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## Potential Effect of a Low-Fat, Vegan Diet on Medication Costs in Type 2 Diabetes

Diabetes treatment typically involves the use of several pharmaceutical agents. Often, one, two, or more drugs are required for blood glucose control, along with additional agents to reduce blood cholesterol and blood pressure. While drug treatments are often necessary and can be lifesaving, their use entails significant costs, as well as adverse effects.

Recent studies suggest that diet changes allow individuals with diabetes to achieve benefits that are similar to those of medications and may allow reductions in medication use. In particular, low-fat vegetarian and vegan diets reduce blood glucose, blood cholesterol, and blood pressure, and help control body weight. The following brief analysis examines the potential for cost savings that may accrue from reductions in medication use that may be expected from the use of a low-fat vegan diet for type 2 diabetes.

### An Example Regimen

An example of a common drug regimen in current use for individuals with diabetes includes all of the following:

1. Metformin, often along with a sulfonylurea or thiazolidinedione
2. A cholesterol-lowering drug, such as atorvastatin (Lipitor)
3. A blood-pressure-lowering medication, such as an angiotensin converting enzyme (ACE) inhibitor (eg, lisinopril), or an angiotensin receptor blocker (ARB) (eg, losartan), often along with hydrochlorothiazide.

The choice of a common regimen for analytical purposes is somewhat arbitrary. Many, although not most, individuals with type 2 diabetes use insulin, and some use newer medications, such as exenatide or sitagliptin. Each of these entails significant costs, but were not included in this analysis.

The following analysis assumes that diabetes medications are taken at or near maximal effective doses, lipid-lowering and blood pressure medications are taken at common, not necessarily maximal, doses, and that medications are used singly (not in combinations) and are purchased monthly from an online discount outlet.

## Drug Costs

The following prices are from DrugStore.com (www.drugstore.com, accessed January 8, 2007). Prices at retail pharmacies may be somewhat higher.

### Metformin

Metformin generic 1,000 mg, 1 pill twice daily: 60 pills = \$55.99

Metformin (Glucophage) 1,000 mg, 1 pill twice daily: 60 pills = \$109.91

### Sulfonylurea

Glipizide generic 10 mg, 1 pill twice daily: 60 pills = \$10.99

Glipizide XL (Glucotrol XL) 10 mg, 1 pill twice daily: 60 pills = \$58.25

Glimepiride (Amaryl) 4 mg, 1 pill twice daily: 60 pills = \$69.98

Glyburide (Micronase) 5 mg, 2 pills twice daily: 120 pills = \$126.41

### Thiazolidinedione

Rosiglitazone (Avandia) 8 mg, 1 pill daily: 30 pills = \$175.08

Pioglitazone (Actos) 45 mg, 1 pill daily: 30 pills = \$179.99

### Statin

Atorvastatin (Lipitor) 40 mg, 1 pill daily: 30 pills = \$103.99

### BP drugs

HCTZ generic 25 mg, 1 pill daily: 30 pills (\$8.99 per 100 pills) = \$2.70

Lisinopril generic 20 mg, 1 pill daily: 30 pills = \$10.99

Lisinopril (Prinivil) 20 mg, 1 pill daily: 30 pills = 31.19

Losartan (Cozaar) 50 mg, 1 pill daily: 30 pills = 57.99

Additional costs, such as glucose meters, test strips, lancets, blood tests (including tests required to monitor potential adverse effects of medications), and medical visits are not included in this analysis, because some monitoring will be required even for well-controlled diabetes. These costs are significant. For example, a 100-pack of One Touch Ultra strips (a commonly used product) costs \$97.99, and could easily be used in the course of a few weeks.

## Effect of a Low-Fat Vegan Diet

A low-fat vegetarian or vegan diet reduces A1c by roughly the same degree as a single oral hypoglycemic agent. In a 22-week randomized clinical trial including 99 individuals with type 2 diabetes, the use of a low-fat vegan diet was associated with an average drop in A1c of 1.0 percentage points (Barnard 2006). Such a diet also reduces low-density lipoprotein cholesterol by 20-40%, which is similar to the effect of common statins.<sup>1-3</sup>

The expected drop in blood pressure from such a diet is less clear. In absence of weight loss, vegetarian diets lead to small but significant reductions in systolic and diastolic blood pressure.<sup>4</sup> However, vegan diets also cause weight loss, leading to larger drops in blood pressure.

We present below the costs of common medication regimens and show the savings that would be adduced if dietary effects obviate the need for one of two oral diabetes medications (a sulfonylurea or thiazolidinedione). We then present the savings that would accrue if diet changes also permitted the elimination of a statin drug, and one of two antihypertensives (hydrochlorothiazide). Greater savings would be realized if ACE inhibitors or ARBs were eliminated.

For purposes of this analysis, we assume that a diet change obviates the need for a medication if its effect is similar in magnitude to that of a medication. However, we note that some clinicians may choose to prescribe statins in the absence of hypercholesterolemia.

Our figures show that the elimination of a single diabetes medication would be expected to produce annual savings ranging from \$131.88 (the cost of a generic sulfonylurea) to \$2,159.88 (the cost of a thiazolidinedione). If diet changes also permitted the elimination of a statin and hydrochlorothiazide, annual savings would range from \$1,412.16 to \$3,440.16 for the scenario described above. The lower figure applies to an individual who discontinues a generic sulfonylurea, atorvastatin, and hydrochlorothiazide. The higher figure differs only in that the discontinued diabetes drug would be a thiazolidinedione.

We caution that this analysis is intended to provide a likely scenario for a common individual case, not comprehensive data for groups of individuals with varied regimens. It should be noted that individual results from any diet regimen vary, depending in part on adherence. Some individuals will not be able to reduce medication use, despite dietary changes, and some may be able to reduce their dosages, but not eliminate their medications. Individuals who do not follow prescribed diets will not achieve any corresponding benefits. However, this analysis suggests that programs that encourage dietary changes are likely to yield substantial benefits.

This analysis disregards differential food costs, which are often lower on vegetarian diets, compared to omnivorous diets, but may be higher for individuals who are not yet accustomed to shopping for such diets. It also disregards intangible benefits of diet changes, such as weight loss, reduced cancer risk, reductions in neuropathy symptoms or joint pain, or the prevention of hypoglycemic episodes (a common result of sulfonylurea treatment).

<b>Monthly Costs for Common Medication Regimens Used for Diabetes</b>				
	<b>SU, ACE Low-cost</b> Sulfonylurea for diabetes, generics for diabetes and BP control, ACE used for BP control.	<b>SU, ACE High- cost</b> Sulfonylurea for diabetes, brand-name drugs used for diabetes and BP control, ACE for BP control.	<b>TZD, ARB Low-cost</b> TZD for diabetes, generic metformin and HCTZ, ARB for BP control.	<b>TZD, ARB High-cost</b> TZD for diabetes, brand-name drugs used, except generic HCTZ, ARB for BP control
<b>Glucose control</b>				
Metformin	55.99	109.91	55.99	109.91
Sulfonylurea or TZD <sup>1</sup>	10.99	126.41	175.08	179.99
<b>Cholesterol control</b>				
Atorvastatin <sup>2</sup>	103.99	103.99	103.99	103.99
<b>Blood pressure control</b>				
HCTZ <sup>2</sup>	2.70	2.70	2.70	2.70
Lisinopril or losartan	10.99	31.19	57.99	57.99
<b>Monthly total</b>	<b>184.66</b>	<b>374.20</b>	<b>395.75</b>	<b>454.58</b>
<b>Annual total</b>	<b>2,215.92</b>	<b>4,490.40</b>	<b>4,749.00</b>	<b>5,454.96</b>
<b><sup>1</sup>Costs without 1 diabetes medication</b>				
Monthly total	173.67	247.79	220.67	274.59
Annual total	2,084.04	2,973.48	2,648.04	3,295.08
Annual savings	131.88	1,516.92	2,100.96	2,159.88
Percent savings	6%	34%	44%	40%
<b><sup>1,2</sup>Costs without 1 diabetes medication, 1 statin, and 1 blood-pressure medication</b>				
Monthly total	66.98	141.10	113.98	167.90
Annual total	803.76	1,693.20	1,367.76	2,014.80
Annual savings	1,412.16	2,797.20	3,381.24	3,440.16
Percent savings	64%	62%	71%	63%

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