeling, 2010.

Spending on Diabetes and Prediabetes for Adults by Primary Source of Coverage 2010

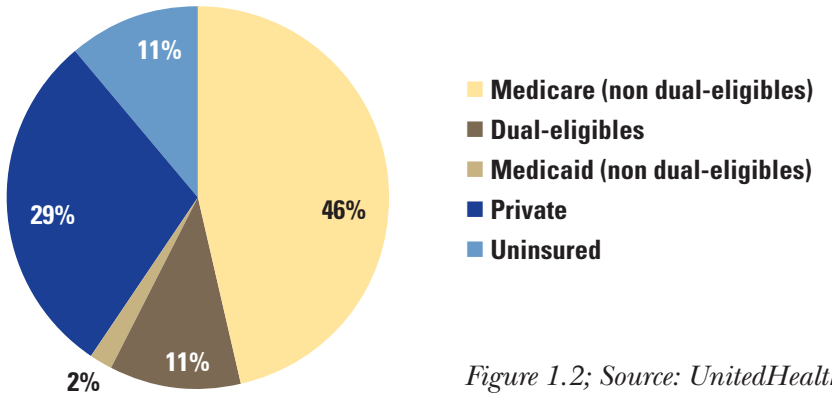


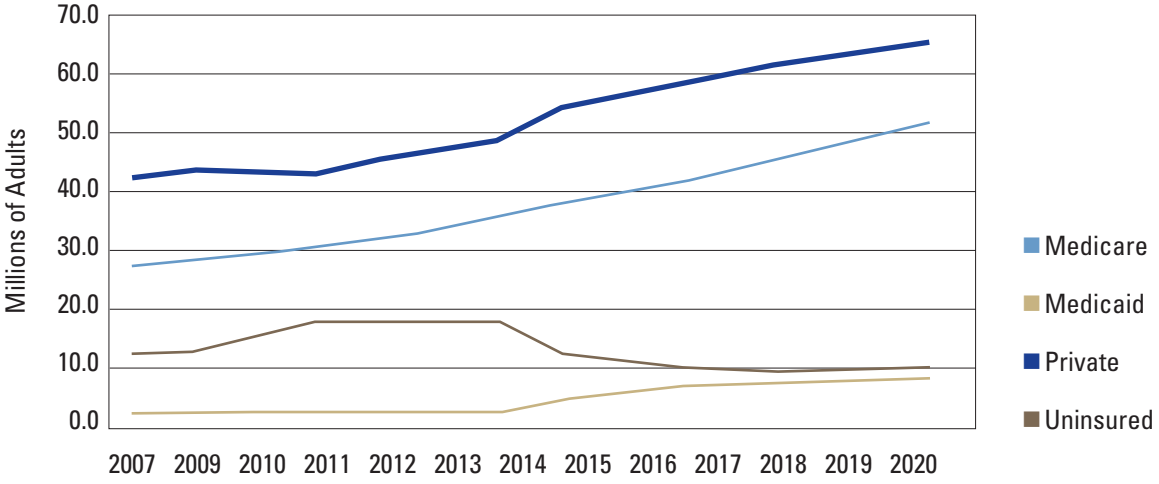
Figure 1.2; Source: UnitedHealth Group modeling, 2010

Private coverage

About eight percent of adults with private coverage (including employer-sponsored and individual coverage) are currently thought to have diabetes—nearly 10 million people. By 2020, that number is expected to grow to about 15 million people, with prediabetes cases accounting for an additional 50 million.

Today, private spending on diabetes and prediabetes is roughly $57 billion, costs that are largely borne by employers and employees. Private spending on diabetes and prediabetes between 2011 and 2020 is estimated to be about $1 *trillion*.

Adults with Diabetes and Prediabetes by Source of Coverage 2007–2020



Note: Individuals enrolled in both Medicare and Medicaid, or dual-eligibles, are included in the Medicare data, as Medicare is their primary source of coverage.

Figure 1.3; Source: UnitedHealth Group modeling, 2010

Under current law, after 2014 a subset of individuals with incomes below 400 percent of poverty will receive federal subsidies for the purchase of health insurance through new insurance exchanges. Those subsidies will, therefore, include some amounts related to the cost of diabetes and prediabetes. **In Table 1.3, we provide new estimates of the costs of federal subsidies related to diabetes and prediabetes—which we project would be about $28 billion (or six percent of all spending on subsidies) between 2014 and 2020.** (See Chapter 5 for the methodology used to estimate these costs.)

Medicare

As shown in Table 1.2, Medicare enrollees, including dual-eligibles, comprise almost half of the total adult population with both diagnosed and undiagnosed type 2 diabetes. Medicare covers almost 13 million people with diabetes, including those dually eligible for Medicaid in 2010. Almost 18 million Medicare beneficiaries (including dual-eligibles) have prediabetes. By 2020, 21 million Medicare beneficiaries are expected to have full-blown diabetes.

Type 2 diabetes prevalence is higher among dual-eligibles than the non-dual Medicare population, with about 40 percent of dual-eligibles having the disease (as compared to 27 percent of the overall Medicare population).

Spending on Medicare beneficiaries with diabetes and prediabetes (including for dual-eligibles) is estimated to be about $2 trillion over the 2011 to 2020 period. As shown in Table 1.3 below, of that total, $1.7 trillion will be paid by the federal government. Beneficiaries—or the states in which they live (on behalf of dual-eligibles)—will pay the balance in the form of premiums, cost-sharing, or for services not covered by Medicare.

Estimated Spending for Prediabetes and Diabetes by the Federal Government and States, 2011-2020 (in billions of dollars)

	Total	Federal	State
Medicare	$1,694	$1,694	0
Medicaid	$228	$145	$83
Federal Subsidies for Exchanges	$28	$28	0
Total	$1,950	$1,867	$83
Percent of all Spending on Diabetes	58%	56%	3%

Note: Medicare and Medicaid spending includes the share of spending on dual-eligibles by each of those programs. Totals do not add to those in Table 1.2 because figures above do not include beneficiary share of cost-sharing for the programs.

Table 1.3; Source: UnitedHealth Group modeling, 2010

Medicaid

The Medicaid program also plays a role in coverage of adults with diabetes, particularly through its support for older people with disabilities and dual-eligible populations. Diabetes is often difficult for state programs to manage because of high turnover in the Medicaid population and the resulting challenges with screening and follow-up. Today, Medicaid covers about four million people with diabetes. By 2020, Medicaid is expected to cover seven million people with diabetes, about two-thirds of whom are dual-eligibles. Prevalence among non-duals in Medicaid is much lower than for the Medicare population, mainly because of age. About nine million other Medicaid enrollees, including dual-eligibles, may have prediabetes.

These estimates are consistent with an analysis performed by the Urban Institute on 2003 Medicaid administrative data, using diagnosis codes reported by the states. That analysis found that about two million Medicaid enrollees had diabetes in 2003. Prevalence was identified as highest among the over-65 dual-eligible population (about 22 percent) but also high in the disabled population (about 13 percent). It further identified that about one-third of those enrollees also had a mental illness.[11]

Over the 10-year period ending in 2020, spending for Medicaid non-dual eligibles with diabetes or prediabetes is estimated to cost about $111 billion. Medicaid will also be responsible for the costs associated with dual-eligibles with diabetes who are not covered by Medicare. As shown in Table 1.3, we estimate that Medicaid's combined spending for dual- and non-dual-eligibles with diabetes or prediabetes will be almost $228 billion over this 10-year period. The federal government will cover $145 billion with the states covering the balance of $83 billion.

Chapter 2:
Preventing and Reversing Obesity

The number of overweight and obese Americans has reached unprecedented levels, reducing healthy life expectancy and placing a growing strain on U.S. health care. As table 2.1 illustrates, more than two-thirds of the adult population were either overweight or obese in 2008. (Federal guidelines define obesity as having a body mass index (BMI), a measure based on the relationship between height and weight, greater than 30. BMI is equivalent to weight in pounds divided by height in inches squared and multiplied by 703. BMI does not measure the amount or distribution of body fat.[12])

Adult Obesity in the United States from 1994 through 2008

	1994	2000	2008
Overweight (25.0–29.9 BMI)	33.0%	34.0%	34.4%
Obese (30.0–39.9 BMI)	20.0%	25.8%	28.2%
Extremely Obese (>= 40 BMI)	2.9%	4.7%	5.7%
Total Overweight and Obese	**55.9%**	**64.5%**	**68.3%**

Table 2.1; Source: National Health and Nutrition Examination Survey, National Center for Health Statistics, Centers for Disease Control and Prevention

Equally concerning is the number of people who have steadily progressed from being overweight to obese. Over the past two decades the percentage of adults who are obese has more than doubled. At the growth rates recently observed, the share of adults who are obese may grow by four to five percentage points over the next decade.[13] Today, 17 percent of children and adolescents are reported to be obese—a prevalence rate that is expected to increase over time.[14]

The Congressional Budget Office (CBO) reports that demographic factors explained only eight percent of the rise in the share of obese adults over the two decades to 2007.[15] There are numerous contributors to this trend: a rise in consumption of high-calorie foods (particularly snack foods); an increase in sedentary lifestyles resulting in less energy expenditure; and changes in family dynamics, work activity and environment.

Obesity is a leading cause of preventable death in the United States, as well as a leading cause of disability and absenteeism. Gaining just 11 to 16 pounds doubles the risk of type 2 diabetes, while an increase of 17 to 24 pounds nearly triples this risk.[16] Obesity, particularly abdominal obesity, is associated with the insulin resistance that is characteristic of type 2 diabetes. CBO estimates that per capita spending for obese adults is 38 percent higher than that of normal-weight adults.[17]

Researchers have found that high-intensity counseling for diet and exercise, combined with behavioral support, can produce sustained weight loss in obese adults, resulting in improved glucose metabolism, lipid levels, and blood pressure.[18]

Financial incentives can also motivate people to lose weight. In one study, one-third of participants received no financial reward for weight loss, while one-third were given $7 for each percentage point of weight loss, and the final one-third were given $14 for each percentage point of weight loss. After three months, those without financial incentives lost an average of two pounds; those who received $7 per percent decrease lost three pounds; and those who received $14 per percent decrease lost five pounds – and were five-and-a-half-times *more likely* to lose five percent of their weight, an amount recommended by the experts and shown to provide significant health benefits.[19] Other studies have examined the role of tax incentives in encouraging individuals to reduce caloric consumption.[20]

Various public policies have been used to stimulate behavior change among populations prone to obesity. These strategies aim to promote physical activity among the at-risk population or to encourage healthy eating, including First Lady Michelle Obama's "Let's Move" campaign.

Employers also now offer an array of incentives that reward employees for taking part in wellness programs and for health improvement. Incentives may include cash, gift cards, health insurance premium reductions, health savings account contributions, personal and vacation-time accruals and merchandise-based rewards. Depending on the activity or program being rewarded, incentive values can vary dramatically—from $5 dollar gift cards to $1,000 premium credits. The PPACA legislation allows rewards for wellness programs of up to 30 percent of the cost of coverage, with the opportunity to increase this to 50 percent.

Case Study: UnitedHealth Group's OptumHealth Experience with Personalized Programs to Support Obesity Reduction

Our experience suggests that wellness programs are most effective when they adopt a gradual, multi-year approach. This means that, initially, incentives are provided for straightforward acts such as completing a health assessment. By year two, "next-step" activities such as an online health coach completion can be adopted, with additional incentives for weight loss in subsequent years. A survey of employers found that 48 percent of employers are currently offering incentives for participation, while 38 percent are offering incentives for completion, and 16 percent are offering incentives for achievement of a specified health outcome.[21] The value and appeal of a particular incentive varies among employees, making incentive selection an important component of a successful program. For example, gift cards are a popular form of incentive but they are taxable. Premium credits help consumers make the connection between their health actions and their health care costs.

Lifestyle coaching interventions and weight management programs focus not only on individuals who need to lose weight, but also on those who need to maintain their healthy weight. OptumHealth uses a data-driven enrollment methodology to proactively identify members at risk of obesity by combining claims, biometric screenings, integrated program referrals, information gathered from self-reported health assessments, and where appropriate, self-enrollment. In order to be economically sustainable, intensive lifestyle interventions are targeted at individuals with hyperglycemia (high blood sugar) and other high-risk factors. For the general adult obese population, a combination of low, moderate and intense interventions are used.

A telephone-based program provides coaching, assessment, a customized action plan, education, motivation and support. The intensity of the program varies depending on the individual's medical history, work/life balance, the stage of change, and behavioral needs. An online health coach assesses the individual's health risk and readiness to change. Based on member responses, a personalization engine uses evidence-based clinical guidelines to customize the program for each individual. Sample program tools include webinars, data tracking, fitness and meal plans, and motivational messaging to help maintain progress between sessions. Among participants who completed the wellness coaching program:

- 92 percent saw some weight reduction.
- 33 percent lost six percent or more of their body weight.
- Average weight loss was four percent.

Chapter 3:
Diagnosing and Reversing Prediabetes

Prediabetes is a condition whereby individuals have blood glucose levels that are higher than normal, but not high enough to be classified as diabetes. Over time, the condition often leads to the onset of diabetes. The same tests used to diagnose diabetes can be used to diagnose prediabetes: the fasting plasma glucose test, the oral glucose tolerance test and hemoglobin A1c. (See Appendix A for more clinical information on diabetes testing.)

Screening and identifying people with prediabetes

As discussed in Chapter 1, prediabetes is a warning sign that diabetes is around the corner and a precursor to a substantial increase in the population with diabetes. Yet only about seven percent of Americans living with prediabetes today are aware that they have this condition.

Federal screening guidelines acknowledge the importance of testing for diabetes, even in adults who do not have symptoms. However, current guidelines have yet to focus on testing for prediabetes.[22] Primary care providers have an important part to play in detection and early intervention through intensive management in the physician's office. But many physician practices are facing an escalating number of patients with prediabetes and diabetes, and are confronted — even overwhelmed — by the physical, emotional, social and environmental factors associated with this disease.

Health plans also recognize their distinctive role in promoting screening for diabetes, and are able to use new analytic tools to help identify people with prediabetes in order to target support before the disease advances.[23]

Case Study: Advanced Analytics to Identify Undiagnosed Prediabetes and Diabetes

UnitedHealth Group's Ingenix has developed an analytic model to aid payers and providers in screening for prediabetes and diabetes, using claims data, demographic information and other databases to identify individuals who are most likely to have undiagnosed needs.[24] By assigning individual risk scores to each member of a population, the model is able to produce an overall assessment of population health as well as individualized assessments. The predictive ability of this identification tool enables earlier disease recognition and helps facilitate targeted outreach to at-risk consumers. A recent study of members with prediabetes and diabetes found that the analytic model correctly identified individuals with the highest risk of developing diabetes more than 80 percent of the time.

Interventions to help prevent the progression from prediabetes to diabetes

While there is no cure for diabetes, there is an effective cure for prediabetes, which can prevent the onset of diabetes. Specifically, clinical trials suggest that the onset of type 2 diabetes can be prevented or delayed through dietary change, moderate-intensity exercise, and modest weight loss.[25,26] Important advances in medical research over the last decade on how patients convert from prediabetes to diabetes have begun changing the public health approach to this issue. In 2002, *The New England Journal of Medicine* published results from the Diabetes Prevention Program (DPP), a study of more than 3,000 people diagnosed with prediabetes. It showed that:

- A carefully designed, intensive lifestyle intervention reduced the incidence of type 2 diabetes by 58 percent in individuals with prediabetes who lost just five percent of their body weight and participated in certain physical activities.[27]
- The ongoing use of the prescription drug Metformin reduced the incidence of diabetes by 31 percent, as compared to placebo.[28]

This study demonstrated that lifestyle changes and drug treatment could reduce the incidence of diabetes in high-risk individuals.[29] In 2001, the Finnish Diabetes Prevention Group, with the same research objective, also found that conversion to diabetes was reduced by 58 percent in the lifestyle intervention group.[30] The costs of the DPP intervention were high due to one-on-one counseling with clinical personnel and nutritionists, averaging about $2,700 per participant over three years. These costs initially complicated efforts to scale up the program.[31]

Subsequently, the CDC provided funding for research to translate the original DPP into a group model and gave funding to the Y (formerly known as YMCA) for 10 sites to implement the program. The group-based model program offers a 16-session core program that is delivered over 20 weeks, with monthly maintenance sessions for reinforcement. It encourages healthy eating, structured physical activity, and behavior modification, such as stress management and motivation.

Given the DPP's 58 percent risk reduction in progressing from prediabetes to diabetes, it is worth exploring why so little was done by the wider health care community in the years following the publication of the trial results to bring the new intervention to scale, and to ensure it had broad population impact. This illustrates one of the challenges associated with health care innovation: new drug or clinical treatments generally spread much faster than new organizational models.

Recognizing that fact, and embracing its role as an activator of new models of prevention and care, UnitedHealth Group decided to collaborate with the Y and CDC to scale the DPP model nationally. This decision led to the formation of a national network of community-based lifestyle coaches who deliver the DPP to identified people with prediabetes.

Case Study: UnitedHealth Group, Y and the CDC – National Diabetes Prevention Program partnership

In moving to scale the DPP nationally, UnitedHealth Group provides advanced analytics and technology support, including assistance with enrollment, content management, data collection, evaluation, payment, and quality assurance. Of critical importance, UnitedHealth Group also funds outreach and consumer marketing, and provides reimbursement for the services delivered under the program. This means that the Y is compensated based on enrollment, program completion and final individual member outcomes, particularly in weight loss. Nearly 60 percent of the U.S. population lives within three miles of a Y, making this a convenient option for program participants. Master trainers supported by the CDC rigorously train the Y lifestyle coaches.

Employers and other payers are joining this program with the expectation that it will help identify individuals with prediabetes and reduce their progression to diabetes, as well as the related disease costs. By delivering an intensive group lifestyle intervention in community settings for less than $400 per person over a two-year period, we expect to significantly improve health outcomes among the participating population. For a typical population of 100 high-risk adults aged 50 and over, the following results might be expected over three years:

- Prevent 15 new cases of type 2 diabetes. [32]
- Prevent 162 missed work days. [33]
- Avoid the need for blood pressure or cholesterol drugs in 11 people. [34]
- Add the equivalent of 20 years of good health. [35]
- Avoid $91,400 in health care costs.[36]

We also are working with academic researchers in the obesity and diabetes domain to leverage our population health data, information on clinical performance, technology platforms and ability to structure consumer- and provider-facing incentives to discover and test new clinical programs that can impact the disease.

The promise of prevention initiatives such as the DPP has spurred interest in further federal support for their expansion. A provision of the PPACA provides authority for grants to model sites, the establishment of a training and outreach program for lifestyle intervention instructors, and a CDC program to determine eligibility for those entities delivering services.[37] The PPACA also provides grants to states to prevent chronic diseases, including diabetes, in the Medicaid population. Grant funding will support initiatives that provide incentives to enrollees to participate in programs that improve health and outcomes through the adoption of healthy behaviors.[38] Finally, PPACA requires the establishment of a national diabetes "report card" that will include information on health outcomes, risk, preventive care practices and quality of care provided to individuals with diabetes or prediabetes.[39]

Chapter 4:
Diagnosing and Controlling Diabetes

People with diabetes typically visit the doctor more often, experience longer and more frequent hospital stays, and use more prescription drugs and medical supplies than people without diabetes. At this stage, the disease manifests itself in the form of high glucose, blood pressure and cholesterol levels. As a result of these conditions, people with diabetes are at risk for micro-vascular disease such as blindness, kidney damage and nerve damage and cardiovascular complications such as stroke and heart attack. According to the Agency for Health Research and Quality, diabetes patients comprise almost a quarter of hospital spending. Hospital stays for people with diabetes also cost more than similar admissions for people who do not have diabetes.[40]

Because type 1 diabetes is caused by a lack of insulin production by the pancreas, the treatment of type 1 diabetes requires insulin injections. Type 2 diabetes also may be treated with insulin, but it is often possible to control the disease's high glucose levels through a combination of diet, exercise and oral medications. Diabetes medications work in many different ways, such as increasing the body's own insulin production, decreasing the amount of glucose generated by the liver, decreasing the absorption of starches from the intestine, or causing the liver or muscles to have a greater response to insulin and to take up glucose from the blood. In addition to these effective therapies, patients with diabetes often can benefit from supplemental medications to improve control of blood pressure and blood cholesterol, or to prevent infections or cardiovascular problems.

Patient self-management is a cornerstone of treatment for diabetes.[41] Patients with diabetes are encouraged to receive education and counseling about diabetes self-care from a certified diabetes educator and nutritional counseling from a registered dietitian. Patients are instructed to self-monitor their blood glucose using a handheld glucometer, meter strips and lancets. Patient self-management also may require additional health care visits to review these activities and to adjust medications accordingly. Patients also are advised to pursue screening exams for high blood pressure and cholesterol, kidney tests, eye tests and foot exams.[42]

However, Table 4.1 shows the relatively low proportion of individuals meeting goals for controlling blood glucose, blood pressure and cholesterol. Seniors show higher rates of control for target hemoglobin A1c, but lower levels for other measures. Non-elderly adults, on the other hand, show higher rates for systolic blood pressure control, but lower rates for other measures.

Control Rates for Blood Glucose, Blood Pressure and Cholesterol

	Percent at Goal People with Diabetes < 65 Years	Percent at Goal People with Diabetes 65+ Years
Target Hemoglobin A1c: < 7	49%	62%
Target Systolic Blood Pressure: < 130	60%	33%
Target LDL Cholesterol: < 100	39%	48%

Table 4.1: Source: Milliman analysis of NHANES data 2003-2006. Target rates for A1c, systolic blood pressure and cholesterol are from the ADA

Improving upon these measures would generate significant clinical and economic benefits. For example:

- Glucose or blood sugar control: Every percentage point drop in A1c blood test results reduces the risk of eye, kidney and nerve disease complications by 40 percent.[43]
- Blood pressure control: Every 10 mm Hg reduction in systolic blood pressure reduces complications related to diabetes by 12 percent.[44]
- Cholesterol monitoring: Improved control of cholesterol (or blood lipids) may reduce cardiovascular complications by 20 percent to 50 percent.[45]

Cost of Diabetes

The annual cost of care for people with diabetes in the commercially-insured population has been reported at between $8,000 and $12,000 a year, excluding the cost of prescription drugs.[46] **In Table 4.2 we present new cost data from a sample of 10 million commercial health plan members. It shows that the average 2009 cost of a known consumer with diabetes who interacted with the health care system was approximately $11,700 compared to $4,400 for the remainder of the population, based on a sample of almost 10 million commercial members. In addition, the average yearly costs of $20,700 for a person with diabetes with complications are almost three times as high as the average cost of $7,800 for people with diabetes who do not have complications.** (Note that the amounts shown in Table 4.2 are for the total costs of care for people with diabetes, not just for their diabetes-related spending.)

Utilization Costs of UnitedHealthcare Adult Members with Diabetes in 2009

	Percent	Cost
Yearly Member Costs:		
Overall Population	100%	$4,600
Remainder of Population	97%	$4,400
People with known diabetes*	3%	$11,700
Diabetes Category		
Diabetes Only	22%	$7,800
Diabetes with Hypertension	58%	$10,000
Diabetes with Complications**	20%	$20,700

** Diabetes defined as presence of one inpatient or two outpatient visits for diabetes in 2009.*
***Complications include micro-vascular and macro-vascular complications attributable to diabetes.*
Table 4.2; Source: UnitedHealth Group, 2010

Furthermore, the costs associated with medication non-compliance (in this case for ACE Inhibitors and ARBs) are significant in people who have diabetes with complications. UnitedHealth Group, for example, found that *non-compliant* members observed over the 2008 to 2009 period experienced higher cost growth (13.8 percent vs. 10.6 percent) during that period and higher annual spending of $24,300 versus $19,400.[47]

Patients with diabetes are at increased risk for cardiovascular complications that include heart attack, chronic angina, stroke, peripheral vascular disease, and other forms of atherosclerosis. In addition, they are at increased risk for vision loss, painful nerve damage in the limbs, and kidney failure. These complications increase with age.

Diabetes is also an important driver of costs in Medicare, including Medicare Advantage. In 2009, seniors from a large sample of UnitedHealth Group's Medicare Advantage members had a diabetes prevalence of 14 percent and average costs that were 33 percent higher than average costs for the remainder of the population enrolled in the same plans. The yearly costs for Medicare members with diabetes who had complications are also almost three times the average cost for people with diabetes who do not have complications. As with the commercial population, non-compliance also carries a cost: in seniors who have diabetes and hypertension, 2009 costs were almost $800 higher per year for members who were not compliant with their prescription drugs. This difference escalated to $6,800 for non-compliant individuals with diabetes who had complications.

Interventions to Help Control Diabetes and Manage Complications

Diabetes awareness and education

The federal and state governments have long been active in the diabetes field. The federal National Diabetes Education Program (NDEP), operated in part by the National Institutes of Health (NIH) and the CDC, provides media support and educational tools to improve the treatment of diabetes and its complications, promote early diagnosis, and to prevent the onset of diabetes. The federal government has helped many states pioneer their own prevention and management initiatives with diabetes-specific funding through the CDC. The agency's State-Based Diabetes Prevention and Control Programs (DPCP) provide resources and technical assistance to state health departments, national organizations and communities. Utah's program, for example, collaborated with commercial and Medicaid health plans to develop initiatives designed to improve care for people with diabetes, resulting in improved quality measures, such as lipid and blood glucose control. In Texas, the state developed a Medicaid diabetes pilot to provide enrollees with self-management education, counseling, and community outreach, and care coordination for qualifying recipients.[48]

Intensive lifestyle interventions

The evidence base from the research community is increasingly demonstrating the value of intensive lifestyle interventions to prevent complications associated with diabetes. The *Look AHEAD Trial* is a long-term, multicenter, randomized clinical trial. It is studying the long-term effects of an intensive lifestyle intervention on major cardiovascular disease events in more than 5,000 overweight or obese patients with type 2 diabetes. Trial participants at 16 clinical centers throughout the country will be followed for a period of up to 13.5 years ending in 2014. NIH, the CDC, and other public and private organizations have sponsored the *Look AHEAD Trial* since 2001. Encouragingly, *Look AHEAD* appears effective in delaying complications associated with diabetes. Early results averaged across four years of the program show that the program produced greater weight loss, increases in fitness, and greater improvements in all cardiovascular risk factors, except LDL-C level, compared with the control group. The lifestyle intervention produced positive changes in glucose control, systolic blood pressure, HDL (good) cholesterol, and triglycerides (blood fats). In addition, the intervention participants achieved lower levels of glucose and blood pressure with a lower need for medication and insulin.[49]

Diabetes-oriented disease management programs

Over the past two decades, health plans' disease management programs have emerged as a tool for improving patient health and reducing health care spending through coordinated interventions in which patients receive information on how best to care for their chronic health problems. In an effort to address the underlying causes of poor health, disease management programs promote behavior change through patient empowerment and education. To effectively engage patients, these programs often rely on data tracking tools that monitor and measure progress towards the achievement of specific goals. Additionally, these programs may coordinate care across settings and employ behavioral science to ensure patients are receiving consistent support and follow-up throughout and after the intervention.

Case Study: Disease Management for Diabetes

UnitedHealth Group's OptumHealth operates a diabetes disease management program for public and private payers, and has demonstrated success with those kinds of interventions. Its high-acuity nurse-driven telephonic program helps improve patients' own management of their condition and prevent progression of the disease to advanced levels. This disease management program reduced inpatient days for people with diabetes participating in the program by about six percent during the 2007 to 2009 period and reduced inappropriate emergency room visits by about 13 percent.[50, 51]

Case Study: Pharmacy Benefit Management for People with Diabetes

UnitedHealth Group's Prescription Solutions Pharmacy Benefits Management company offers a suite of diabetes-focused clinical programs, which identify gaps in therapy that contribute to increased morbidity, mortality, and overall health care costs. For example, a statin initiation program targets patients with diabetes and/or coronary artery disease with no pharmacy claims for a statin, a category of cholesterol-lowering medications that have been shown to prevent cardiovascular events in persons with diabetes. Program interventions include care coordination and support of decision making by health care providers using outreach letters, individualized provider reports listing specific patients who may benefit from initiation or intensification of a statin, and education materials detailing up-to-date clinical guidelines on high cholesterol management. Direct outreach to patients through education materials is also conducted to highlight the benefits of cholesterol-lowering medications, to encourage members to take medications daily, and to appropriately manage other aspects of their conditions. A Prescription Solutions program demonstrated that patients with diabetes and/or coronary artery disease with no pharmacy claims for a statin who received the intervention were 66% more likely to start a statin (in compliance with accepted guidelines) compared to the control group who did not receive the intervention.[52]

Primary care medical homes

In addition to the many novel forms of delivery system redesign already discussed, by helping develop primary care medical homes, health plans are increasingly using primary care payment reform to strengthen the role of primary care. These models incentivize primary care physicians and their teams to provide coordination and management of chronic conditions such as diabetes. Multi-specialty teams help facilitate transitions between care settings, make use of technologies like patient registries and e-prescribing, and are supported in their accountability for their patients' quality and appropriateness of care. UnitedHealthcare is currently piloting a number of primary care medical home models across the country in partnership with physicians; the pilots typically include enhanced incentives for improved diabetes-oriented prevention and care.

Community-based care providers

Implemented in 1996, the Asheville Project relied on pharmacists to help patients adhere to the treatment plan developed in conjunction with their usual primary physician. This included education and support for routine diabetes prevention care, medication adherence, and healthy eating and activity goal-setting. An evaluation of this program found that mean A1c decreased at all follow-ups, with more than 50 percent of patients demonstrating improvements at each visit. The number of patients with optimal A1c values (more than 7 percent) also increased at each follow-up. More than 50 percent showed improvements in lipid levels at every measurement. Annual net cost savings for employers and participants ranged from $1,622 to $3,356.[53] The Midwest Business Group on Health's Diabetes Ten City Challenge also replicated the Asheville model (pharmacists providing private, face-to-face diabetes consultation and coaching) in 10 cities with 27 employers and achieved similar outcomes.

Case Study: UnitedHealth Group's Diabetes Control Program

UnitedHealth Group closely studied the Asheville Project and the Diabetes Ten City Challenge pilots and determined that the model could be effectively replicated and scaled with the goal of producing improved consumer outcomes (e.g., reduced blood pressure, cholesterol and hemoglobin A1c) and a meaningful financial return for employers and payers who include the program in their benefit package. In 2010, UnitedHealth Group introduced a national version of the Asheville pilot called the Diabetes Control Program (DCP). This expansion of the Asheville model is the first scalable health service intervention that targets the population with diabetes using advanced identification tools, a proven clinical intervention and a broad network of well-trained provider pharmacists. As with the DPP, we are implementing the DCP in cooperation with employer groups and health plans, and provide incentives for our own UnitedHealthcare members. The DCP is a prime example of how the United States can use non-physician providers such as pharmacists to support primary care practices and provide continuous and intensive support for people with diabetes, through ongoing education and behavioral interventions, risk factor reduction, health promotion, and detection for early signs of complications.

Value-based insurance designs

Value-based insurance designs (VBID) can be used to encourage patient compliance with evidence-based standards of care through information, incentives (such as reducing or eliminating co-pays), and other behavioral "nudges."

Case Study: UnitedHealth Group's Diabetes Health Plan

Goal: Avoid complications of diabetes through early identification and incentives for compliant behaviors

Diabetes and Prediabetes Screening Model

Identifies diabetes and prediabetes through:

- Historical Claims Analysis
- Health Assessment
- Biometric Screening

UnitedHealth Premium Program

Provides access to UnitedHealth Premium designated physicians and facilities that follow national evidence-based quality of care guidelines and market-based cost-efficiency guidelines

Compliance Requirements

Designed to help consumers modify their behavior, improve health and reduce costs. These include:

- Tracking website with personalized care compliance plans
- Automatic re-enrollment in year two for members who adhere to evidence-based requirements
- Compliance Monitoring System
- Access to the UnitedHealthcare Personal Health Record

Diabetes Specific Benefit

For employees with diabetes and prediabetes. These include:

- Reduced or eliminated physician office out-of-pocket expenses (for diabetes-related visits)
- No charge for selected diabetes self-monitoring training and supplies
- Reduced or eliminated out-of-pocket expenses for certain diabetes-related drugs and drugs prescribed for co-morbid conditions

UnitedHealth Group pioneered the first commercial VBID design focused solely on diabetes, the Diabetes Health Plan™ (DHP). It provides enhanced benefits to people with prediabetes and people with diabetes, in exchange for meeting care compliance goals derived from evidence-based guidelines, including medication, lab services, professional services, and preventive screenings. The DHP approach starts with a screening model using targeted biometric screening to identify patients with diabetes. The program helps navigate patients to physicians with documented success in supporting people with diabetes. Patients also benefit from a unique condition-specific, web-based reminder system that highlights relevant compliance goals. Early results of the DHP program are encouraging from both an enrollment (as an indicator of consumer acceptance) and compliance (as an indicator of outcomes) perspective. Among participating members, compliance with guidelines for diabetes management has risen by 70 percent. More specific compliance improvement results include:

- LDL– improved from five percent to 28 percent.
- HbA1c– improved from 35 percent to 59 percent.
- Cancer screenings: breast cancer screening increased from 57 percent to 80 percent, and colon cancer screening increased from 31 percent to 59 percent.
- Enrollees filled prescriptions for treatment of the clinical features of diabetes (drugs for hyperlipidemia, hypertension) at a greater rate after DHP enrollment than during the prior year.

It should be emphasized that these are early results from what is an innovative experiment. We expect to continue to evolve the model as more data become available.

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Case Study: UnitedHealth Group's Diabetes Health Plan *continued*

Coordinated care for Medicaid and Medicare beneficiaries with diabetes

Medicaid health plans tackle diabetes through enhanced care coordination strategies that use care teams to promote self-management, patient decision-making, participation in interventions and measurement of outcomes. For example, a mandatory Medicaid managed care program in New York has worked to improve the treatment and management of diabetes by monitoring patient HbA1c levels and diabetes lipids. New York's program has demonstrated improvement in the documentation of hemoglobin A1c testing, blood pressure assessments, and foot and eye exams.[54]

Preventive Care in Medicaid Managed Care Versus Fee-for-Service Care in New York State

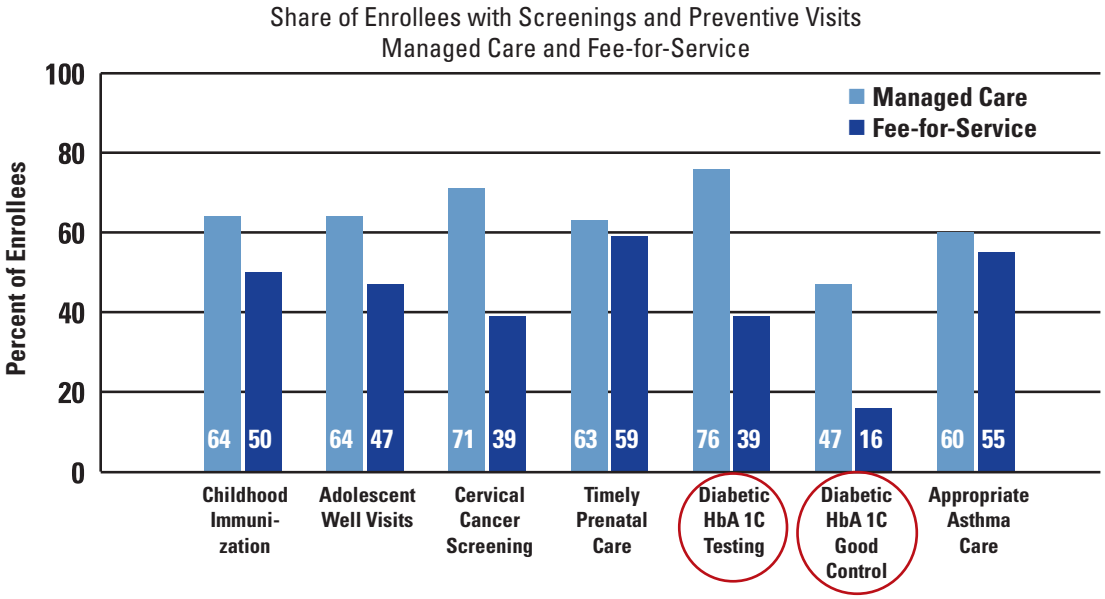

Figure 4.1; Source: New York State Department of Health, November 2008

Case Study: UnitedHealth Group's Medicaid Care Management for People with Diabetes

UnitedHealthcare Community & State, the largest Medicaid health plan in the nation, uses a care management program for high-risk patients with diabetes who need intensive services to help prevent the disease from worsening. This program uses a team approach in which care managers assign enrollees to primary care physicians and develop care plans that are based on evidence-based clinical guidelines and diabetes-specific care information. We proactively identify our Medicaid enrollees with diabetes using predictive modeling, target gaps in care or opportunities for interventions, particularly medication compliance, and focus efforts on individuals with the highest risk of hospitalization.

Similarly, Medicare Advantage plans can help connect beneficiaries with diabetes to appropriate providers and services, using coordination services and extra benefits not covered under traditional Medicare. One such example is a telephonic outreach program in which a registered nurse provides patients with diabetes with educational materials, conducts a telephonic clinical assessment, and regularly follows up with patients to provide coaching. The intervention successfully reduced diabetes-related hospital admissions and medical costs among participating beneficiaries.[55]

At the most intensive end of the spectrum of patient need are diabetes patients who, for example, have end stage renal disease (ESRD), a condition that warrants eligibility for Medicare, but only after a 30-month waiting period among persons with employer-based group coverage. Diabetes is the leading cause of ESRD, a complex and highly costly condition that is almost entirely preventable. In 2006, there were 422,000 patients with ESRD in the Medicare program and 84,000 patients not yet eligible for Medicare, with an overall cost to Medicare alone of $23 billion. The average yearly expenditure in 2006 per person with diabetes and ESRD was $71,233.[56]

Because both quality of life and outcomes in ESRD have been suboptimal, there has been a recent shift to improve quality of care and outcomes using Special Needs Plans (SNPs). These are Medicare managed care plans that use targeted benefit design for chronically ill patients and commonly deploy nurse practitioners and other care extenders/care management professionals in models designed to support ESRD patients. Payments from CMS are tied to quality. Early results have been encouraging, and these SNPs have become an option for ESRD patients in many geographic areas. This model exemplifies how bundled payments can help shift reimbursement from a pure fee-for-service model to an outcomes-based value model.

Case management and specialized network models

People with diabetes with complications are often candidates for so-called "case management," as they are at a high risk for additional adverse physical outcomes and high utilization of health care services. Treatment options for people with diabetes at the far end of the complication spectrum are varied, and often the patient encounters difficulty navigating complex treatment choices. In accessing appropriate care, programs also support patients in choosing complex care networks that use medical centers with demonstrably superior quality processes and outcomes. These can also generate savings, which partly arise from appropriate utilization, fewer complications leading to readmissions, and shorter hospital stays.

Case Study: Specialty Networks for Complex Obesity and Diabetes-Related Treatments

UnitedHealth Group's OptumHealth offers programs for people with diabetes needing transplantation (for ESRD) or other complex care to help them receive high-quality, cost-effective health care. OptumHealth's Kidney Resource Service is a transplant program that provides incentives for the use of high-quality surgical procedures with demonstrated superior outcomes and efficiency. Uncontrolled diabetes is the number one cause of kidney failure in the United States, and was responsible for 44 percent of new cases in 2005 according to the CDC's National Diabetes Fact Sheet. Transplantation is a costly procedure for government payers and employers, and quality and efficiency vary substantially among hospitals.

Similarly, there is mounting evidence that bariatric surgery is a viable treatment alternative for some patients with diabetes and severe obesity. UnitedHealth Group has developed a bariatric surgery program (BRS) to help patients assess how to pursue this course of treatment considering the clinical and economic variability in surgical outcomes. This program provides incentives for the use of high quality surgical procedures with demonstrated outcomes for patients while reducing costs to the health care system. BRS identifies bariatric surgical candidates, steers them to Centers of Excellence, and provides case management support to avoid complications and help maintain weight loss. UnitedHealth Group's data suggest that the use of the highest-performing centers of excellence can save an average $2,377 per procedure on initial costs and an additional $932 per complication.

Chapter 5:
Costs of Inaction, Opportunities for Savings

The costs and health risks associated with diabetes can largely be averted with targeted actions for prevention and compliance. As described in the preceding chapters, specific interventions can help reduce obesity, help prevent progression from prediabetes to diabetes, and minimize health complications.

To illustrate the clinical and financial opportunity in making various diabetes-related interventions available, we entered the outcome parameters of these interventions into a simulation tool that evaluates changes in a hypothetical "real world" setting. Appendix C, Exhibit 8 describes the interventions and clinical outcomes for select populations, with different populations at risk for diabetes or its complications receiving tailored interventions that have been proven to work. We modeled the total opportunity as if the interventions were available to the entire at-risk population in the United States. In other words, we estimated the size of the theoretical opportunity, assuming participants are compliant and adherent and best case outcomes are achieved.

Taken together, our report estimates that these interventions could lead to a 10-year net savings of up to $250 billion and an associated reduction of 10 million people with prediabetes or diabetes. (See Table 5.1.) This would arise from four sets of interventions:

1) Weight Loss Intervention Among People at Risk for Prediabetes and Diabetes

Overweight and obese individuals are at higher risk for prediabetes and type 2 diabetes than those with normal weight. As discussed in Chapter 2, synchronizing low, moderate and intensive lifestyle interventions for all overweight individuals can reduce the prevalence of prediabetes and diabetes. Our simulation suggests that a five percent weight loss (the target recommended by American Heart Association) could reduce prediabetes gradually, leading to a 10 percent reduction by 2020. Some reduction in conversion to diabetes also would occur.

If that happened, almost 10 million people would not develop prediabetes or diabetes over the next 10 years, resulting in $45 billion lower projected health system costs in the coming decade– and a far larger saving over their lifetimes. Of those savings, we estimate that the federal government would realize $23 billion, just over half, mainly for spending under the Medicare program, but also as a reduction in federal subsidy payments for insurance coverage purchased through state exchanges. States would see a reduction of about $1 billion from their share of Medicaid. Privately insured individuals would see savings from their spending on health insurance. (See Appendix C, Exhibit 12). As weight loss programs of this type can also be adopted by individuals with prediabetes or diabetes, we discuss the savings opportunity from similar lifestyle interventions for those populations separately.

2) Potential Savings Opportunity from Reversing Prediabetes

As discussed in Chapter 3, people with prediabetes are at much higher risk for developing full-blown diabetes, so efforts to prevent progression of the disease could lead to substantial cost savings and better population health. The DPP, the national control trial described previously, showed that intensive lifestyle intervention can reduce the incidence of diabetes by 58 percent among this group.[57]

We have developed estimates of the savings opportunity if all U.S. adults with prediabetes were to enroll in the DPP, assuming that the results of that program are replicated. If such risk reduction could be achieved by all prediabetes patients, diabetes prevalence perhaps could be reduced by 8 percent by 2020. We estimate the number of individuals expected to convert from prediabetes to diabetes would be reduced by three million individuals over the next decade, with cumulative health system savings of $105 billion (net of the estimated implementation costs). Of those savings, $61 billion would be realized through savings to the federal government through a reduction in Medicare and Medicaid spending, and exchange subsidies. (See Appendix C, Exhibit 11.)

3) Potential Savings Opportunities from Controlling Diabetes and Managing Complications

Building on the type of interventions described in Chapter 4, we provide new estimates of two diabetes-related interventions. The first is a medical compliance intervention, and the second is an intensive lifestyle intervention focused on weight loss for people with diabetes.

As the Asheville and Ten Cities Challenge studies demonstrated, improved compliance improves outcomes for people with diabetes. A recent meta-analysis of data from 2,247 patients in 16 studies with pharmacist management intervention found a significant reduction in hemoglobin A1c levels, (0.62 percent reduction over controls).[58] Blood cholesterol also is shown to be reduced. Our simulation model suggests that if such a reduction could be achieved among all people with diabetes and was maintained over the 10-year projection period, new medical complications among the diabetes population could be significantly reduced. (See Appendix C, Exhibit 9.)

This in turn would produce estimated health care savings of $34 billion over the next ten years. Savings would accrue from a reduction in the number of diabetes-related complications resulting from improved health status (as measured by a reduction in A1c and LDL levels) among people with diabetes moving from non-compliant to compliant status. Savings to the federal government might be $21 billion over the period.

Lifestyle interventions have also been shown to reduce risks for diabetes complications among diabetes patients. A recent study shows that on average across four years of the trial period, participants who received intensive lifestyle intervention had a greater percentage of weight loss than the control group (–5.7 percent) and greater improvements in hemoglobin A1c level (–0.27 percent), systolic (–2.3 mm Hg) and diastolic (–0.5 mmHg) blood pressure, and levels of high-density lipoprotein cholesterol (1.7 mg/dL) and triglycerides (–5.8 mg/dL).[59] If such improvements could be introduced to all diabetes patients who have overweight and obesity problems, the new cases of diabetes complications could come down significantly, which in turn would reduce costs. Based on our model for the population with diabetes, we estimate $88 billion in health care savings over 10 years. Savings to the federal government might be $53 billion over the period. (See Appendix C, Exhibit 10.)

4) Combined Interventions for At-Risk Populations

Based on the intervention scenarios we modeled for various target populations, we also modeled an "all initiative" scenario where the best available intervention(s) were introduced to at-risk populations accordingly. For example, if overweight and obese diabetes patients received both the pharmacist's management and intensive lifestyle intervention, we assume they would achieve the same glycemic improvement as participants in the former trial, and the weight loss and other risk reductions achieved from the latter. Normal weight diabetes patients would receive only pharmacist management since they are not at risk of weight-related problems, and would see similar benefit from the pharmacist's management scenario.

Our savings estimates account for the net costs of providing the interventions with the assumption, based on our experience, that the costs commonly offset about 30 percent of expected savings in the commercial sector. Depending on the nature and intensity of interventions for diabetes, the population targeted, and the scale of the effort, costs might be higher or lower. (See Appendix D.)

Our simulation model suggests that, as compared to the status quo scenario, the interventions have the potential to reduce diabetic-related complications by about 10 percent by 2020; diabetes prevalence would be reduced by 9 percent by 2020; prediabetes prevalence would be gradually lowered on net by 7 percent by 2020. As a result, we estimate a net reduction of around $250 billion in medical costs ($357 billion gross) and a gain of $239 billion in productivity. (See Appendix C, Exhibit 13.)

Estimated Net Savings Opportunities from Initiatives to Address Obesity, Prediabetes and Diabetes in U.S. Adults, 2011-2020 [60]

	Expected Cumulative Health Care Cost Savings Individuals by Source of Primary Coverage, 2011-2020 [62] *in Billions of Dollars*				
	Private	**Medicaid**	**Medicare**	**Other**	**Total**
People without Diabetes — Lifestyle Intervention (Recommended Weight Loss[61])	16	2	24	2	45
People with Prediabetes — Intensive Lifestyle Intervention like the Diabetes Prevention Plan	29	3	67	5	105
People with Diabetes — Improved Medication Adherence (Asheville & Ten Cities)	9	1	23	1	34
People with Diabetes — Intensive Lifestyle Intervention (Look Ahead)	25	3	57	3	88
All Initiatives *(net of interactions)*	74	9	157	10	250
Reduction in Number of Individuals with Prediabetes and Diabetes, 2020 (in millions)	5.1	0.6	3.2	0.9	9.8

Note: Numbers may not sum to row totals due to rounding.
Table 5.1; Source: UnitedHealth Group modeling, 2010

To estimate the share of diabetes spending incurred by federal and state governments, we first identified total spending for beneficiaries in Medicare and Medicaid using figures from our model, and then further identified spending associated with individuals dually eligible for both programs. We estimated the share of spending paid by the government, rather than beneficiaries. For most Medicare beneficiaries, we estimate that the government contributes about 85 percent of the total costs of their care on average, based in part on analysis from the Medicare Payment and Advisory Commission's June 2010 Data Book on the share of fee-for-service spending by Parts A, B and D and the average beneficiary cost-sharing required under those programs. We made adjustments to account for how those shares would differ in a population with diabetes and subsidies available under the Part D program.

In the case of the dual-eligibles or those eligible for Medicaid assistance with their Medicare cost-sharing only, either all or some of the balance is paid by state Medicaid programs. Medicaid pays additional amounts for services not covered by Medicare. We based our estimate of the split of Medicare and Medicaid payments for dual-eligibles on data provided by the Kaiser Family Foundation in a recent report analyzing the cost of chronic conditions for this population.[63] Our projections for the federal share of Medicaid spending account for higher federal matching rates for the Medicaid population that will be used to reimburse states for covering individuals newly eligible for Medicaid under PPACA's Medicaid expansion.

We undertook a second analysis to estimate the share of federal subsidies that will be provided to individuals in 2014 under state exchanges that could add to the health care costs of diabetes and prediabetes. Federal subsidy amounts will likely reflect the cost of private health insurance coverage offered through the exchange marketplace, and therefore will include costs related to diabetes and prediabetes in the population. We first divided our estimated spending for diabetes and prediabetes in the privately insured population by estimates of private national health expenditures to get a share of private health insurance spending related to diabetes and prediabetes. We applied that share to the annual projection for federal spending on exchange subsidies developed by the Congressional Budget Office to approximate the share of projected subsidy spending that reflects the costs of diabetes in the population. We assumed that the percentage of the population expected to be covered through the exchange with diabetes or prediabetes would be similar to the share of diabetes in the commercial population, based on our estimates on diabetes prevalence among the uninsured.

In developing our savings estimates, we followed a similar logic in attributing our savings by total costs for individuals by category of primary insurance coverage to federal and state governments. Results are shown in Table 5.2.

Estimated Savings Opportunities for Initiatives to Address Obesity, Prediabetes, Diabetes in U.S. Adults, by Public Payers, 2011-2020

	Expected Net Health Care Cost Savings by Payer, 2011-2020 *in Billions of Dollars*				
	Federal	**State**	**Total Public**	**% System Savings**	**Health System**
People without Diabetes — Lifestyle Intervention (Recommended Weight Loss[64])	23	1	24	53%	45
People with Prediabetes — Intensive Lifestyle Intervention like the Diabetes Prevention Plan	61	3	64	61%	105
People with Diabetes — Improved Medication Adherence (Asheville & Ten Cities)	21	1	22	63%	34
People With Diabetes — Intensive Lifestyle Intervention (Look Ahead)	53	2	55	62%	88
All Initiatives *(net of interactions)*	144	6	150	60%	250

Table 5.2; Source: UnitedHealth Group modeling, 2010

Our analysis of savings opportunities shows that the federal government in particular stands to benefit from initiatives to reduce the prevalence of prediabetes and diabetes: an estimated 58 percent of net savings would accrue to the federal government. Most of those savings would be to Medicare (which would see savings of $130 billion), though some would also be realized by state Medicaid programs and through lower exchange subsidy payments. Savings to Medicare may depend on investments in preventing prediabetes and diabetes for the under-65 population. An important challenge to consider is that those who pay for "upstream" interventions often do not reap the rewards of those investments. Similarly for low-income individuals cycling in and out of Medicaid, finding ways to provide consistent care management and funding for interventions would be beneficial. In Chapter 6 we discuss key public policy recommendations that could help with these challenges.

In summary, there is now an important emerging evidence base about interventions that can reduce the risk of diabetes and its complications. Applying them broadly has the potential not only to save lives and improve health, but to significantly reduce the costs of diabetes-related care.

Chapter 6:
Selected Public Policy Recommendations

Many health promoting and potentially cost-saving intervention strategies depend on voluntary participation of individuals most likely to benefit. In this context, it is likely that a wide variety of environmental and social factors will influence the degree to which support for those interventions will result in optimal results. To support broader action to tackle prediabetes and diabetes, a number of policy changes could potentially make a positive contribution and simultaneously enhance the overall benefit of health system-based strategies. These could include:

1. Strengthen resources for public awareness. The established link between obesity, prediabetes, and diabetes is generally not well understood by the public, nor is the ability to effectively manage these conditions. A broad campaign at the national or state level akin to anti-smoking campaigns could focus on describing the clinical chain of obesity, prediabetes and type 2 diabetes. It could additionally offer data on prevalence, outcomes and information on how individuals can avoid or control these conditions. A comprehensive campaign could help spur positive behavior change at multiple levels, ranging from screening, improved health actions, and enrollment in appropriate intervention programs.

2. The United States Preventive Services Taskforce should examine evidence for prediabetes screening. The USPSTF currently recommends targeted testing for diabetes only among adults with hypertension or at high risk for cardiovascular disease. With cost-effective and evidence-based diabetes prevention programs rapidly becoming more available in community settings, there may be greater benefit now than ever before from clinical efforts to identify high risk persons with prediabetes who could benefit most from these new preventive services.

3. Use predictive analytics in the meantime to help identify the population with prediabetes, in combination with patient outreach. New risk identification models and support for the wider team of health professionals and staff can help expand targeted screening. Identifying at-risk individuals with advanced analytics helps employers and health plans improve the wellness of their populations. Medicare and Medicaid should also make use of this emerging science.

4. Expand the evidence base for diabetes care and treatments through comparative effectiveness research. While there are a number of effective treatments for diabetes, there are many unanswered questions that physicians and patients face daily. These include:

- What are the optimal combinations of medications for patients with different combinations of risk factors?
- What are the best ways to monitor the progression of diabetes and intensify care in a timely way?
- What are the best strategies to manage diabetes among patients with multiple chronic conditions?
- What are the best strategies to promote patient education and healthier lifestyles among patients with low literacy levels?
- How should community-based and clinical interventions work together to optimize population health?
- What are the best ways to broadly disseminate new research findings into practice more quickly?

These and myriad other questions demonstrate the need for comparative effectiveness research. AHRQ and the Patient Centered Outcome Research Institute (PCORI) should ensure these questions are appropriately prioritized.

5. Ensure reimbursement for evidence-based diabetes interventions in federal health programs. Both the DPP and the DCP have credible clinical trials supporting the interventions and private sector applications that further support the effectiveness of these solutions. Coverage of these interventions as a FFS-reimbursed benefit for individuals with prediabetes and diabetes in Medicare and Medicaid could make substantial progress to reduce the diabetes risk and health costs for the populations in those programs.

6. Update CMS-approved diabetes screening options to include a HbA1c test as recommended by the American Diabetes Association. The A1c test is the only test option that does not require an overnight fast, and it is currently used routinely by healthcare providers to monitor the status of patients who already have diabetes. For these reasons, this is becoming a preferred test for diagnosis by many health care providers.

7. Raise reimbursement levels for primary care providers for evidence-based diabetes prevention and care. Physicians and other providers who actively engage in diabetes prevention and control activities should receive additional funding for those activities with funding released as a share of savings from improved "upstream" care, perhaps through patient-centered medical homes or other similar payment reform models. These typically pay physicians higher amounts for the provision of high-quality care, and for their leadership in ensuring their patients receive appropriate and efficient care more broadly.

8. Create new reimbursement models for community-based providers. Public and private payers should encourage new models of care for populations with prediabetes and diabetes. In Medicare and Medicaid, solutions could be pursued that reimburse trained "extenders" such as the Y lifestyle coaches and retail pharmacists in community settings for the delivery of DPP and DCP benefits, using funding from shared savings from improved "upstream" care.

9. Employ incentives to strengthen employer wellness programs. PPACA includes new provisions that allow financial incentives tied to health status to go up to 30 percent of the cost of employee coverage. The Secretaries of Labor and Health and Human Services have the ability to increase wellness rewards to 50 percent of the cost of coverage. Where needed, this should be available to promote diabetes prevention and diabetes management.

10. Provide incentives for consumers to participate. Getting consumer participation in health interventions is a significant and ongoing challenge. Just as private sector payers have created value-based insurance designs that encourage participation, policymakers should consider doing the same for fee-for-service Medicare and Medicaid. Enrollees in the new state exchanges should also see meaningful financial incentives to stay healthy or to maintain compliance with chronic care treatment programs. Mandated or incentive-based consumer models will drive appropriate adoption rates and meaningful health and cost reduction outcomes.

11. Maintain continuity of care for people with diabetes. It is important for people with diabetes to maintain a consistent source of care that is coordinated to ensure they can most effectively manage their conditions. This is particularly an issue for low-income enrollees in Medicaid programs where enrollees lose eligibility due to fluctuations in their income. State Medicaid programs could adopt continuous eligibility for six months or longer to improve continuity of care for this population. New health insurance exchanges should adopt strong incentives for eligible individuals to enroll in coverage at the start of the year and then stay continuously enrolled.

12. Deploy network models in Medicare for complex case management. The cost of network-based interventions such as Centers of Excellence for complex case management is low relative to the savings opportunity, and provides a strong incentive for payers and employers to pursue similar initiatives. For people with diabetes with complications this model promotes high-achieving hospitals and the opportunity to manage intensively the course of this disease and reduce net spending.

Appendix A: Clinical Definitions

Overweight and Obesity are commonly used to refer to individuals with excess fat. More formally, overweight and obesity refer to increased body weight in relation to height compared with some standard of acceptable weight. Body mass index (BMI), most commonly used to classify overweight and obesity in medicine and epidemiology, is expressed as weight/height (kg/m2). Adults with a BMI greater than or equal to 25 are considered overweight, those greater than or equal to 30 are considered obese and those greater than or equal to 40 are considered extremely obese.

Prediabetes is a condition in which individuals have blood glucose levels that are higher than normal, but not high enough to be classified as diabetes.

According to the American Diabetes Association, prediabetes is diagnosed when:

- the fasting blood glucose is between 100 and 125 mg/dL (IFG); and
- the two-hour glucose is between 140 and 199 mg/dL (IGT), or when the A1c is between 5.7 and 6.4 percent.

Between 33 percent and 65 percent of those with IFG or IGT will go on to develop type 2 diabetes within six years, compared to less than five percent of those with normal blood glucose.[65]

Diabetes mellitus, more commonly known as **diabetes**, is a group of metabolic diseases characterized by hyperglycemia, or high blood sugar, resulting from the body not producing enough insulin or not responding properly to the insulin that is produced.

The two most common forms of diabetes include:[66]

- **Type 1 Diabetes.** This form of diabetes, which accounts for only five to 10 percent of those with diabetes, (previously known by the terms insulin-dependent diabetes), or juvenile-onset diabetes, results from a cellular-mediated autoimmune destruction of the cells of the pancreas.
- **Type 2 Diabetes.** This form of diabetes, which accounts for 90–95 percent of those with diabetes, (previously also referred to as non–insulin-dependent diabetes, or adult-onset diabetes), encompasses individuals who have insulin resistance and usually have relative – rather than absolute – insulin deficiency. At least initially, and often throughout their lifetime, these individuals do not need insulin treatment to survive.

The American Diabetes Association currently recommends three tests to identify diabetes mellitus: 1) blood glucose concentration following an overnight fast; 2) blood glucose concentration collected two hours after drinking a standard glucose drink; or 3) the hemoglobin A1c test (a test the reflects the average blood glucose concentration over a eight to 10 week period). The A1c test is the only test option that does not require an overnight fast, and it is already used routinely by health care providers to monitor the status of patients who already have diabetes. For these reasons, this is becoming a preferred test for diagnosis by many health care providers.

Appendix B:
Methodology for Estimating Current and Future Burden of Diabetes (with and without interventions)

Overview

The purpose of this analysis is to investigate the future prevalence and cost of diabetes that will likely be experienced by Americans in the period between 2010 and 2020. Historical trends from economic and epidemiological literature form the evidence base upon which projections are built. Using this evidence base we are able to predict (1) trends in prevalence and cost, assuming historical trends prevail, and (2) trends in prevalence and cost in the context of improved prevention and management of diabetes.

Exhibit 1 below illustrates the building blocks and main assumptions of the estimation.

Exhibit 1. Model Components by Model Scenarios

Model Determinants[67]	Baseline Diabetes Projection with Trending	Diabetes Projection with Interventions
1. Population age structure	Census Projection	Census Projection
2. Medicare/Medicaid beneficiary population projection	CBO projection	CBO projection
3. Diabetes prevalence rates by population segments	Rate increases that reflect the momentum of prediabetes and type 2 diabetes onset due to recent obesity trend	Interventions that are shown to have the potential to reduced the onset of diabetes or its complications
4. Health care utilization attributed to diabetes	Age-gender specific utilization rates (e.g., number of hospitalization, emergency room visits, outpatients and office visits per diabetes patient per year) remain constant to 2007 level	Age-gender specific utilization rates increase over time; potential reduced complication rate
5. Foregone productivity attributed to diabetes	Age-gender specific loss productivity measure (e.g., number of absent days, early mortality) remain constant to 2007 level[68]	Age-gender specific productivity trend mirrors the trend in health care utilizations among at risk population
6. Costs for attributed health care utilizations	Nominal cost increase over time mirroring national health expenditure increase	Nominal cost increase over time mirroring national health expenditure increase

Baseline diabetes projection

Our baseline projection addresses the research question, "What would be the size and costs of the diabetes problem in the next 10 years if the population continues to age and the diabetes prevalence rate continues to grow without major change in intervention and medical technology?" To answer this question, we combine recently published literature on the costs of diabetes with population projections by the U.S. Census Bureau.

We established a baseline for diabetes prevalence and costs in the American population over a 10-year period between 2010 and 2020 and split the prevalence and costs along the following dimensions:

- Four types of diabetes – Type 1 Diabetes Mellitus (T1DM), Type 2 Diabetes Mellitus (T2DM), Undiagnosed Diabetes Mellitus (UDM), Prediabetes (PD)
- Medical (direct costs) and non-medical (absenteeism and presenteeism)
- Eight age groups, (<18, 18-34, 35-44, 45-54, 55-59, 60-64, 65-69, and 70 and above)
- Gender (male or female)
- Four race/ethnicity categories (non-Hispanic white, non-Hispanic black, non-Hispanic other, Hispanic)
- Insurance coverage (Commercial, Medicare, Medicaid, and no insurance)

Data and methods

Adapting the **Costs of Diabetes Model** developed for the published and peer reviewed "Economic Costs of Diabetes in the U.S. in 2007" study, we tracked the combinations of the above dimensions over a 10-year period. The Costs of Diabetes Model was originally developed with funding from the American Diabetes Association (ADA) to provide estimates of the national burden associated with diagnosed diabetes in 2007. The model was later expanded to estimate the national burden associated with diagnosed T1DM, T2DM, UDM, PD, and gestational diabetes. For this study we have further expanded the model to provide more refined estimates of the national costs, and to provide estimates of likely future costs under alternate diabetes prevention and management scenarios. The model consists of the following components of estimates in determining future outcomes, including:

1. Change in population age composition, often referred to as population aging in the U.S. context
2. Prevalence rates within segments of population that are driven by etiological factors (e.g., obesity rate) other than population aging
3. Health care utilization among patients group that are attributed to diabetes, across different type of diabetes
4. Medical and nonmedical costs incurred by diabetes patient population due to their use of healthcare services and foregone loss in productivity

Prevalence estimates

Under the baseline scenario, there are mainly two driving forces for increase in diabetes prevalence over time. Even with constant diabetes prevalence and complication rates (at the 2007 level) for population strata defined by age, gender, and ethnicity, the overall prevalence will continue to increase due to the change in population age structure toward a greater concentration of older Americans, a phenomenon called population aging. On top of that, a continuous rise in overweight and obesity during past decades continues to increase the risk of developing diabetes.

A brief overview of the data and methods in estimating prevalence rates by demographic and diabetes type/stage for 2007 is provided below.[69] Estimates come from the following data sources:

- **The 2004-2006 National Health Interview Survey** (NHIS). The NHIS sampling frame is the non-institutionalized U.S. population. Using responses to the question "Other than during pregnancy, have you EVER been told by a doctor or health professional that you have diabetes or sugar diabetes?" we calculate prevalence rates for diagnosed diabetes by patient demographic. The NHIS also contains information to identify respondents' primary medical insurer, which we use to calculate the proportion of diagnosed diabetes cases in each demographic group insured by Medicare.
- **The 2004 National Nursing Home Survey** (NNHS). We used the NNHS to supplement the NHIS by calculating diagnosed diabetes prevalence rates by demographic group among the institutionalized population. The NNHS contains patient diagnoses (ICD-9 codes) indicating the medical conditions of the nursing home residents. We use these codes to estimate prevalence rates for T1DM (codes 250.x1 or 250.x3) and for T2DM (codes 250.x0 or 250.x2). Demographic group uses estimates of the proportion of the U.S. population institutionalized, by demographic group, to combine prevalence rates for the institutionalized and non-institutionalized populations into overall diagnosed diabetes prevalence rates.
- **The 2003-2006 National Health and Nutrition Examination Survey** (NHANES). The NHANES is a stratified random sample of the non-institutionalized population in the U.S. In addition to collecting information via survey, a subset of NHANES respondents are asked to provide clinical information, including glucose levels collected from a fasting plasma glucose (FPG) test or an Oral Glucose Tolerance Test (OGTT). Respondents report whether they "have ever been told by a doctor or health professional that they have diabetes or sugar diabetes," and by combining responses to this question with FPG and OGTT results, we can calculate prevalence rates for UDM and PD by demographic group. Applying these prevalence rates to the current U.S. population produces national estimates of total cases of T1DM, T2DM, UDM, and PD.

To estimate the trend in age-gender specific prevalence rate for prediabetes and type 2 diabetes, we conducted a simulation that follows the 2003-2006 NHANES snapshot sample as a starting population for 10 years. The simulation suggest that the prevalence rates (existing cases plus incidence cases) are higher across all age and gender groups as compared to the baseline year, ranging from 7 percent higher than the 2007 level in 2010 to 28 percent higher in 2020. Similarly, prediabetes rates are 10 percent higher than the 2007 level in 2010 and 39 percent higher in 2020.

Cost estimates

The costs attributable to diabetes are mainly driven by two forces: the complications diabetes patients have and the medical costs in treating these conditions. Average annual medical spending per patient was based on the published estimates by Lewin researchers. A brief overview of the data and method for deriving the annual cost as a snapshot is provided below. Our cost projection consists of consecutive snapshots of annual diabetes costs between 2010 and 2020.

Diabetes increases the risk for neurological symptoms, peripheral vascular disease, cardiovascular disease, renal complications, endocrine/metabolic complications, ophthalmic complications, and other complications. Even people with elevated glucose levels below the threshold for diabetes are at increased risk for cardiovascular disease, renal complications, peripheral vascular disease, neurological complications, endocrine complications, and other conditions.

The model used an attributable risk approach to quantify the proportion of health care use for conditions associated with diabetes. Further, the model calculated etiological fractions by combining estimates of disease prevalence with "rate ratios" that reflect annual health care utilization for people with a condition (i.e., T1DM, T2DM, UDM, PD) compared to people without that condition. We analyzed the following data sources to calculate rate ratios by demographic (age and sex), setting (inpatient, emergency, and ambulatory), and diabetes complication group:

- We use the **2006 Ingenix MCURE** database and the **2006 Medicare 5 percent Sample File** to quantify differences in health care utilization for people with T1DM and T2DM compared to people with no indication of diabetes. MCURE is used to model utilization patterns for the population under age 65, while the Medicare 5 percent Sample is used to model utilization for the age 65 and older population.

- To model health care use patterns for people with UDM and PD, we use Ingenix data containing three years of medical claims for a population of 3.5 million adults continuously insured from January 1, 2004 to December 31, 2006. The population is primarily commercially insured through UnitedHealth Group, although the database contains beneficiaries of other commercial and public insurers. Because the UDM population (by definition) cannot be identified directly, we identified a proxy population consisting of people within two years of first diagnosis with diabetes. Specifically, we identified people first diagnosed with diabetes in 2006 (n=29,770) and then compared their health care use in 2004 and 2005 to patients with no history of diabetes between 2004 and 2006 (n= 3.2 million). To model healthcare utilization associated with PD, we used multivariate Poisson regression analysis to quantify differences in patterns of utilization by people who had a fasting plasma glucose (FPG) in 2004, and compared their health care use patterns in 2005 and 2006 to people with no indication of PD.

We multiplied national estimates of health care use (by demographic, setting, and chronic condition) by the calculated etiological fractions to estimate the proportion of national health care utilization by people with PD, UDM, T1DM, and T2DM in excess of utilization that would likely occur with diabetes. Data sources analyzed to estimate national utilization and national medical expenditures include the following:

- The **2004-2005 Nationwide Inpatient Sample** to estimate total inpatient days and hospital costs;
- The **2003-2005 National Ambulatory Medical Care Survey** to estimate total physician office visits;
- The **2003-2005 National Hospital Ambulatory Medical Care Survey** to estimate total emergency and outpatient visits;
- The **2000 National Home and Hospice Care Survey** to estimate total hospice visits;
- The **2004 National Nursing Home Survey** to estimate total days in long-term and short-term nursing facilities; and
- The **2003-2005 Medical Expenditure Panel Survey** to estimate average per annum usage for other health care services (e.g., home health care, podiatric care) and products (e.g., pharmaceuticals and medical supplies), as well as average medical cost per health care event (e.g., per visit).

Estimates of average medical expenditures per unit of service from the Nationwide Inpatient Sample and Medical Expenditure Panel Survey were calculated by patient age and include all sources of payments (e.g., paid by insurer and self pay). To estimate medical expenditures to the Medicare program we calculated the proportion of payments for the age 65 and older population.

Productivity

The estimates on the value of lost productivity associated with full-blown diabetes also come from published statistics based on the Costs of Diabetes Model we developed. As a brief summary, we calculate the number of Full Time Equivalent workdays lost due to increased absenteeism and reduced performance at work (presenteeism), and the years of lost work due to chronic disability and premature mortality. The productivity loss for people employed in the workforce is calculated by combining age-sex-specific estimates of workforce participation rates (estimated from the 2006 NHIS), average earnings (from the Bureau of Labor Statistics), and the size of the population with diabetes. The cost per person not working per day is calculated using average daily earnings for those working. SSI payments are not included in the cost estimate, as this is considered a transfer payment (i.e., a cost to one person is a benefit to another person).

Absenteeism and presenteeism. People with diabetes may have higher rates of health-related absenteeism than their peers without diabetes. A synthesis of the published literature found that people with diabetes had a health-related absenteeism rate that was, on average, 0.8 percent higher than people without diabetes (equivalent to 1.9 workdays per worker with diabetes per year). To determine productivity loss associated with UDM we extrapolate productivity loss from the DDM population to the UDM population controlling for differences in demographics and the prevalence and severity of chronic health problems.

Disability. The cost estimates for diabetes-related disability are based on the estimated disability cases that would qualify for social security supplemental insurance (SSI) payments—a conservative assumption. We identify these cases using the 2004–2006 NHIS, and use multivariate logistic regression (results not shown) to compare rates of disability by diagnosed diabetes status controlling for other factors hypothesized to be correlated with the likelihood of receiving disability payments. The rate of people unable to work because of diabetes-related disability increases with age.

Mortality. We combine CDC data for 2004 on cause of death, etiological fractions derived from several sources, and estimates of total diabetes cases in 2004 by age and sex to estimate mortality rates for diabetes-attributed deaths from renal disease, cerebrovascular disease, and cardiovascular disease (as well as directly from diabetes). We extrapolate these rates to the 2007 population using the growth in number of diabetes cases between 2004 and 2007. Individuals with prediabetes may also have incurred excessive productivity loss.[70] According to a DPP study, participants in the different intervention groups reported similar time lost from school, work, or usual activities as a result of diabetes-related visits, illness, or injury. The loss averaged $2,600 in the three-year period between 1999 and 2001, roughly $1,200 per year in 2010 dollars after adjusting for inflation using the All Urban CPI.

Cost breakdown by primary source of coverage

Economic costs were further broken down by insurance coverage status (i.e., commercial, Medicare, Medicaid and no insurance). We use the term commercial in this section to refer to private sources of coverage, including employer-sponsored and individual coverage. Figures on the privately insured include people receiving employer-sponsored benefits through the Federal Employees Health Benefits Plan and the TRICARE program. For a snapshot of 2007, we used the distribution of diabetes patients observed in NHANES, a national survey. We pooled NHANES waves from 1999 to 2008 to increase sample size. NHANES data could not distinguish between type 1 and type 2 diabetes. Therefore the same race-gender-age specific distributions are used for both types.

Health care reform will likely have different impacts over time on individuals' insurance coverage status. We model the movements between insurance coverage based on the Congressional Budget Office's (CBO) August 2010 baseline enrollment projections for Medicare and Medicaid and estimates of changes in health insurance coverage in its estimate of the Patient Protection and Affordable Care Act.

Exhibit 2. Baseline Diabetes Projection (All Segments of Adult Population Combined)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Type 2														
Total Population (Millions)	227	230	232	235	238	240	243	245	247	250	252	255	257	260
Disease Cases (Millions)	17.2	17.9	18.6	19.3	20.1	20.8	21.6	22.5	23.4	24.3	25.2	26.2	27.2	28.2
Disease Prevalence	7.6%	7.8%	8.0%	8.2%	8.4%	8.7%	8.9%	9.2%	9.4%	9.7%	10.0%	10.3%	10.6%	10.8%
Medical costs ($Billions)	$110	$119	$130	$140	$151	$164	$180	$202	$224	$249	$274	$301	$331	$363
Productivity loss ($Billion)	$56	$60	$65	$70	$75	$81	$87	$98	$107	$117	$127	$138	$149	$161
Medical cost per case	$6,430	$6,653	$6,974	$7,270	$7,517	$7,862	$8,294	$9,003	$9,589	$10,231	$10,864	$11,504	$12,196	$12,899
Type 1														
Total Population (Millions)	227	230	232	235	238	240	243	245	247	250	252	255	257	260
Disease Cases (Millions)	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Disease Prevalence	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Medical costs ($Billions)	$4	$4	$4	$5	$5	$5	$6	$6	$7	$7	$8	$9	$9	$10
Productivity loss ($Billion)	$2	$3	$3	$3	$3	$4	$4	$5	$6	$6	$7	$8	$9	$10
Medical cost per case	$9,394	$9,761	$10,272	$10,754	$11,167	$11,739	$12,457	$13,602	$14,585	$15,665	$16,762	$17,879	$19,075	$20,310
Undiagnosed Diabetes														
Total Population (Millions)	227	230	232	235	238	240	243	245	247	250	252	255	257	260
Disease Cases (Millions)	6.5	6.7	7.0	7.2	7.5	7.8	8.1	8.5	8.8	9.2	9.5	9.8	10.2	10.5
Disease Prevalence	2.9%	2.9%	3.0%	3.1%	3.2%	3.3%	3.4%	3.5%	3.6%	3.7%	3.8%	3.9%	3.9%	4.1%
Medical costs ($Billions)	$12	$13	$14	$15	$16	$17	$19	$21	$23	$26	$28	$31	$34	$37
Productivity loss ($Billion)	$7	$8	$8	$9	$10	$11	$12	$14	$15	$17	$19	$20	$22	$25
Medical cost per case	$1,797	$1,860	$1,951	$2,037	$2,107	$2,195	$2,309	$2,501	$2,657	$2,830	$3,003	$3,175	$3,358	$3,542
Prediabetes														
Total Population (Millions)	227	230	232	235	238	240	243	245	247	250	252	255	257	260
Disease Cases (Millions)	59.7	62.0	64.4	66.8	69.3	71.9	74.5	77.2	80.1	83.0	86.1	89.2	92.4	95.7
Disease Prevalence	26.3%	27.0%	27.7%	28.4%	29.2%	29.9%	30.7%	31.5%	32.4%	33.2%	34.1%	35.0%	35.9%	36.8%
Medical costs ($Billions)	$27	$29	$31	$34	$36	$40	$43	$49	$54	$60	$66	$72	$79	$87
Productivity loss ($Billion)	$72	$77	$84	$91	$97	$105	$114	$128	$141	$156	$171	$187	$204	$222
Medical cost per case	$446	$462	$486	$508	$526	$551	$581	$632	$674	$720	$764	$808	$856	$905

Exhibit 3. Baseline Diabetes Projection (Commercially Insured Population)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Type 2														
Total Population (Millions)	136	135	131	126	131	132	134	145	147	149	151	153	152	152
Disease Cases (Millions)	6.8	6.9	6.9	6.8	7.3	7.5	7.8	8.6	9.0	9.3	9.7	10.0	10.2	10.4
Disease Prevalence	5.0%	5.1%	5.3%	5.4%	5.6%	5.7%	5.8%	6.0%	6.1%	6.3%	6.4%	6.6%	6.7%	6.8%
Medical costs ($Billions)	$31	$33	$35	$36	$40	$43	$47	$56	$62	$69	$76	$82	$89	$95
Productivity loss ($Billion)	$34	$36	$37	$38	$42	$45	$49	$58	$64	$71	$77	$84	$90	$97
Medical cost per case	$4,656	$4,827	$5,071	$5,296	$5,481	$5,723	$6,023	$6,526	$6,940	$7,390	$7,814	$8,238	$8,693	$9,148
Type 1														
Total Population (Millions)	136	135	131	126	131	132	134	145	147	149	151	153	152	152
Disease Cases (Millions)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3
Disease Prevalence	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Medical costs ($Billions)	$1	$1	$1	$1	$1	$2	$2	$2	$2	$2	$2	$3	$3	$3
Productivity loss ($Billion)	$1	$2	$2	$2	$2	$2	$2	$2	$2	$3	$3	$3	$3	$3
Medical cost per case	$5,721	$5,951	$6,269	$6,572	$6,819	$7,119	$7,498	$8,138	$8,677	$9,262	$9,815	$10,366	$10,950	$11,533
Undiagnosed Diabetes														
Total Population (Millions)	136	135	131	126	131	132	134	145	147	149	151	153	152	152
Disease Cases (Millions)	2.7	2.8	2.7	2.7	2.9	3.0	3.1	3.4	3.6	3.7	3.8	4.0	4.0	4.1
Disease Prevalence	2.0%	2.0%	2.1%	2.2%	2.2%	2.3%	2.3%	2.4%	2.4%	2.5%	2.5%	2.6%	2.6%	2.7%
Medical costs ($Billions)	$5	$5	$5	$5	$6	$6	$7	$8	$9	$10	$11	$12	$13	$14
Productivity loss ($Billion)	$5	$5	$5	$6	$6	$7	$7	$9	$10	$11	$12	$13	$13	$14
Medical cost per case	$1,688	$1,755	$1,847	$1,935	$2,007	$2,096	$2,207	$2,395	$2,551	$2,720	$2,881	$3,042	$3,215	$3,388
Prediabetes														
Total Population (Millions)	136	135	131	126	131	132	134	145	147	149	151	153	152	152
Disease Cases (Millions)	32.6	33.4	33.1	32.8	34.9	36.1	37.6	41.6	43.3	45.0	46.7	48.3	49.3	50.4
Disease Prevalence	24.1%	24.7%	25.4%	26.0%	26.7%	27.3%	28.0%	28.7%	29.4%	30.2%	30.9%	31.6%	32.4%	33.1%
Medical costs ($Billions)	$12	$13	$13	$14	$15	$17	$18	$22	$24	$27	$29	$32	$34	$37
Productivity loss ($Billion)	$39	$41	$43	$45	$49	$53	$58	$69	$77	$85	$93	$101	$109	$117
Medical cost per case	$373	$387	$407	$425	$440	$460	$484	$524	$558	$594	$629	$662	$699	$734

Exhibit 4. Baseline Diabetes Projection (Medicare and Medicaid Dual-Eligible Population)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Type 2														
Total Population (Millions)	6	7	7	7	7	7	7	8	8	8	8	8	9	9
Disease Cases (Millions)	2.0	2.1	2.2	2.3	2.5	2.6	2.7	2.8	3.0	3.1	3.2	3.4	3.5	3.7
Disease Prevalence	31.6%	32.3%	33.1%	33.8%	34.6%	35.3%	36.0%	36.8%	37.5%	38.3%	39.2%	40.0%	40.8%	41.7%
Medical costs ($Billions)	$15	$16	$18	$20	$21	$23	$26	$29	$33	$36	$40	$44	$49	$54
Productivity loss ($Billion)	$4	$4	$5	$5	$6	$6	$7	$7	$8	$9	$10	$11	$12	$13
Medical cost per case	$7,458	$7,704	$8,063	$8,393	$8,665	$9,045	$9,525	$10,320	$10,970	$11,684	$12,391	$13,102	$13,870	$14,645
Type 1														
Total Population (Millions)	6	7	7	7	7	7	7	8	8	8	8	8	9	9
Disease Cases (Millions)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Disease Prevalence	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Medical costs ($Billions)	$0	$0	$0	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1
Productivity loss ($Billion)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Medical cost per case	$15,637	$16,215	$17,037	$17,805	$18,462	$19,383	$20,537	$22,375	$23,917	$25,610	$27,341	$29,086	$30,956	$32,859
Undiagnosed Diabetes														
Total Population (Millions)	6	7	7	7	7	7	7	8	8	8	8	8	9	9
Disease Cases (Millions)	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8
Disease Prevalence	7.0%	7.2%	7.4%	7.5%	7.7%	8.0%	8.2%	8.4%	8.6%	8.8%	9.0%	9.1%	9.3%	9.5%
Medical costs ($Billions)	$1	$1	$1	$1	$1	$1	$1	$2	$2	$2	$2	$2	$3	$3
Productivity loss ($Billion)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Medical cost per case	$1,851	$1,907	$1,994	$2,075	$2,139	$2,219	$2,328	$2,515	$2,664	$2,832	$3,006	$3,179	$3,361	$3,543
Prediabetes														
Total Population (Millions)	6	7	7	7	7	7	7	8	8	8	8	8	9	9
Disease Cases (Millions)	1.5	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.4	2.5	2.6	2.7	2.9
Disease Prevalence	23.2%	23.7%	24.3%	24.9%	25.6%	26.3%	27.0%	27.7%	28.4%	29.1%	29.9%	30.7%	31.5%	32.3%
Medical costs ($Billions)	$1	$1	$1	$1	$1	$1	$2	$2	$2	$2	$3	$3	$3	$4
Productivity loss ($Billion)	$2	$2	$2	$2	$3	$3	$3	$4	$4	$4	$5	$5	$6	$7
Medical cost per case	$637	$659	$691	$720	$744	$777	$818	$887	$943	$1,004	$1,063	$1,123	$1,187	$1,251

Exhibit 5. Baseline Diabetes Projection (Medicaid Eligible Population)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Type 2														
Total Population (Millions)	11	11	12	13	13	13	12	19	23	27	27	28	28	29
Disease Cases (Millions)	0.5	0.6	0.7	0.7	0.7	0.7	0.7	1.1	1.4	1.6	1.7	1.8	1.9	1.9
Disease Prevalence	5.1%	5.3%	5.4%	5.5%	5.6%	5.7%	5.8%	5.9%	6.1%	6.2%	6.3%	6.5%	6.6%	6.7%
Medical costs ($Billions)	$2	$3	$3	$3	$3	$3	$3	$6	$7	$9	$10	$11	$12	$13
Productivity loss ($Billion)	$3	$3	$3	$3	$3	$3	$3	$6	$8	$10	$11	$12	$13	$14
Medical cost per case	$4,352	$4,512	$3,791	$3,959	$4,096	$4,276	$4,499	$4,874	$5,182	$5,517	$5,832	$6,147	$6,485	$6,822
Type 1														
Total Population (Millions)	11	11	12	13	13	13	12	19	23	27	27	28	28	29
Disease Cases (Millions)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Disease Prevalence	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Medical costs ($Billions)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Productivity loss ($Billion)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1	$1	$1	$1
Medical cost per case	$4,747	$4,924	$5,173	$5,406	$5,595	$5,836	$6,139	$6,654	$7,085	$7,553	$7,994	$8,432	$8,899	$9,365
Undiagnosed Diabetes														
Total Population (Millions)	11	11	12	13	13	13	12	19	23	27	27	28	28	29
Disease Cases (Millions)	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5
Disease Prevalence	1.2%	1.3%	1.3%	1.3%	1.4%	1.4%	1.4%	1.4%	1.5%	1.5%	1.6%	1.6%	1.6%	1.7%
Medical costs ($Billions)	$0	$0	$0	$0	$0	$0	$0	$1	$1	$1	$1	$1	$1	$1
Productivity loss ($Billion)	$0	$0	$0	$0	$0	$0	$0	$1	$1	$1	$1	$1	$1	$2
Medical cost per case	$1,518	$1,575	$1,655	$1,731	$1,792	$1,871	$1,969	$2,135	$2,271	$2,420	$2,560	$2,700	$2,851	$3,001
Prediabetes														
Total Population (Millions)	11	11	12	13	13	13	12	19	23	27	27	28	28	29
Disease Cases (Millions)	1.5	1.7	1.9	2.1	2.1	2.1	2.0	3.3	4.0	4.8	5.1	5.3	5.5	5.7
Disease Prevalence	14.6%	15.0%	15.3%	15.7%	16.1%	16.4%	16.8%	17.2%	17.6%	18.1%	18.5%	19.0%	19.4%	19.9%
Medical costs ($Billions)	$1	$1	$1	$1	$1	$1	$1	$2	$2	$3	$3	$3	$4	$4
Productivity loss ($Billion)	$2	$2	$2	$3	$3	$3	$3	$5	$7	$9	$10	$11	$12	$13
Medical cost per case	$347	$359	$377	$394	$407	$425	$447	$484	$514	$547	$578	$609	$642	$675

Exhibit 6. Baseline Diabetes Projection (Medicare and Dual-Eligible Population)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Type 2														
Total Population (Millions)	44	45	46	47	48	49	51	53	55	56	58	59	61	63
Disease Cases (Millions)	8.2	8.6	8.9	9.3	9.7	10.2	10.8	11.4	12.0	12.6	13.3	13.9	14.6	15.3
Disease Prevalence	18.7%	19.1%	19.5%	19.9%	20.3%	20.7%	21.1%	21.6%	22.1%	22.5%	23.0%	23.5%	23.9%	24.4%
Medical costs ($Billions)	$69	$74	$81	$88	$94	$103	$114	$131	$146	$163	$181	$201	$223	$247
Productivity loss ($Billion)	$12	$13	$14	$15	$17	$18	$20	$23	$26	$29	$32	$35	$38	$42
Medical cost per case	$8,397	$8,667	$9,065	$9,429	$9,707	$10,110	$10,622	$11,432	$12,126	$12,894	$13,656	$14,422	$15,258	$16,100
Type 1														
Total Population (Millions)	44	45	46	47	48	49	51	53	55	56	58	59	61	63
Disease Cases (Millions)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Disease Prevalence	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Medical costs ($Billions)	$2	$2	$3	$3	$3	$3	$3	$4	$4	$5	$5	$5	$6	$7
Productivity loss ($Billion)	$0	$0	$0	$0	$0	$0	$0	$0	$1	$1	$1	$1	$1	$1
Medical cost per case	$21,162	$21,843	$22,850	$23,775	$24,415	$25,460	$26,785	$28,660	$30,419	$32,398	$34,446	$36,514	$38,803	$41,130
Undiagnosed Diabetes														
Total Population (Millions)	44	45	46	47	48	49	51	53	55	56	58	59	61	63
Disease Cases (Millions)	2.9	3.1	3.2	3.3	3.5	3.7	3.9	4.1	4.3	4.5	4.7	4.9	5.2	5.4
Disease Prevalence	6.7%	6.9%	7.0%	7.2%	7.3%	7.5%	7.6%	7.8%	7.9%	8.1%	8.2%	8.3%	8.5%	8.6%
Medical costs ($Billions)	$6	$6	$7	$7	$8	$9	$10	$11	$12	$14	$15	$17	$18	$20
Productivity loss ($Billion)	$0	$1	$1	$1	$1	$1	$1	$1	$2	$2	$2	$2	$3	$3
Medical cost per case	$1,970	$2,029	$2,121	$2,207	$2,275	$2,359	$2,474	$2,673	$2,831	$3,009	$3,195	$3,379	$3,573	$3,767
Prediabetes														
Total Population (Millions)	44	45	46	47	48	49	51	53	55	56	58	59	61	63
Disease Cases (Millions)	15.5	16.2	16.9	17.7	18.5	19.6	20.7	22.0	23.2	24.5	25.8	27.3	28.7	30.3
Disease Prevalence	35.2%	36.1%	37.0%	37.9%	38.7%	39.7%	40.7%	41.6%	42.6%	43.6%	44.7%	45.8%	47.0%	48.2%
Medical costs ($Billions)	$11	$12	$13	$14	$15	$16	$18	$21	$23	$26	$29	$33	$36	$40
Productivity loss ($Billion)	$19	$20	$22	$24	$26	$29	$32	$37	$41	$46	$51	$57	$63	$70
Medical cost per case	$688	$711	$745	$776	$800	$834	$877	$947	$1,005	$1,069	$1,131	$1,193	$1,260	$1,327

Exhibit 7. Baseline Diabetes Projection (Uninsured Population)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Type 2														
Total Population (Millions)	36	38	43	49	46	46	45	28	23	18	16	15	15	16
Disease Cases (Millions)	1.5	1.6	2.0	2.5	2.3	2.4	2.4	1.3	1.0	0.7	0.5	0.4	0.5	0.6
Disease Prevalence	4.2%	4.4%	4.7%	5.0%	5.0%	5.1%	5.2%	4.5%	4.2%	3.7%	3.3%	3.0%	3.3%	3.5%
Medical costs ($Billions)	$7	$8	$11	$14	$13	$14	$15	$10	$9	$7	$7	$7	$8	$9
Productivity loss ($Billion)	$7	$8	$11	$14	$14	$15	$15	$10	$9	$8	$7	$7	$8	$9
Medical cost per case	$4,584	$4,766	$5,350	$5,583	$5,780	$6,018	$6,318	$7,649	$8,919	$11,178	$13,074	$15,312	$15,448	$15,796
Type 1														
Total Population (Millions)	36	38	43	49	46	46	45	28	23	18	16	15	15	16
Disease Cases (Millions)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Disease Prevalence	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Medical costs ($Billions)	$0	$0	$0	$1	$1	$1	$1	$0	$0	$0	$0	$0	$0	$0
Productivity loss ($Billion)	$0	$1	$1	$1	$1	$1	$2	$2	$2	$3	$3	$4	$5	$5
Medical cost per case	$4,494	$4,716	$5,161	$5,562	$5,661	$5,886	$6,146	$6,081	$6,251	$6,382	$6,507	$6,626	$7,142	$7,640
Undiagnosed Diabetes														
Total Population (Millions)	36	38	43	49	46	46	45	28	23	18	16	15	15	16
Disease Cases (Millions)	0.7	0.7	0.9	1.0	1.0	1.0	1.0	0.7	0.6	0.5	0.5	0.5	0.5	0.5
Disease Prevalence	1.9%	1.9%	2.0%	2.1%	2.1%	2.1%	2.2%	2.4%	2.6%	2.9%	3.0%	3.2%	3.2%	3.3%
Medical costs ($Billions)	$1	$1	$1	$2	$2	$2	$2	$1	$1	$1	$1	$1	$1	$2
Productivity loss ($Billion)	$1	$2	$2	$3	$3	$3	$3	$3	$3	$3	$4	$4	$5	$6
Medical cost per case	$1,527	$1,594	$1,706	$1,807	$1,859	$1,937	$2,031	$2,130	$2,243	$2,364	$2,471	$2,576	$2,742	$2,906
Prediabetes														
Total Population (Millions)	36	38	43	49	46	46	45	28	23	18	16	15	15	16
Disease Cases (Millions)	9.9	10.6	12.4	14.2	13.8	14.1	14.2	10.4	9.5	8.8	8.5	8.3	8.8	9.2
Disease Prevalence	27.3%	28.0%	28.6%	29.2%	30.0%	30.6%	31.3%	37.1%	41.7%	48.8%	53.1%	57.1%	57.7%	58.6%
Medical costs ($Billions)	$3	$4	$4	$5	$5	$6	$6	$5	$4	$4	$4	$4	$5	$5
Productivity loss ($Billion)	$12	$13	$16	$19	$19	$21	$22	$17	$17	$16	$17	$17	$19	$21
Medical cost per case	$321	$335	$360	$382	$392	$408	$427	$441	$461	$482	$503	$523	$556	$587

Appendix C: Estimates of Impacts of Alternative Intervention Strategies

To illustrate the clinical and cost-savings opportunities in making available various diabetes interventions to the overall American adult population, we input the outcomes observed in previous trials of each of the interventions into the HPMM that we used to construct our baseline estimates. We analyzed the effects of interventions related to weight loss, intensive lifestyle intervention based on the DPP experience, improved compliance based on the DCP experience, and an intensive lifestyle intervention based on the Look Ahead program. The results show the post-intervention results for each approach separately and combined if we were to make them available to the U.S. adult population at-risk for prediabetes and diabetes. Figures do not include numbers for type 1 diabetes as our interventions do not target that condition.

Exhibit 8. Intervention Scenarios Modeled by Targeted At-Risk Population

Interventions*	No Intervention	Weight Loss	Intensive Lifestyle Intervention (DPP)	Improved Compliance (Pharmacist's Management)	Intensive Lifestyle Intervention (Look Ahead)	All Initiatives
Diabetic (normal weight)						
BMI	0	0	0	0	0	0
BP	0	0	0	0	0	0
Cholesterol	0	0	0	-2.5%		-2.5%
A1c	0	0	0	-0.62%		-0.62%
Diabetic (overweight or obese)						
BMI	0	0	0	0	-5.27%	-5.27%
BP	0	0	0	0	-2.36 mg/dL	-2.36 mg/dL
Cholesterol	0	0	0	-2.5%	-4.25%	-4.25%
A1c	0	0	0	-0.62%	-0.27%	-0.62%
Triglyceride	0	0	0	0	-5.81 mg/dL	-5.81 mg/dL
Prediabetic						
BMI	0	0	-5%	0	0	-5%
FPG	0	0	-5 mg/dL	0	0	-5 mg/dL
Non-diabetic (normal weight)						
BMI	0	0	0	0	0	0
Non-diabetic, (overweight or obese)						
BMI	0	-5%	0	0	0	-5%

**100% at risk population*
Full benefits illustrated in the trials
Full participation among at risk population
No recidivism in period beyond the original period

Exhibit 9. Type 2 Diabetes Costs Under Status Quo and Improved Compliance Among Diabetes Scenarios

			Prevalence		Health Costs Attributable to Diabetes		Productivity Costs Attributable to Diabetes	
			2010	2020	2010	10 year proj (2011-2020)	2010	10 year proj (2011-2020)
Total	Baseline (Adults Only)	Prediabetics	66,844,262	95,660,160	$34	$585	$91	$1,526
		Type 2 Diabetics	26,559,203	38,693,118	$155	$2,692	$80	$1,306
		Total	93,403,465	134,353,278	$189	$3,278	$170	$2,832
	Opportunity (Adults Only)	Prediabetics	66,844,262	95,660,160	$34	$585	$91	$1,526
		Type 2 Diabetics	26,559,203	38,693,118	$155	$2,644	$80	$1,280
		Total	93,403,465	134,353,278	$189	$3,229	$170	$2,806
Commercial	Baseline (Adults Only)	Prediabetics	32,838,674	50,372,973	$14	$256	$45	$809
		Type 2 Diabetics	9,552,765	14,473,872	$41	$756	$44	$778
		Total	42,391,439	64,846,845	$55	$1,011	$88	$1,587
	Opportunity (Adults Only)	Prediabetics	32,838,674	50,372,973	$14	$256	$45	$809
		Type 2 Diabetics	9,552,765	14,473,872	$41	$742	$44	$764
		Total	42,391,439	64,846,845	$55	$998	$88	$1,573
Medicaid	Baseline (Adults Only)	Prediabetics	2,090,613	5,723,930	$1	$22	$3	$77
		Type 2 Diabetics	908,190	2,404,708	$3	$86	$3	$91
		Total	2,998,803	8,128,638	$4	$108	$6	$168
	Opportunity (Adults Only)	Prediabetics	2,090,613	5,723,930	$1	$22	$3	$77
		Type 2 Diabetics	908,190	2,404,708	$3	$84	$3	$89
		Total	2,998,803	8,128,638	$4	$106	$6	$166
Medicare	Baseline (Adults Only)	Prediabetics	17,669,738	30,317,434	$14	$258	$24	$452
		Type 2 Diabetics	12,629,202	20,745,221	$95	$1,738	$16	$298
		Total	30,298,940	51,062,654	$109	$1,996	$40	$750
	Opportunity (Adults Only)	Prediabetics	17,669,738	30,317,434	$14	$258	$24	$452
		Type 2 Diabetics	12,629,202	20,745,221	$95	$1,706	$16	$293
		Total	30,298,940	51,062,654	$109	$1,964	$40	$745

Exhibit 10. Type 2 Diabetes Costs Under Status Quo and Intensive Lifestyle Intervention Among Diabetes Scenarios

			Prevalence		Health Costs Attributable to Diabetes		Productivity Costs Attributable to Diabetes	
			2010	2020	2010	10 year proj (2011-2020)	2010	10 year proj (2011-2020)
Total	Baseline (Adults Only)	Prediabetics	66,844,262	95,660,160	$34	$585	$91	$1,526
		Type 2 Diabetics	26,559,203	38,693,118	$155	$2,692	$80	$1,306
		Total	93,403,465	134,353,278	$189	$3,278	$170	$2,832
	Opportunity (Adults Only)	Prediabetics	66,844,262	95,660,160	$34	$585	$91	$1,526
		Type 2 Diabetics	26,559,203	38,693,118	$155	$2,567	$80	$1,239
		Total	93,403,465	134,353,278	$189	$3,152	$170	$2,765
Commercial	Baseline (Adults Only)	Prediabetics	32,838,674	50,372,973	$14	$256	$45	$809
		Type 2 Diabetics	9,552,765	14,473,872	$41	$756	$44	$778
		Total	42,391,439	64,846,845	$55	$1,011	$88	$1,587
	Opportunity (Adults Only)	Prediabetics	32,838,674	50,372,973	$14	$256	$45	$809
		Type 2 Diabetics	9,552,765	14,473,872	$41	$720	$44	$741
		Total	42,391,439	64,846,845	$55	$976	$88	$1,550
Medicaid	Baseline (Adults Only)	Prediabetics	2,090,613	5,723,930	$1	$22	$3	$77
		Type 2 Diabetics	908,190	2,404,708	$3	$86	$3	$91
		Total	2,998,803	8,128,638	$4	$108	$6	$168
	Opportunity (Adults Only)	Prediabetics	2,090,613	5,723,930	$1	$22	$3	$77
		Type 2 Diabetics	908,190	2,404,708	$3	$81	$3	$86
		Total	2,998,803	8,128,638	$4	$104	$6	$164
Medicare	Baseline (Adults Only)	Prediabetics	17,669,738	30,317,434	$14	$258	$24	$452
		Type 2 Diabetics	12,629,202	20,745,221	$95	$1,738	$16	$298
		Total	30,298,940	51,062,654	$109	$1,996	$40	$750
	Opportunity (Adults Only)	Prediabetics	17,669,738	30,317,434	$14	$258	$24	$452
		Type 2 Diabetics	12,629,202	20,745,221	$95	$1,656	$16	$284
		Total	30,298,940	51,062,654	$109	$1,914	$40	$736

Exhibit 11. Type 2 Diabetes Costs Under Status Quo and Intensive Lifestyle Intervention Among Prediabetes Scenarios

			Prevalence		Health Costs Attributable to Diabetes		Productivity Costs Attributable to Diabetes	
			2010	2020	2010	10 year proj (2011-2020)	2010	10 year proj (2011-2020)
Total	Baseline (Adults Only)	Prediabetics	66,844,262	95,660,160	$34	$585	$91	$1,526
		Type 2 Diabetics	26,559,203	38,693,118	$155	$2,692	$80	$1,306
		Total	93,403,465	134,353,278	$189	$3,278	$170	$2,832
	Opportunity (Adults Only)	Prediabetics	66,844,262	98,631,840	$34	$595	$91	$1,552
		Type 2 Diabetics	26,559,203	35,721,438	$155	$2,533	$80	$1,220
		Total	93,403,465	134,353,278	$189	$3,128	$170	$2,773
Commercial	Baseline (Adults Only)	Prediabetics	32,838,674	50,372,973	$14	$256	$45	$809
		Type 2 Diabetics	9,552,765	14,473,872	$41	$756	$44	$778
		Total	42,391,439	64,846,845	$55	$1,011	$88	$1,587
	Opportunity (Adults Only)	Prediabetics	32,838,674	51,484,584	$14	$259	$45	$819
		Type 2 Diabetics	9,552,765	13,362,261	$41	$711	$44	$731
		Total	42,391,439	64,846,845	$55	$969	$88	$1,550
Medicaid	Baseline (Adults Only)	Prediabetics	2,090,613	5,723,930	$1	$22	$3	$77
		Type 2 Diabetics	908,190	2,404,708	$3	$86	$3	$91
		Total	2,998,803	8,128,638	$4	$108	$6	$168
	Opportunity (Adults Only)	Prediabetics	2,090,613	5,908,615	$1	$23	$3	$79
		Type 2 Diabetics	908,190	2,220,023	$3	$80	$3	$85
		Total	2,998,803	8,128,638	$4	$103	$6	$164
Medicare	Baseline (Adults Only)	Prediabetics	17,669,738	30,317,434	$14	$258	$24	$452
		Type 2 Diabetics	12,629,202	20,745,221	$95	$1,738	$16	$298
		Total	30,298,940	51,062,654	$109	$1,996	$40	$750
	Opportunity (Adults Only)	Prediabetics	17,669,738	31,910,693	$14	$266	$24	$466
		Type 2 Diabetics	12,629,202	19,151,961	$95	$1,635	$16	$280
		Total	30,298,940	51,062,654	$109	$1,900	$40	$747

Exhibit 12. Type 2 Diabetes Costs Under Status Quo and Weight Loss Among Non-Diabetics Scenarios

			Prevalence		Health Costs Attributable to Diabetes		Productivity Costs Attributable to Diabetes	
			2010	2020	2010	10 year proj (2011-2020)	2010	10 year proj (2011-2020)
Total	Baseline (Adults Only)	Prediabetics	66,844,262	95,660,160	$34	$585	$91	$1,526
		Type 2 Diabetics	26,559,203	38,693,118	$155	$2,692	$80	$1,306
		Total	93,403,465	134,353,278	$189	$3,278	$170	$2,832
	Opportunity (Adults Only)	Prediabetics	66,844,262	86,379,089	$34	$551	$91	$1,438
		Type 2 Diabetics	26,559,203	38,154,883	$155	$2,662	$80	$1,290
		Total	93,403,465	124,533,972	$189	$3,214	$170	$2,728
Commercial	Baseline (Adults Only)	Prediabetics	32,838,674	50,372,973	$14	$256	$45	$809
		Type 2 Diabetics	9,552,765	14,473,872	$41	$756	$44	$778
		Total	42,391,439	64,846,845	$55	$1,011	$88	$1,587
	Opportunity (Adults Only)	Prediabetics	32,838,674	45,485,723	$14	$241	$45	$762
		Type 2 Diabetics	9,552,765	14,272,536	$41	$747	$44	$769
		Total	42,391,439	59,758,258	$55	$988	$88	$1,531
Medicaid	Baseline (Adults Only)	Prediabetics	2,090,613	5,723,930	$1	$22	$3	$77
		Type 2 Diabetics	908,190	2,404,708	$3	$86	$3	$91
		Total	2,998,803	8,128,638	$4	$108	$6	$168
	Opportunity (Adults Only)	Prediabetics	2,090,613	5,168,587	$1	$21	$3	$72
		Type 2 Diabetics	908,190	2,371,257	$3	$85	$3	$90
		Total	2,998,803	7,539,844	$4	$106	$6	$162
Medicare	Baseline (Adults Only)	Prediabetics	17,669,738	30,317,434	$14	$258	$24	$452
		Type 2 Diabetics	12,629,202	20,745,221	$95	$1,738	$16	$298
		Total	30,298,940	51,062,654	$109	$1,996	$40	$750
	Opportunity (Adults Only)	Prediabetics	17,669,738	27,375,998	$14	$243	$24	$425
		Type 2 Diabetics	12,629,202	20,456,647	$95	$1,719	$16	$295
		Total	30,298,940	47,832,645	$109	$1,961	$40	$720

Exhibit 13. Type 2 Diabetes Costs Under Status Quo and All Initiatives Intervention Scenarios

			Prevalence		Health Costs Attributable to Diabetes		Productivity Costs Attributable to Diabetes	
			2010	2020	2010	10 year proj (2011-2020)	2010	10 year proj (2011-2020)
Total	Baseline (Adults Only)	Prediabetics	66,844,262	95,660,160	$34	$585	$91	$1,526
		Type 2 Diabetics	26,559,203	38,693,118	$155	$2,692	$80	$1,306
		Total	93,403,465	134,353,278	$189	$3,278	$170	$2,832
	Opportunity (Adults Only)	Prediabetics	66,844,262	89,350,769	$34	$561	$91	$1,464
		Type 2 Diabetics	26,559,203	35,183,203	$155	$2,359	$80	$1,129
		Total	93,403,465	124,533,972	$189	$2,921	$170	$2,593
Commercial	Baseline (Adults Only)	Prediabetics	32,838,674	50,372,973	$14	$256	$45	$809
		Type 2 Diabetics	9,552,765	14,473,872	$41	$756	$44	$778
		Total	42,391,439	64,846,845	$55	$1,011	$88	$1,587
	Opportunity (Adults Only)	Prediabetics	32,838,674	46,597,334	$14	$244	$45	$772
		Type 2 Diabetics	9,552,765	13,160,924	$41	$662	$44	$681
		Total	42,391,439	59,758,258	$55	$906	$88	$1,453
Medicaid	Baseline (Adults Only)	Prediabetics	2,090,613	5,723,930	$1	$22	$3	$77
		Type 2 Diabetics	908,190	2,404,708	$3	$86	$3	$91
		Total	2,998,803	8,128,638	$4	$108	$6	$168
	Opportunity (Adults Only)	Prediabetics	2,090,613	5,353,272	$1	$21	$3	$74
		Type 2 Diabetics	908,190	2,186,573	$3	$74	$3	$79
		Total	2,998,803	7,539,844	$4	$96	$6	$153
Medicare	Baseline (Adults Only)	Prediabetics	17,669,738	30,317,434	$14	$258	$24	$452
		Type 2 Diabetics	12,629,202	20,745,221	$95	$1,738	$16	$298
		Total	30,298,940	51,062,654	$109	$1,996	$40	$750
	Opportunity (Adults Only)	Prediabetics	17,669,738	28,969,257	$14	$250	$24	$439
		Type 2 Diabetics	12,629,202	18,863,388	$95	$1,521	$16	$261
		Total	30,298,940	47,832,645	$109	$1,772	$40	$700

Appendix D: Approaches to Measuring Costs of Interventions

Intervention programs that help patients improve their health and better comply with medical treatment have costs which can vary depending on their intensity and complexity. Given the considerable uncertainties about actual costs, we have drawn on cost data from those programs that UnitedHealth Group operates as well as published third-party data. Nevertheless these costs estimates should be regarded as illustrative and provisional.

The following simplified example shows the potential savings and variation from different approaches, which assume replication the results of the DPP control trial.

We present the case of 100 people with prediabetes and look at the difference in spending for enrolling in the intervention and not enrolling. If those 100 do not enroll in the DPP, we would expect 11 percent to develop diabetes each year; after three years, 30 would be have diabetes and 70 would continue to have prediabetes. If those same 100 people with prediabetes enrolled in the lifestyle intervention, we would expect only five percent to develop diabetes each year; after three years, 15 would be diabetic and 85 would continue to have prediabetes.

Using UnitedHealth Group data regarding the difference in cost between a person with diabetes who is free of complications versus the rest of the population, the intervention would result in a gross savings of approximately $120,000 over the three-year period. With an average DPP intervention cost of $400 per individual over this period, this savings would be offset by a $40,000 ($100 x 400) program cost representing 33 percent of the gross savings.

A variation on this approach would be a model that offers both the intervention and a financial incentive for participation. As an example, if we provided an additional incentive of $200 per individual in order for them to participate in the lifestyle intervention then our total cost would be $600 per individual or $60,000 in total (which would then bring our investment up to 50 percent of the total savings).

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61 Various research bodies—including the American Dietetic Association, the American Heart Association, and the National Institutes of Health, with its national obesity guidelines—recommend aiming for conservative weight loss of five percent to 10 percent of a person's current body weight. It is achievable and can result in significant improvements in their health risks.

62 Numbers may not add up to totals due to rounding.

63 Kasper, J., Watts, M.O. & Lyons, B. (2010). Chronic Disease and Co-Morbidity Among Dual Eligibles: Implications for Patterns of Medicaid and Medicare Service Use and Spending. Kaiser Commission on Medicaid and the Uninsured. Issue Paper. (Retrieved from http://www.kff.org/medicaid/upload/8081.pdf.)

64 Various research bodies—including the American Dietetic Association, the American Heart Association, and the National Institutes of Health, with its national obesity guidelines—recommend aiming for conservative weight loss of 5 percent to 10 percent of a person's current body weight. It is achievable and can result in significant improvements in their health risks.

65 Geiss, L.S., James, C., Gregg, E.W., Albright, A., Williamson, D.F., & Cowie, C.C. (2010). Diabetes Risk Reduction Behaviors Among U.S. Adults with Prediabetes. *American Journal of Preventive Medicine, 38,* 4, 403-409. DOI: 10.1016/j.amepre.2009.12.029. (http://www.ajpm-online.net/article/S0749-3797(10)00009-7/abstract)

66 American Diabetes Association (2010). Position Statement: Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care, 33,* Suppl 1, S5-S10. DOI: 10.2337/diacare.27.2007.S5.

67 Model determinants are all age-gender specific unless otherwise stated.

68 Detailed data and methods for 2007 level estimates are described in Dall, et al (2008, 2009, & 2010) and Zhang et al (2009): Dall T.M., Zhang Y., et al.", 2007, Cost associated with overweight and obesity, high alcohol consumption, and tobacco use within the military health system's TRICARE Prime enrolled population, *American Journal of Health Promotion*, Vol. 22, No. 2, 120-139.

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69 Estimates come from the following data sources:
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- Innovative approaches to universal coverage and health benefits, grounded in evidence-based care and consumer engagement
- Reducing health disparities, particularly in underserved communities
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- Payment reform strategies that better support physicians, hospitals and other providers in delivering high quality patient-centered care
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