The Impact of Diabetes on Aging Texas Well:
Costs of Medicaid Long Term Care Attributable to Diabetes

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Purpose: Strategic planning for public health is informed by knowledge of disease, by epidemiology, by the availability of interventions that prevent or modify disease, and by an understanding of the costs and benefits associated with those interventions. To the extent that long-term care (LTC) costs are avoidable through the use of effective prevention or early detection and intervention, those costs are relevant to strategic planning. The purpose in this paper is to offer relevant data from the Texas Department of Human Services (TDHS) LTC program area to help further inform the discussion of strategic planning for the prevention and treatment of Type 2 diabetes. While it is possible to estimate both immediate and long-term costs of disease using a variety of models and data sources, TDHS LTC data, particularly data that are compiled from the federally mandated Minimum Data Set (MDS) assessments of nursing facility residents, can provide additional confirmation of or alternatives to conclusions that might be drawn from national data or small scientific studies.

Introduction: Type 2 diabetes is an emerging global epidemic of non-communicable disease (Zimmet, 2001). Its increasing prevalence among Texans, particularly among younger Texans, threatens large increases in future healthcare spending. A significant part of that spending will be devoted to long-term care. Because obesity is a significant risk factor for the development of Type 2 diabetes and because diabetic complications typically develop over a 20- to 30-year timeframe, there is opportunity to implement interventions that can mitigate or avoid the health consequences and economic burden of this epidemic. A recurring issue in strategic planning for public funding of healthcare is the relative merit (cost benefit ratio) of interventions in what appears to be *zero-sum game*. That is, all healthcare interventions, whether for prevention or treatment, have associated costs and compete for essentially the same available public funding. Funding new initiatives means that other initiatives receive less funding.

The cost modeling approach used in this paper assumes that there will be no revolutionary cure for diabetes over the interval of time for which projections are made. The projections themselves examine a variety of scenarios including: 1) the trend in disease prevalence continues as it has the past decade, and 2) the disease prevalence remains at the level that is today. Additionally, costs are projected across all prevalence levels between 0% and 50%. The purpose of these scenarios is to compare the likely costs of *doing nothing* that we do not already do today with the costs of implementing highly effective interventions that would decrease the prevalence of Type 2 diabetes (Narayan, Gregg, Fagot-Campagna, Engelgau, Vinicor, 2000).

Because of the long timeframe between the diagnosis of Type 2 diabetes and the emergence of its most severe complications, it is instructive to examine health consequences and healthcare costs among a cohort of diabetics who have already developed those complications. In this paper, we examine a specific cost component, the healthcare costs borne by the Medicaid program for institutional LTC, attributable to diabetes. We also consider related Medicaid expenses such as the cost of medications and that portion of acute care costs due to recipients of LTC who are covered by Medicaid.

For most residents, nursing facility institutionalization represents the end of a long chain of events resulting in end-organ injuries whose disabling effects can no longer be effectively ameliorated by their social support systems. That is, most diabetics enter nursing facilities because of the complications of diabetes rather than because of the diagnosis of diabetes itself and because it is no longer possible to manage the disability resulting from those complications otherwise.

Background of the Disease: The patient characteristics most associated with the development of diabetes are obesity (Zimmet, online), age (Harris, Flegal, Cowie, et al., 1998), and minority ethnicity (Carter, Pugh & Monterrosa, 1996). Until the last two decades, Type 2 diabetes was distinctly uncommon among the young. Previously known as *adult-onset diabetes* or non-insulin dependent diabetes (NIDDM), Type 2 diabetes was formerly a disease that primarily affected older adults and increased in prevalence with advancing age. It was strongly related to decreasing muscle mass and increasing body fat. Insulin resistance and glucose intolerance were precursors frequently observed prior to the onset of frank diabetes. Today, 90-95% of all diabetes is estimated to be Type 2 disease (National Diabetes Information Clearinghouse, 1999). An estimated 98% of diabetics 45 years or older have Type 2 disease. Some authors estimate that one in four North Americans over the age of 45 will have Type 2 diabetes by the year 2004 (Stanford Hospital & Clinics, 2001). Today, sixty-five percent of diabetic individuals younger than 45 have Type 2 disease. As Type 2 diabetes becomes more prevalent among the young, a larger percentage of diabetes among those younger than 45 will be Type 2.

During the last decade, Type 2 diabetes among the young has become increasingly common. A study conducted from 1985-1994 in Chicago found a 9% annual rise in the incidence of Type 2 diabetes among African American and Hispanic children aged 0-17 years (Keenan, Walsh, Grover, Alva, Onyemere, Lipton, 2000). The incidence of Type 1 (juvenile) diabetes remained constant during that decade whereas the incidence of Type 2 diabetes more than doubled. Among minorities, diabetes is not only more common but also appears at an earlier age and accounts for a disproportionate number of complications at a younger age (Worley, Lalonde, Kerr, Benavente, Hart, 1998) and (Pugh, Medina, Cornell, Basu, 1995). Hispanics, Blacks and Native Americans are the ethnic groups most affected.

The most dramatic complications of diabetes are consequences of damage to the vascular system; both small (micro-vascular) and medium-sized (macro-vascular) vessels are affected. The organs most frequently and dramatically affected by micro-vascular changes are the eyes and kidneys. The sites most frequently affected by macro-vascular disease are the heart, brain and the lower extremities. While any organ can be affected, the sites listed above account for a majority of the disability resulting from diabetic complications. Diabetes is the leading cause of blindness, kidney failure and leg amputations in adults. Stroke, heart attack, congestive heart failure and hypertension are all seen more commonly among diabetics. A significant fraction of the prevalence of these *target conditions* is a direct consequence of diabetes; that is, diabetes is the cause.

Relevant MDS Data: TDHS uses Minimum Data Set (MDS) resident assessment data to calculate quality indicators for nursing facilities in order to report facility-specific ratings based on resident outcomes. The MDS is a federally mandated uniform resident assessment performed quarterly on all nursing facilities residents in Medicare or Medicaid-certified nursing facilities. The MDS resident assessment instrument includes a section (Section I1) for reporting the presence or absence of 43 chronic medical conditions. Only two items from Section I1 (schizophrenia and bi-polar illness) are currently used in quality indicator calculations themselves. By design, quality indicator calculations ignore the assessments of Medicare short-stay residents. Thus, the only residents included in the quality indicator result set are long-term care residents.

For the analysis described here, a subset of nine MDS Section I1 conditions were identified as target conditions closely associated with diabetes. These conditions commonly result in disabilities that challenge an individual’s social supports to provide adequate care without institutionalization. The target conditions considered in this analysis were the following: congestive heart failure (CHF), atherosclerotic heart disease (ASHD), other cardiovascular diseases, loss of limb (amputation), stroke (CVA), aphasia, hemiplegia or hemiparesis, retinopathy, and renal failure.

Some conditions such as retinopathy and renal failure were included because diabetes is their most common cause. Others such as hemiplegia and aphasia were included because they commonly result from stroke, and diabetes is a major contributor to stroke. While our list of nine diabetic end-organ injuries does not identify every possible diabetic complication that could lead to institutionalization, it does include those MDS Section I1 conditions that are most closely related to diabetes. Most of these conditions are also associated with risk factors other such as smoking, hypercholesterolemia and hypertension. Rather than attempt to explore the effects of those risk factors as well, the analysis here simply examines diabetics and non-diabetics in order to estimate the etiologic fraction of these conditions that is attributable to diabetes.

The following analysis is based on MDS Section I1 data for residents who were included in the quality indicator result set for the first quarter of calendar year 2000. The 73,004 residents considered in this analysis were either Medicaid residents or private-pay residents residing in certified nursing facilities. None were Medicare short-stay residents.

Scope of the Problem

The following tables provide a snapshot of the scope of diabetes in Texas in FY2000. Table 1 shows the overall and ethnic-group-specific prevalence of diabetes and each target condition in the cohort of nursing facility residents detailed above.

Table 1. Prevalence (%) of Diabetes and Target Conditions by Ethnicity

Condition	Overall (N=72,995)	American Indian or Alaskan Native (N=239)	Asian or Pacific Islander (N=207)	Black non-Hispanic (N=7,619)	Hispanic (N=8,204)	White non-Hispanic (N=56,675)
Diabetes	21.8	26.8	24.6	32.8	37.3	18.1
Atherosclerotic Heart Disease	11.0	9.6	9.2	9.8	10.8	11.2
Congestive Heart Failure	23.5	21.8	19.3	22.2	19.3	24.3
Other Cardiovascular Disease	17.1	17.2	11.1	15.7	16.0	17.4
Missing Limbs	2.5	3.8	0.5	6.7	5.2	1.6
Aphasia	3.4	1.7	7.2	5.4	4.8	2.9
Cerebrovascular Accident	24.0	25.9	35.3	33.7	28.1	22.0
Hemiplegia or Hemiparesis	8.5	13.0	20.8	12.9	13.7	7.0
Retinopathy	0.4	0.4	0.0	0.7	1.1	0.3
Renal Failure	3.5	4.6	5.8	7.1	6.2	2.6

The prevalence of diabetes in Texas nursing facilities mirrors the prevalence of the disease in the non-institutionalized population of comparable age. It is also consistent with the prevalence of diabetes as determined from Medicare hospital discharge data from other states. And, the ethnic group differences in the prevalence of related target conditions are also consistent with the differences noted in the clinical literature. The ethnic group-specific differences in the prevalence of diabetes, amputation, retinopathy, renal failure and stroke as well as stroke-related findings is striking. Minority ethnicity is associated with a 1.68 to 4-fold greater incidence for these conditions.

Table 2 shows the mean age of diabetic nursing facility residents who also had one of the target conditions. Table 3 provides the same information for non-diabetic NF residents.

Table 2. Mean Age of Diabetics with Certain Conditions by Ethnicity

Condition	Overall (N=15,932)	Black non-Hispanic (N=2,497)	Hispanic (N=3,057)	White non-Hispanic (N=10,254)
Atherosclerotic Heart Disease	81.62	80.32	80.15	82.28
Congestive Heart Failure	81.87	79.17	80.40	82.75
Other Cardiovascular Disease	81.09	78.43	79.31	82.14
Missing Limbs	77.15	77.00	76.21	78.06
Aphasia	76.67	73.31	76.45	78.46
Cerebrovascular Accident	77.88	75.50	75.91	79.45
Hemiplegia or Hemiparesis	75.27	72.81	73.96	76.92
Retinopathy	73.69	73.33	71.97	74.84
Renal Failure	76.02	75.38	73.02	78.48

Table 3. Mean Age of non-Diabetics with Certain Conditions by Ethnicity

Condition	Overall (N=57,063)	Black non-Hispanic (N=5,122)	Hispanic (N=5,147)	White non-Hispanic (N=46,421)
Atherosclerotic Heart Disease	86.14	84.59	85.12	86.42
Congestive Heart Failure	86.44	83.81	85.29	86.79
Other Cardiovascular Disease	85.22	82.56	83.44	85.69
Missing Limbs	82.27	82.73	81.48	82.24
Aphasia	74.73	71.53	70.72	76.18
Cerebrovascular Accident	81.78	78.14	78.92	82.78
Hemiplegia or Hemiparesis	77.09	74.72	74.57	78.15
Retinopathy	79.08	84.33	75.50	79.00
Renal Failure	83.03	81.11	81.63	83.79

From Tables 2 and 3, the following patterns are noteworthy:

- With the exception of aphasia and hemiplegia, each target condition occurs four to seven years earlier in diabetic residents.
- With the exception of renal failure, each target condition occurs two to four years earlier in Hispanic diabetics than White diabetics.
- With the exception of amputation and retinopathy, each target condition occurs two to five years earlier in Black diabetics than White diabetics.
- Even among non-diabetics there are systematic differences in mean ages for most of the target conditions such that minority residents are younger. Similar disparities have been noted among non-institutionalized diabetics. These differences suggest possibilities such as lifelong differences in quality healthcare between groups, group differences in health behavior, and inherent differences with respect to each group's vulnerability to the target conditions.

Estimating the Costs Attributable to Diabetes

Estimating the amount of Medicaid LTC dollars spent on diabetes was conducted in two steps. First, the etiologic fraction of each target condition attributable to diabetes was computed in a manner similar to Huse (Huse, Oster, Killen, et al., 1989). Second, each condition's etiologic fraction was used with FY2000 cost

data to estimate the average daily cost attributable to diabetes. The result of this procedure was an estimate of how much DHS spends on Medicaid LTC because of diabetes.

Calculating the Etiologic Fraction: For each target condition, the prevalence of the condition among diabetics and non-diabetics were computed. Next, the relative risk was calculated as the ratio of each condition's prevalence among diabetics to its prevalence among non-diabetics. Finally, the relative risk for each condition was entered into Huse's etiologic fraction formula along with the prevalence of diabetes for the total sample (21.8%; see Table 1). Table 4 details the results of the calculation for each target condition.

Table 4. Etiologic Fraction of Target Conditions Attributable to Diabetes

Condition	Prevalence (%)		Relative Risk	Etiologic Fraction (%)
	Diabetics	Non-Diabetics		
Atherosclerotic Heart Disease	12.1	10.7	1.13	2.8
Congestive Heart Failure	29.8	21.8	1.37	7.4
Other Cardiovascular Disease	19.8	16.3	1.21	4.5
Missing Limbs	6.4	1.4	4.57	43.8
Aphasia	4.2	3.1	1.35	7.2
Cerebrovascular Accident	32.1	21.7	1.48	9.5
Hemiplegia or Hemiparesis	12.5	7.3	1.71	13.4
Retinopathy	1.7	0.0	-	100.0
Renal Failure	6.9	2.6	2.65	26.5

From Table 4, note that diabetes is indeed a risk factor for each target condition, as indicated by a relative risk greater than one. Note also that for retinopathy, a relative risk could not be computed because the denominator of the relative risk (i.e., prevalence of retinopathy among non-diabetics) was zero. However, because only diabetics experienced retinopathy, the etiologic fraction must logically be 100%.

Calculating the Average Daily Cost Attributable to Diabetes: In 2001, The DHS Office of Programs estimated that the state spent an estimated $81.22 per LTC resident per day in FY2000[1]. This figure was multiplied by each target condition's prevalence in the total sample (see Table 1) to estimate the average daily cost of each condition per resident. Next, since we are only interested in the proportion of each condition's cost attributable to diabetes, the average daily cost was multiplied by each condition's etiologic fraction (see Table 4) to arrive at each condition's average daily cost attributable to diabetes. Note that these average daily costs are per resident. To arrive at the total average daily cost, each condition's average daily cost attributable to diabetes was multiplied by 73,004 residents. Table 5 details the results of this process for each target condition.

[1] A more recent DHS Office of Programs figure for FY2000 LTC costs is $81.36 per resident per day.

Table 5. Average Daily Cost ($) of Target Conditions Attributable to Diabetes, FY2000

Condition	Average Daily Cost of Condition (Per Resident)	Average Daily Cost of Condition Attributable to Diabetes (Per Resident)	Average Daily Cost Attributable to Diabetes (Total)
Atherosclerotic Heart Disease	8.93	0.25	18,087.93
Congestive Heart Failure	19.09	1.41	103,215.22
Other Cardiovascular Disease	13.89	0.62	45,339.31
Missing Limbs	2.03	0.89	64,889.85
Aphasia	2.76	0.20	14,474.96
Cerebrovascular Accident	19.49	1.84	134,614.99
Hemiplegia or Hemiparesis	6.90	0.93	67,744.71
Retinopathy	0.32	0.32	23,717.54
Renal Failure	2.84	0.75	54,994.40

Adding the total average daily costs of each condition attributable to diabetes, the estimated amount that DHS spent on Medicaid LTC directly attributable to diabetes in FY2000 was:

- **$527,078.91** per day, or
- **$192,383,802.32** per year, or
- about **9%** of the state's total Medicaid LTC budget.

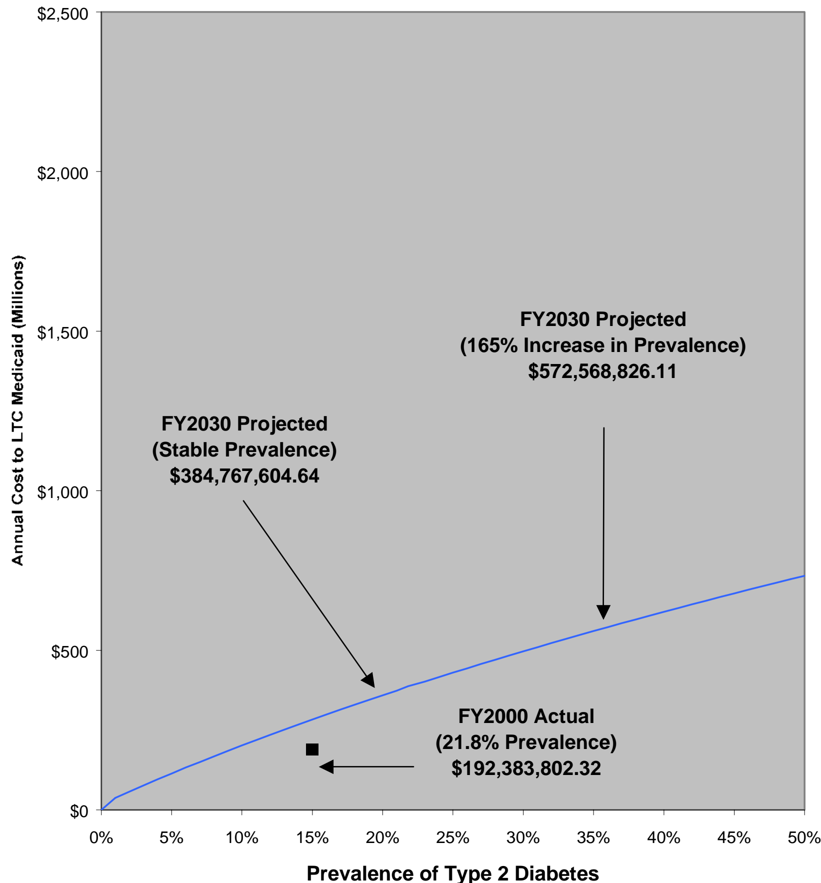
Projecting the Cost of Diabetes into FY2030

A more pressing question than "How much did Texas spend as a result of diabetes in FY2000?" is "What will Texas spend in the future as a result of diabetes?" A critical step in projecting future costs was determining the functional relationship between prevalence of diabetes and cost. By varying prevalence of diabetes between 0% and 50% while holding all other parameters constant, the above estimation technique produced a function that related prevalence and cost in the FY2000 data. The second step was to adjust this function by the projected increase in LTC population by the target year. The target year selected was FY2030, far enough into the future that intervention in the present might offset costs in the target year (assuming that intervention today would focus on managing diabetes to prevent the expected end-organ injury that develops about 30 years after the initial diagnosis). According to the Urban Institute, LTC populations are expected to double by 2030 (Urban Institute, 2002). Thus, the function was adjusted by a factor of two and is plotted in Figure 1.

Note that if prevalence remains stable, the annual cost of diabetes to Medicaid LTC will double to $384,767,604.64 (in FY2000 dollars). However, it is not expected that prevalence will remain stable. Indeed, the CDC estimates that the

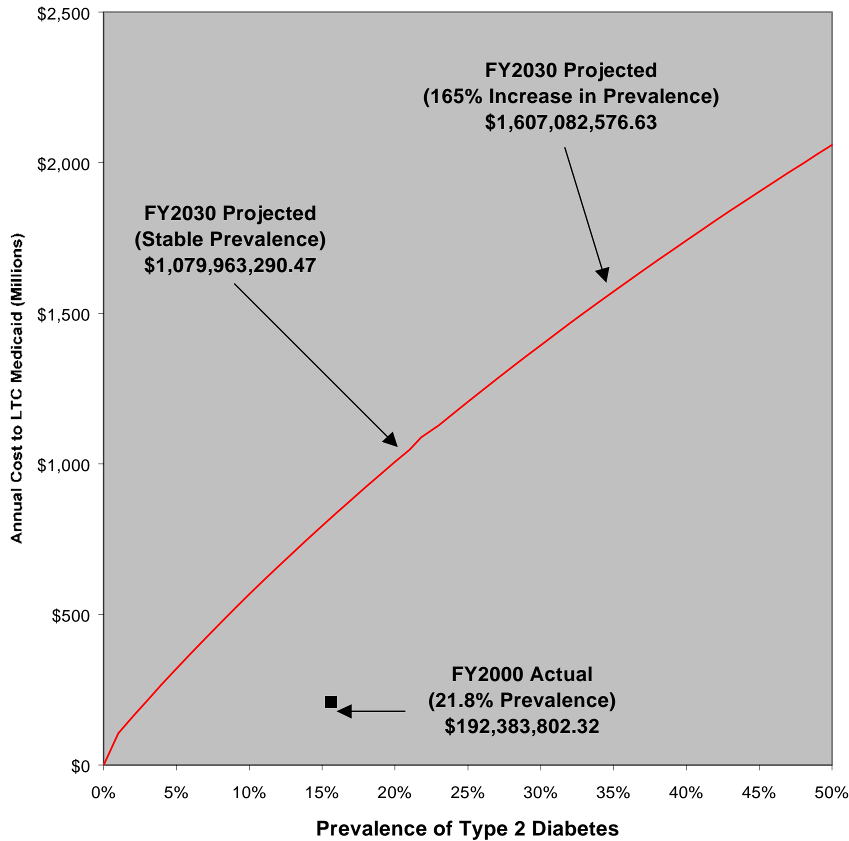
prevalence of diabetes will rise by 165% over the next 50 years (Boyle, Honeycutt, Venkat Narayan, et al., 2001). For Texas, this would mean an increase from 21.8% to 36%. If we move along the function plotted in Figure 1 from 21.8% prevalence to 36% prevalence, we can see that the cost of diabetes to Medicaid LTC may nearly triple to $572,568,826.11 (again, in FY2000 dollars).

Figure 1. Estimated Cost of Type 2 Diabetes to Texas LTC Medicaid (In FY2000 Dollars)



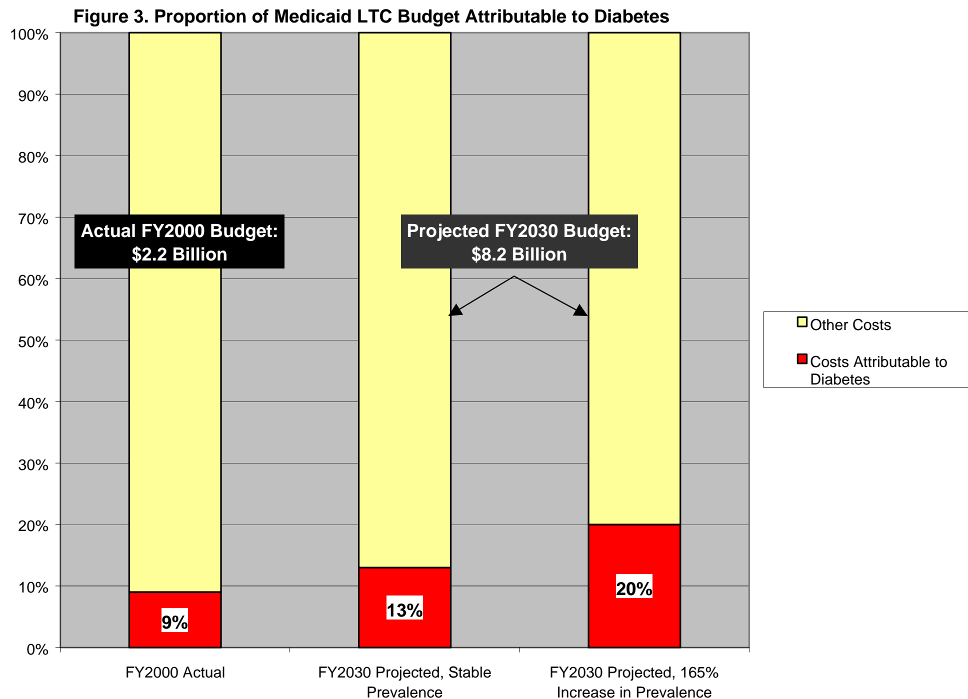
The last variable to account for in our projection is inflation. Figure 1 estimated costs in FY2000 dollars, which will probably be worth much more than FY2030 dollars. To account for the effect of inflation over 30 years, the function in Figure 1 was multiplied by (one plus the inflation rate) raised to the 30th power. The inflation rate was estimated to be .035 (or 3.5%) annually, so the function was multiplied by 1.035 to the 30th power (for more information on selecting the inflation rate and calculating the multiplier, see Gramlich, 1990). The new function, adjusted for inflation, is plotted in Figure 2.

Figure 2. Estimated Cost of Type 2 Diabetes to Texas LTC Medicaid (Adjusted for Inflation)



Note that if prevalence remains stable, DHS will actually spend $1,079,963,290 in FY2030 as a result of diabetes. Assuming prevalence increases to 36% (see above), DHS will actually spend $1,607,082,576 as a result of diabetes.

Not only will Texas probably spend more, but diabetes-related illness will also account for a larger share of the total Medicaid LTC budget. Assuming the same inflation rate used to adjust the cost function in Figure 2 and that no real-dollar increases to the Medicaid LTC budget are made, it is estimated that the Medicaid LTC budget in FY2030 will be about $8.2 billion. Figure 3 shows that while diabetes accounted for only 9% of the total Medicaid LTC FY2000 budget, by FY2030 diabetes will probably account for somewhere between 13% and 20% of the total Medicaid LTC budget.



Conclusion: If nothing more than what Texas is already doing is done to prevent diabetes among the young, Texas Medicaid LTC will likely spend between $1 billion and $1.6 billion in FY2030 as a result of diabetes. That represents a six- to eight-fold increase in spending over the next 30 years. This increase will account for 13% to 20% of the FY2030 Medicaid LTC budget (as compared to 9% in FY2000).

Because Type 2 diabetes is largely preventable through lifestyle modification (i.e., healthy diet, regular exercise, etc.), the costs estimated above are largely avoidable. Published cost-benefit analyses of health promotion indicate that each dollar invested in present prevention efforts (e.g., immunizations, workplace safety, seat belts) can save two to eight dollars in future healthcare expenditures (Canadian National Report on Immunization, 1996). Even assuming an extremely optimistic cost-benefit ratio of 1:10 for current diabetes prevention efforts and stable prevalence through FY2030, the current $4 million annual investment in the Texas Diabetes Council represents only about 10% of the funding needed to address the problem. A more reasonable expectation would be that the benefits of the existing investment would amount to about $34 million in costs avoided in FY2030 (adjusted for inflation as above). Therefore, it is recommended that all state agency programs that address Type 2 diabetes in children be coordinated and funded at the levels necessary to ensure that Aging Well in Texas can be a realistic expectation for today's children.

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