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Diabetes Prevention Services: Cost Savings and the Role of Incentives

Dan Sherman, Ph.D.
Nalini Pande, J.D.
Marilyn Moon, Ph.D.
Jennifer Lucado, MPH
Eloesa McSorley, MPH
Quy Nhi Nguyen, MPH

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Executive Summary

Background

The Diabetes Prevention Program (DPP) is a program that has been found to prevent or delay the onset of Type 2 diabetes. The published literature on the DPP varies in terms of program services, costs and findings depending on which version of the intervention is reviewed (the two versions of DPP and study findings are described in the Appendix). While the original DPP intervention literature includes a 10 year follow up and a large sample size[1], the less comprehensive YMCA (Y-DPP) version has literature reflecting a 1-year follow-up and is based on a small sample size.[2] Our assumption is that the Y-DPP has long term outcomes similar to the more resource–intensive program.

The Bipartisan Policy Center (BPC) retained the American Institutes for Research (AIR) to develop a financial model of the costs and benefits of a Y-DPP-like program. The model uses as a base the general approach and assumptions from a recent study by Zhuo (2012) of potential savings from a diabetes prevention program similar to the Y-DPP program over a 25-year period.[3] The primary focus of the analysis presented here is not to develop an overall estimate of the total savings from prevention programs, but rather to illustrate how the financial incentives to payors vary given different assumptions of who would pay for these services, the type of payor, and the age at which individuals would first receive prevention services. These illustrations are developed at the level of the individual who receives these services.

We outline below three different scenarios:

- In the first scenario, a private payor bears the initial costs of the prevention program, but subsequent benefits may accrue to other payors (including Medicare) as individuals switch health plans over time.
- In a second scenario, the Federal Government covers the full cost of the program but benefits would likely be primarily realized by private payors.
- In the third scenario, an ACO-type organization[4] incurs the program cost, but will also realize most of the benefits except for what we assume is a relatively small share of individuals who switch to another ACO.[5] We assume the ACO is in a two-sided risk/shared savings agreement. Consequently, ACOs differ from private plans because they share risk, which gives them a greater stake in savings.

For all scenarios, the Federal Government would receive some benefits from savings when individuals enroll in Medicare as well as higher tax revenue when private plans reduce rates. These rate reductions would lead to higher taxable wages and salaries for employees in place of untaxed benefits.

[1] Diabetes Prevention Program Research Group. (2009). 10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program Outcomes Study. *The Lancet*, 374 (9702), 1677–1686.
[2] Ackermann, R. Finch, E. Brizendine, E., Honghong, Z., and Marrero, D. (2008). Translating the Diabetes Prevention Program into the Community: The Deploy Pilot Study. *American Journal of Preventive Medicine*, 35(4): 357-363.
[3] Zhuo, X., Zhang, P., Gregg, E., Barker, L., Hoerger, T.J., Pearson-Clarke, T., and Albright, A. (2012). A Nationwide Community-Based Lifestyle Program Could Delay or Prevent Type 2 Diabetes Cases and Save $5.7 Billion in 25 Years. *Health Affairs*, 31(1), 50-60.
[4] For purposes of this modeling, we define an ACO as a healthcare organization comprised of a group of coordinated health care providers, which provides care to a defined population of patients.
[5] ACOs are more likely to retain individuals over a longer period than a private plan given that individuals would be less likely to switch delivery systems (e.g., PCPs, provider groups) as often as they would switch health plans. Thus, we assume a relatively small share of individuals switch ACOs.

AIR has estimated the cost at the individual level of providing prevention services and potential savings in medical costs associated with diabetes. The model computes total discounted costs and savings as net present value, the discounted value of benefits of the program in terms of reduced medical spending net of costs of providing prevention services. The age of the individual matters as it affects who achieves savings. The model assumes individuals receive their health care through the Medicare program once they turn 65. From the standpoint of a private health plan that provides prevention services, there may be little incentive to provide prevention services to older individuals if the "breakeven" point at which savings exceeds costs is after age 65, when we assume people switch to Medicare. Additionally, a private payor may have little incentive to provide these services if large shares of individuals shift to other health plans after the private payor funds the prevention program for those individuals. The ACO-type organization would have a greater incentive to provide prevention services since it would receive net positive benefits once it hits the breakeven point. This is due to less shifting as well as savings continuing when people age into Medicare.

High-level Findings

BPC's broader vision for long term health reform includes policies that encourage providers to be partially or fully-at risk for health costs. This modeling helps to inform consideration of these policies by showing how incentives to provide prevention services may vary depending on who pays for these services and who accrues the savings, over a 25 year time period.

Key findings:

- **There is a large population with pre-diabetes in the US who could benefit from a diabetes prevention program with a significant number unaware that they have pre-diabetes.**
    - Approximately 28 percent of the population meet several of the criteria for pre-diabetes
    - Only about 1 in 6 of these individuals have been told they have pre-diabetes

- **A diabetes prevention program can produce overall cost savings which increase over time for an individual.**

In terms of the three scenarios discussed above, we draw the following conclusions assuming initial medical cost savings of $100 per person per year as shown in Table 1 in the Findings Section. Estimates assuming initial medical cost savings of $130 per person per year are available in Table 2. Leakage estimates across all scenarios are available in Tables 1 and 2.

- **Scenario 1:**
    - **Private plans realize net savings even when they pay for the program:**
        - Over a 25-year period, a private plan with no leakage that provided prevention services to a 40 year old would receive $674 of benefits in reduced medical costs[6] after accounting for the cost of the prevention program to the plan. With

[6] Overall net savings are approximately $1000 per person for the 25-year period, but we assume that the plan retains only 85% of medical savings and pays all program costs. A key finding of the modeling is that prevention services produce overall net

low leakage, the plan would receive $449 of benefits in reduced medical costs after accounting for the cost of the prevention program to the plan.

    - Private payors bear the cost of the prevention program, but do not realize all the benefits if individuals switch health plans over time. The shifting of covered individuals to other plans reduces net benefits (especially in early years) for the initial plans, though the modeling shows that even with significant shifts small net benefits can still occur for a 40 year-old.

  - **Private plans do not have an incentive to cover those age 55 or older when they pay for the program**[7]: Under current payment arrangements, private health plans do not have an incentive to provide diabetes prevention services to those age 55 or older since it takes more than 10 years for plans to recoup the costs of providing these services in the form of reductions in medical costs. By the time private plans would recoup their prevention costs, individuals would have shifted to Medicare.

- **Scenario 2:**

  - **Private plans would have an incentive to provide prevention program services if the Federal Government covered program costs.** In this scenario, the Federal Government covers the full cost of the program but benefits would be primarily realized by private payors depending on age. For example, over a 25-year period, a private plan with no leakage that provided prevention services to a 40 year old would receive $1,767 of benefits in reduced medical costs, with the Federal Government covering $1,380 in prevention costs.

  - **The Government realizes some savings even when it pays for the program:**

    - The Government will receive positive benefits for those who are near 60 who begin the program since they will be in Medicare and incur program savings.
    - The Government will receive little benefit from a younger population who will stay within the private plan when most of the savings are realized over a 25-year period.
    - There may be some benefits to the Government in terms of higher tax revenues if private plans reduce rates and employers pass along savings to employees; we separately compute savings under this assumption.

  - **The Federal Government could potentially reduce its overall costs, at least for those over 60 years of age by directly covering prevention costs, since health care prevention costs for these individuals would be lower after they were 65.**

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program savings to a private payor of approximately $674 for a forty-year old individual (mortality reduces this number for older individuals) over a 25-year period, assuming the plan covers the individual for 25 years.

[7] Even without switching to other health plans, a private payor will not begin to see the cumulative net benefit from prevention services for at least 10 years. Much of the net benefit of a prevention program comes after this period, at which point there may be more complications of diabetes and the real costs of medical care (net of inflation) have increased. Thus, the majority of program costs are incurred initially while savings only come later.

- **Scenario 3:**

  Under an ACO-type arrangement, an ACO would have an incentive to provide prevention services to individuals of all ages, even those over 65, since the ACO would be able to capture savings which increase over time.

    - In the third scenario, an ACO-type organization representing a large share of a local market, incurs the program cost, but will also realize most of the benefits as long as individuals who switch to another ACO are a relatively small number. For a 40-year old individual, an ACO would receive net benefits of $362 by providing prevention services.
    - The larger the ACO, the more likely it would capture net benefits over time.
    - The ACO-type organization would reap most of the benefits of a Y-DPP-like program, since even if the organization paid all program costs, it would be able to receive net positive benefits once it hits the breakeven point of approximately 15 years (at a 6 percent discount rate).
    - Savings continue even after an individual becomes eligible for Medicare because we assume ACOs have entered into a two-sided risk/shared savings agreement with Medicare.

I. Introduction

A. Purpose of the Project

The Diabetes Prevention Program (DPP) is a prevention program targeted at high-risk individuals to delay or prevent the onset of the disease. There have been two distinct models of the DPP implemented. While the original DPP intervention literature includes a 10 year follow up and a large sample size[8], the YMCA version of the DPP intervention has literature reflecting a 1-year follow-up and is based on a small sample size.[9] We provide in the Appendices a description of both DPP models (Appendix A), the findings from the literature regarding the short term and long term effects of the DPP programs (Appendix B), the distribution of people with pre-diabetes risk factors and diagnosis by age and gender (Appendix C) and information on estimating DPP medical cost savings (Appendix D).

BPC retained AIR to develop a financial model of the costs and benefits of a Y-DPP-like program. The AIR model uses as a base some of the assumptions and findings from a recent study by Zhuo (2012) of a prevention program similar to the Y-DPP program.[10] The primary focus of the analysis presented here is not to develop an overall estimate of the potential savings from prevention programs, but rather to illustrate how the financial incentives to payors would vary given different assumptions of who would pay for these services, the type of payor, and age at which individuals would first receive prevention services. These illustrations are developed at the level of the individual who receives these services.

B. Background: Population with Pre-diabetes

Although AIR modeled program savings at the level of the individual, to provide context, we show below the distribution of people with pre-diabetes risk factors and diagnosis by age and gender from 2009-2010 National Health and Nutrition Examination Survey (NHANES) data. We provide additional detail in a larger table in Appendix C. This offers a useful context regarding what it would take to scale up the prevention program. Interestingly, it appears that many people with pre-diabetes have not yet been diagnosed although they meet the criteria for pre-diabetes. Although NHANES does not capture all risk factors for pre-diabetes, such as family history, we were able to use key markers (age, body mass index, and blood sugar levels) that are used to assess risk of diabetes.[11]

1. The Size of the Population with Pre-diabetes

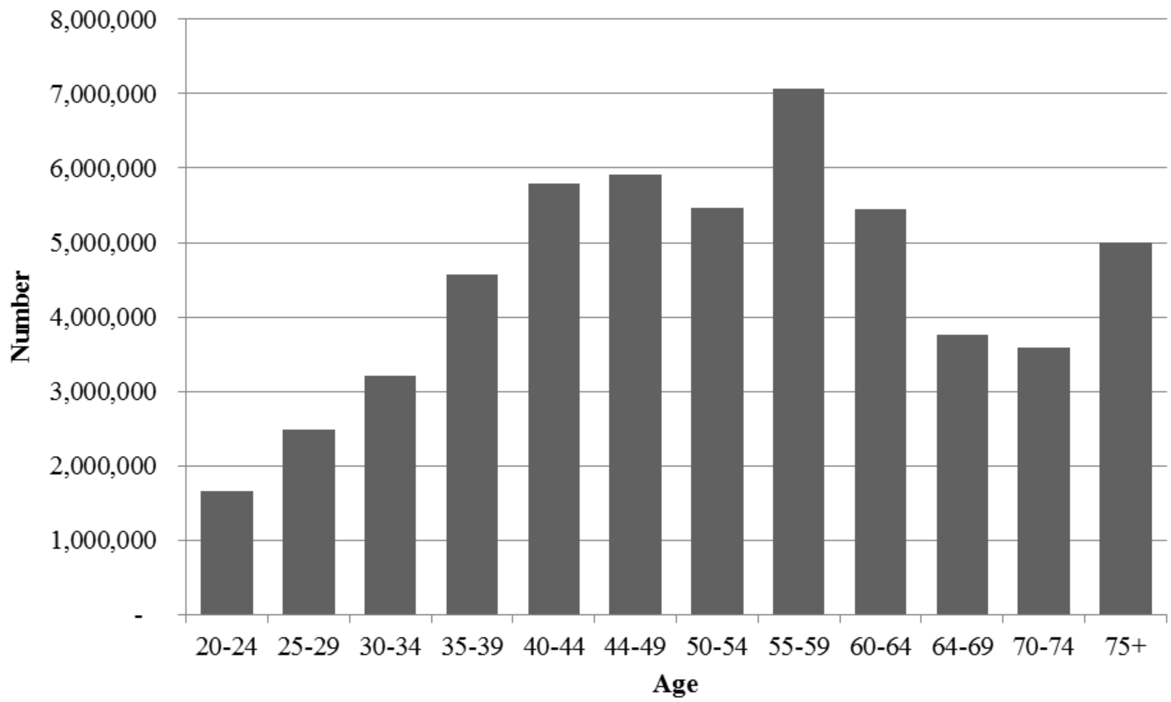
Diabetes prevention programs have the goal of identifying individuals with pre-diabetes who could receive services that could delay or prevent the onset of diabetes. To provide context for the analysis presented in this report, AIR developed estimates of the size of the population with pre-diabetes from the NHANES data, an ongoing Federal survey that collects clinical measures needed to evaluate whether a person has pre-diabetes, based on key markers of Body Mass Index (BMI) and blood sugar measures.[12]

[8] Diabetes Prevention Program Research Group, (2009)
[9] Ackermann, (2008)
[10] Zhuo, (2012)
[11] Centers for Disease Control and Prevention (CDC). (2012). National Center for Health Statistics (NCHS). National Health and Nutrition Examination Survey Data. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Retrieved from: http://www.cdc.gov/nchs/nhanes/nhanes2009-2010/nhanes09_10.htm.
[12] CDC, (2012) These blood sugar measures are Fasting Plasma Glucose and Hemoglobin A1c. Definitions of these measures can be found as notes to Table C-1 in Appendix C.

The survey also asks individuals if they have been told they have pre-diabetes, which allows us to compare those individuals' reported assessment of their pre-diabetic state to an assessment based on clinical measures. We have excluded individuals from the analysis who indicate that they have diabetes, in that they would not be included in a new prevention program. Our analysis is broken down by age, which accounts for the fact that prevalence of pre-diabetes increases with age.[13]

Figure 1 presents estimates of the total number of adults within different age groups who have pre-diabetes based on combined measures of BMI and blood sugar. Across the adult population, we estimate that approximately 57 million individuals have pre-diabetes by the criteria specified here. This differs from the CDC's estimate of 79 million people aged 20 years or older who had pre-diabetes in 2010.[14] The difference is based on the finding that almost 20% of people with pre-diabetes have normal body weight and would not be captured as part of screening criteria that includes elevated BMI.[15] The age groups that have the largest number of individuals with pre-diabetes are from the groups covering ages 40 to 64, which indicate they would make up the largest number of individuals in a prevention program.

Figure 1: Estimated Number of Individuals with Pre-diabetes by Age[16] (based on Weight and Blood Sugar Factors Only)



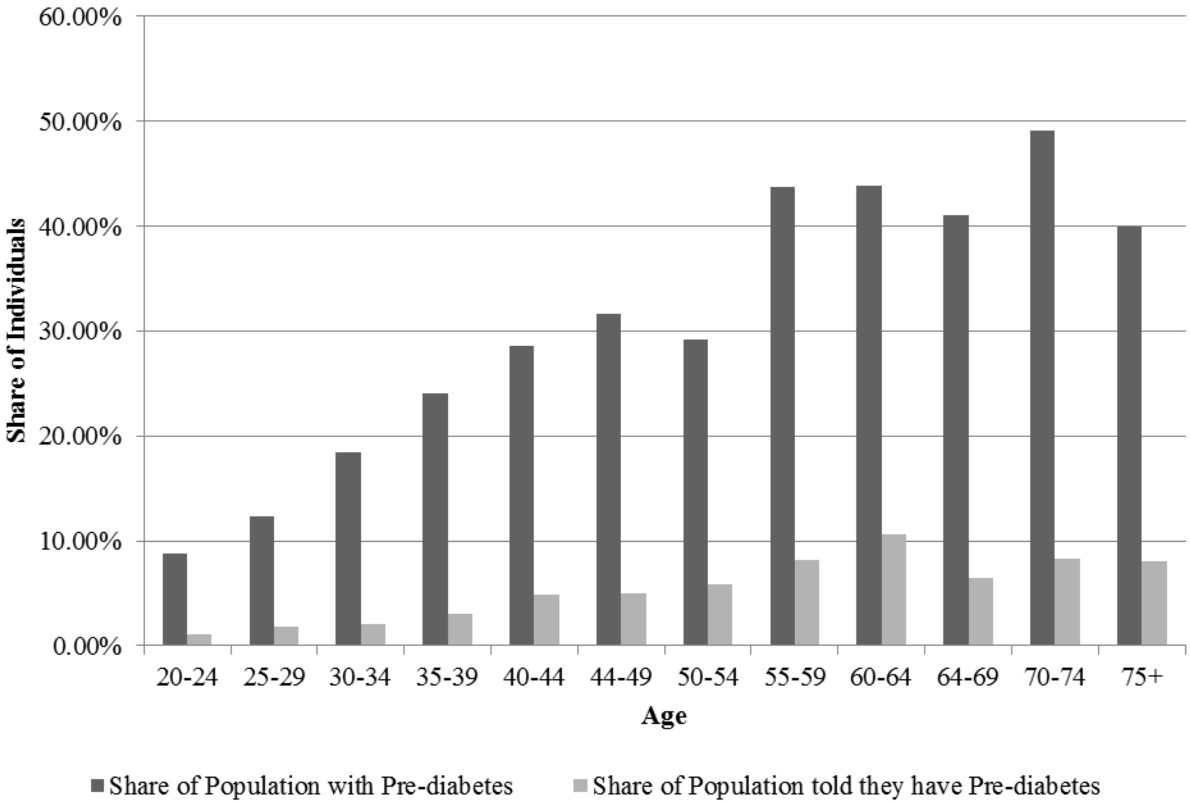
S
ource: AIR analysis of 2009-2010 NHANES Data as presented in Appendix C

Figure 2 shows the share of individuals within age groups who have pre-diabetes by BMI and blood sugar measures and also the share who self-report that they have pre-diabetes. The share of individuals with

[13] Figure 1 is based on AIR analysis of NHANES data as presented in Appendix C.
[14] Centers for Disease Control and Prevention. (2011). National Diabetes Fact Sheet: National Estimates and General Information on Diabetes and Prediabetes in the United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.
[15] 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.
[16] Excludes individuals who have diabetes.

pre-diabetes increases with age and is over 40 percent for those 55-74 years of age. The fact that the prevalence of pre-diabetes is lower at younger ages suggests that any prevention program would need to be well targeted to identify younger people with pre-diabetes. Figure 2 also shows that in all age groups, the majority of individuals who meet BMI and blood sugar criteria for pre-diabetes did not report that they had ever been told by a doctor or health care professional that they have pre-diabetes. This suggests that a prevention program that relied only on an individual's self-report of his/her pre-diabetic state would fail to capture most people with pre-diabetes.

Figure 2: Share of the Population that has Pre-diabetes and Is Aware of Status[17]



Source: AIR analysis of 2009-2010 NHANES Data as presented in Appendix C

[17] Excludes individuals who have diabetes.

II. Model Approach

A. Policy Questions

BPC's broader vision for long-term health reform includes organized delivery systems of providers that are partially or fully-at risk for health costs. BPC's theory behind this modeling exercise was to demonstrate why a potentially successful diabetes prevention program might not be adopted in a widespread manner under today's payment and delivery system. Thus, the model findings might serve as an example of how BPC's proposed payment and delivery reforms would create the necessary financial incentives for investments that improve quality outcomes and contain costs.

We have developed basic models for the three scenarios proposed by BPC to illustrate incentives for different payors to offer diabetes prevention services.

Under the three scenarios described below with a Y-DPP like program, we focus on addressing the following questions:

- **Which entity reaps the benefits of the program given who pays for the program costs?**
- **How long does it take for the program to breakeven given initial program costs?**
- **Given these findings, what are the incentives to fund a prevention program for individuals of a given age?**

B. BPC Phase II Economic Modeling – 3 Scenarios

We use three scenarios for the modeling.

1. Private Payor, competitive market

In the first scenario, a private plan would pay the cost of the program, but not all of the benefits would accrue to the plan, since some of the beneficiaries whose diabetes was delayed or prevented entirely would be enrolled in other private or government plans at the time when they would have experienced high medical costs. In this scenario, we first would develop estimates of leakage based on average plan switching behavior. Under this scenario, we would expect that there would be little incentive for a private plan to adopt the program on its own, especially for older individuals who we would assume would transfer to Medicare at age 65.

2. Government Payor

In the second scenario, the Federal Government would pay for the program. In this case, some of the benefits would accrue to private plans, but some would accrue to the Federal Government through lower Medicare costs and additional tax revenue as employer premiums decreased and compensation shifted toward taxable wages and salaries. In this scenario, we would expect that a substantial portion of the benefits would accrue to the private sector.

3. ACO-like Organization

In the third scenario, the program would be paid for by an ACO-type organization[18] that has contracts with private payors and Medicare. We believe the ACO would be likely to capture most of the benefits, although some would be lost to leakage from beneficiaries changing ACOs. In this scenario, there would be a relatively small share of individuals who switch ACOs given that this would require switching delivery systems (e.g., PCPs, provider groups) as opposed to switching health plans, which is depicted in the first two scenarios. We assume the ACO is in a two-sided risk/shared savings agreement in which the ACO is at risk for a portion of the health care of its patients but will also benefit from a percentage of savings that are incurred (and that such risk sharing continues when people switch to Medicare). We expect that ACOs would face greater incentives than private plans to provide prevention services over the twenty-five year period because the costs and benefits would be mostly aligned in one organization.

Key Assumptions

We describe below several key assumptions for this modeling exercise. We found the following assumptions allow us to come quite close both in terms of medical savings and program cost as in Zhuo's article, which we have used as a benchmark in developing model results. We have discounted program cost at 3 percent over 25 years to investigate the longer term impact of these programs. This is particularly important since many estimates of benefits from prevention services (such as the CBO) rely only on a ten year time frame.

1. **Age:** We estimate potential savings from the program for individuals who are 40, 50, 55, 60, and 65 as illustrations using the perspective of different payors over a 25 year period. We are assuming average diabetes costs are similar among individuals of all ages once they have been diagnosed with the disease. We would expect savings for those under age 40 to be similar to those who are 40, given similar mortality rates.

2. **Program Services:** We relied on the assumptions Zhuo used for program services. Zhuo used the YMCA based DPP study described by Ackermann and colleagues for his modeling.[19,20] The program consisted of a group-based one year intervention with 16 intensive core sessions over 5 months and 6 monthly post-core sessions. The second year would consist of eight maintenance sessions and 1-2 counseling sessions annually after the first two years. All sessions would be conducted in a group setting by trained lifestyle coaches for the first two years and by any health care provider afterwards.[21]

3. **Program costs**: We are assuming a well-established prevention program. The basic model AIR used takes Zhuo's estimate of basic program costs of $300 per person the first year (derived from Ackermann), $150 the second year, and $50 for the third year and thereafter.[22]

[18] For purposes of this modeling, we define an ACO as a healthcare organization comprised of a group of coordinated health care providers, which provides care to a defined population of patients.
[19] Ackermann, R. T., & Marrero, D. G. (2007). Adapting the Diabetes Prevention Program Lifestyle Intervention for Delivery in the Community: The YMCA Model. The Diabetes Educator, 33(1), 69–78.
[20] Ackermann, (2008)
[21] Zhuo, (2012)
[22] Zhuo, (2012)

4. **Recruitment and screening**: Zhuo used an estimate of about $150 per person for both age groups he considered (18-64, 65-84) that covered a community-wide screening program.[23] This cost covers the cost of screening the entire population and then assigns the cost entirely to those who actually are enrolled in the program. A program that screens a large number of individuals but captures only a small share of individuals (e.g., where prevalence of pre-diabetes is low) will have higher costs per enrolled individual.[24] We are assuming that screening for this version of the program will be for individuals who are part of a health plan and that risk for diabetes will be assessed as part of standard examinations and thus well targeted. For modeling purposes, we are assuming these costs are $50 per person enrolled in a prevention program to cover efforts to notify people, prepare background material, to answer questions, etc. Since these costs are incurred as the program begins, a higher level of cost would reduce the net present value by the amount it was over the assumed value.

5. **Program Compliance:** One factor that could affect the ability of a prevention program to realize savings is the extent to which individuals comply with the program and realize benefits (e.g., reduced weight). Zhuo, using information from the original intervention, indicated that in the second year, follow-up would consist of eight maintenance sessions and 1-2 counseling sessions annually after the first two years.[25] We are assuming in our cost modeling that individuals receive these ongoing counseling sessions. Zhuo assumed, however in computing potential reductions in medical costs that the intervention would not be as effective as possible, in that some individuals would regain weight over time and generally not realize the full benefit of the program. He incorporated this assumption by lowering the overall estimate of the program's effects in terms of its ability to prevent diabetes.[26] This assumption lowers estimates of potential cost savings from what they would be if there were perfect compliance with the program. By using Zhuo's estimates of annual medical savings as a basis for our estimates (see below), we implicitly incorporate this type of assumption.

6. **Annual Medical Cost Savings**: The Zhuo article finds (discounted at 3 percent) medical cost savings of about $2,600 per person for the age group of 18-64 year olds and $2,200 for those 65-84 for a 25 year period. Zhuo's model implicitly builds in mortality, so the lower estimates for older individuals may reflect mortality as individuals die at a greater

[23] Zhuo, (2012)

[24] Zhuo had separate screening activities for different age groups in his model. These age groups were 18-64 and 65-84. Individuals aged 18-64 would be screened at their regularly scheduled doctor's visits. Individuals who did not make these visits would not be screened. Those with an elevated BMI (at least 25 kg/m2) were asked to take the paper and pencil diabetes risk test of the CDC ($0.10 per person). Those that screened positive on the paper and pencil test were then asked to take the diagnostic blood test ($11.70) to confirm pre-diabetes. Cost used for additional physician's office time for these activities was $53.20 per person, from the CMS fee schedule. Individuals aged 65-84 were contacted by letter and invited to take a lab test for fasting plasma glucose (FPG) or hemoglobinA1c (HA1c) to determine pre-diabetes status. Cost of the lab test was determined to be $11.70 per person, based on the CMS fee schedule. Zhuo, (2012)

[25] Zhuo, (2012)

[26] Zhuo took a conservative approach and assumed that the intervention strategy would lead to a 40 percent relative reduction in risk for diabetes during the first two years of participation and a reduction of 10 percent in each of the following years for participants ages 18-64. Zhuo, (2012)

rate. The overall estimate of these costs are about $2,400 per person.[27] Zhuo has shared data that indicate his discounted per-year savings are approximately a steady $100 per year. We are therefore using an estimate of $100 per year for the reduction in medical costs in the first year and then "growing" it by 3 percent per year before any differential cost inflation or discounting. This enables us to match Zhuo and seems defensible as a means of accounting for the potential increase in complexity of cases. This is also relatively conservative; a higher estimate of annual medical cost savings would increase the overall net benefit of the program. As an alternative to this estimate, we have also considered an estimate of $130 per year in the first year to illustrate the sensitivity to our assumed savings.[28]

7. **Inflation**: For each age group considered, we estimate a per-person annual program cost and also a stream of benefits that are medical cost savings. One issue is whether program costs should be inflated in the calculation to reflect their expected growth beyond the general rate of inflation over time, as the economy returns to more typical growth patterns. In consultation with BPC staff, we use the assumption that medical costs (which form the basis of savings in the model) will grow at the CBO's projected GDP most recent growth rate (for 2022) net of inflation to create a real growth rate for these costs.[29] We will similarly compute growth in program costs based on expected real growth in the Employment Cost Index.[30] Accounting for inflation in this manner will increase net benefits, in that the adjustment factor for medical cost savings is somewhat greater than that for program costs.

8. **How cost savings are divided between public and private payors for individuals of a given age:** The savings associated with a prevention program should not entirely be attributed to a payor or ACO, in part because individuals could potentially enjoy reductions in their premiums and copays as medical costs are reduced. In the case of private payors, we have assumed that plans could realize up to 85 percent of these savings (assuming this to be the actuarial value of the share of the medical costs they cover), with the rest passed on as lower copays.[31] In the case of Medicare, we assume that all individuals will be enrolled in Medicare when they turn 65. In terms of people transferring to Medicare at age 65 for scenarios 1 and 2, we are assuming that 65 percent of cost savings will be retained by the Federal Government as plans reduce their rates.[32] For scenario 3, we assume the ACO accrues 70 percent of medical cost savings for those

[27] Zhuo, (2012)

[28] The medical cost savings of the YMCA version of the DPP program over three years was estimated to be $400 (i.e., 4 Million for 10,000 Medicare beneficiaries). Source: Longjohn, M. (2013, February 6). Telephone interview. YMCA (June 18, 2012) The Y Receives Innovation Grant to Test Cost Effectiveness of Diabetes Prevention Program Among Medicare Population. Retrieved February 12, 2013 from http://www.ymca.net/news-releases/20120618-innovation-grant.html.
Based on this, we estimated $130 gross medical cost savings per year. Zhuo's methodology is discussed in more detail in Appendix D.

[29] Congressional Budget Office. (2012a). An Update to the Budget and Economic Outlook: Fiscal Year 2012 to 2022. Washington, DC: US. Government Printing Office. Retrieved from: http://www.cbo.gov/sites/default/files/cbofiles/attachments/08-22-2012-Update_to_Outlook.pdf.

[30] Congressional Budget Office, (2012a)

[31] We assume that the lower copays do not create tax revenue for the Federal Government since we assumed employees will not have flexible spending plans or health savings accounts.

[32] This assumption was developed by AIR based on unpublished estimates from the Office of the Actuary of the Center for Medicare and Medicaid Services and the 2012 Trustees Report. About 35 percent of costs for Medicare covered services are covered by individuals through premiums, deductibles and copayments.

under 65 and 70 percent of any medical cost savings under Medicare based on a two-sided risk/shared savings agreement.

The Federal Government could receive some benefits from higher tax revenue if private plans reduce rates for working individuals under age 65 as private plans realize net benefits from offering prevention services. These rate reductions would lead to higher taxable wages and salaries for employees in place of untaxed benefits, which in turn would lead to higher tax revenues.[33] Under each scenario, we have computed this increase in tax revenue (which also can be considered to be a reduction in tax expenditures to maintain health benefits) based on the share of net profits that would otherwise be retained by the plan or ACO. We then estimate the (per-person) addition to Federal revenue from income taxes using the data available from the Congressional Budget Office that show the average American household paid 7.2 percent in Federal individual income taxes in 2009.[34] We assume that the Federal Government will receive tax revenue from income taxes (7.2 percent)[35] and FICA taxes (15.3 percent)[36] or a total of 19.1[37] percent (22.5 percent times 85 percent) of the total that medical savings plans are expected to pass along to employers and employees.

9. **Model Structure and Discounting**: We estimate NPVs of cash flows under the assumption that there is an initial (screening) cost in year 0 as a person reaches a given age (perhaps age 50) and then receives program services over the next period (year 1). We are discounting year 1 by the interest rate, essentially assuming that costs and benefits accrue at the end of the year. Depending on the payor considered, we apply different discount rates (6 percent for private payors, 3 percent for the government).

10. **Mortality:** The model accounts for mortality, which is important in that some portion of individuals who receive prevention services die, thus reducing the benefits to the entity that has paid for prevention services (which are most expensive in the first years of the program considered). We do not have mortality rates *specific* to the population with pre-diabetes. If those with pre-diabetes are more likely to die at greater rate at specified age, then we may overstate the net benefits of providing the prevention service. If we did not, however, account for mortality, we would be assuming that all individuals receiving prevention services would survive for 25 years, an assumption that would not be tenable, especially for older individuals.

11. **Plan Switching:** A plan that considers providing prevention services will receive lower net benefits if members shift to other health plans. For the first scenario, we make assumptions of the share of individuals who switch health plans over time. In order to explore how often individuals switch plans, we conducted a wide search of published literature, grey literature, and publicly available Federal statistics.[38] AIR found three

[33] We assume that employers pass on all net profits from the plan/ACO for prevention activities in the year they are realized to their employees.
[34] Congressional Budget Office. (2012b). *The distribution of household income and Federal taxes, 2008 and 2009* (Pub. No. 4441). Washington, DC: Congressional Budget Office.
[35] Congressional Budget Office, (2012b)
[36] FICATax. (2012). FICA Tax Resource Guide. Retrieved on February 6th, 2013 from: http://www.ficatax.org/.
[37] The 19.1 estimate is computed by multiplying .225 by .85.
[38] We performed these searches using PubMed, GoogleScholar, Google, and Bing. We used the terms such as "health plan," "health insurance," "medical insurance," and "medical coverage" along with "switch," "change," and "disenroll." In general, we limited the published literature search results to the past 15 years. Unfortunately, many of the results did not offer relevant information. Some focused on switching between different *types* of plans, such as

studies that focused on plan switching (Deloitte, [39,40] Center for Studying Health System Change[41] and Emory[42]) which had point in time estimates regarding the number of people who switched in a given year. However, we believe that the measure critical to plan switching is the average number of years the non-elderly stay with the same health insurance company before they switch, as opposed to the studies that indicate how many people switch in a given year.

As a basis for involuntary switching, we use figures of how often people switch jobs (median job tenure from the Bureau of Labor Statistics), although this does not address situations where people switch jobs but keep the same insurance in the new job. In 2012, American workers ages 25 and older had been working for their current employer for a median of 5.4 years.[43] Younger workers tended to switch employers more often than older workers; 25 to 34 year olds had a median tenure of 3.2 years, while 55 to 64 year olds had a median tenure of 10.3 years.[44] For purposes of our modeling, we will assume that 10 percent of individuals switch private plans each year for the first 5 years (and thus match the median tenure) as a point of comparison to estimates that do not take account of switching. We also apply a less stringent set of assumptions that 5 percent of individuals change plans each year for 5 years for additional comparison. We believe it is more appropriate to use higher levels of plan switching for younger individuals and lower levels of plan switching for older individuals.

HMO and PPO, without reporting if the switch was between different plans and some focused on the effects of a factor such as premium costs on patterns of switching.

[39] Deloitte Center for Health Solutions. (2009). *2009 Survey of health care consumers: Key findings, strategic implications.* Washington, DC: Deloitte LLP.

[40] Deloitte Center for Health Solutions. (2011). 2011 *Survey of health care consumers in the United States: Key findings, strategic implications.* Washington, DC: Deloitte LLP.

[41] Cunningham, P.J. (2013). *Few Americans switch employer health plans for better quality, lower costs* (NIHC Research Brief No. 12). Washington, DC: Center for Studying Health System Change.

[42] Atherly, A., Florence, C., & Thorpe, K.E. (2005). Health plan switching among members of the Federal Employees Health Benefits Program. *Inquiry: A Journal of Medical Care Organization, Provision, and Financing, 42*(3), 255-265.

[43] Bureau of Labor Statistics. (2012). Table 1. Median years of tenure with current employer for employer wage and salary workers by age and sex, selected years, 2002-2012. *Economic News Release*. Retrieved from http://www.bls.gov/news.release/tenure.t01.htm

[44] Bureau of Labor Statistics, (2012)

III. Findings

Results from the modeling are summarized in this section in charts and tables that make assumptions about the age of an individual at the time they are first enrolled in the prevention program, the costs of the program, its benefits in terms of reduced medical costs, and the share of savings (in terms of reduced medical costs) that a payor/ACO will realize. Additional assumptions of the model, such as inflation rates, are constant across scenarios presented here, and are given in the Key Assumptions section of this report.

Three different payment scenarios are considered:

- Scenario 1: A private plan covers the prevention services for an individual up to the age of 65, at which time the individual will become a Medicare beneficiary. We assume the private plan accrues 85 percent of medical cost savings and the Federal Government will directly accrue 65 percent of any medical cost savings under Medicare;

- Scenario 2: The Federal Government covers the prevention services for an individual enrolled in a private plan until he/she becomes a Medicare beneficiary at age 65. We assume the private plan accrues 85 percent of medical cost savings and the Federal Government will directly accrue 65 percent of any medical cost savings under Medicare;

- Scenario 3: An ACO-type organization covers the prevention services for an individual up to the age of 65, at which time the individual will become a Medicare beneficiary within the ACO structure. We assume the ACO accrues 70 percent of medical cost savings for those under 65 and 70 percent of any medical cost savings under Medicare based on a two-sided risk/shared savings agreement.

For each of the three scenarios and set of assumptions, we compute net present values (NPVs) of the funds associated with providing diabetes prevention services to an individual over a period of up to 25 years. A positive NPV results when the total benefits of a prevention program (reductions in medical costs) over time exceed the costs of supporting the program. The calculation accounts for the timing of costs and benefits and applies discounting to bring them to their present value. An NPV of $500 in scenario 1, for example, implies that that a private plan that covered an individual would realize total net benefits (medical savings minus what it pays for the cost of the program) worth $500 in terms of present value for that individual.

The various outputs of the model under the three scenarios are presented in tables at the end of this section that show how model outputs vary under different assumptions, including the age at which the individual is enrolled in the prevention program. A key input into our models is the estimate of the gross medical savings associated with a prevention program. The tables at the end of the section present results for two different assumptions regarding the size of these initial medical savings. The first is that a prevention program reduces the cost of medical treatment for an individual by $100 per year (initial medical savings), and that these savings in medical costs persist and grow by 3 percent a year, with adjustment for growth beyond general inflation.[45] The second is that these medical savings are $130 for an individual in the first year, rather than $100; the same assumptions regarding subsequent growth are then applied.

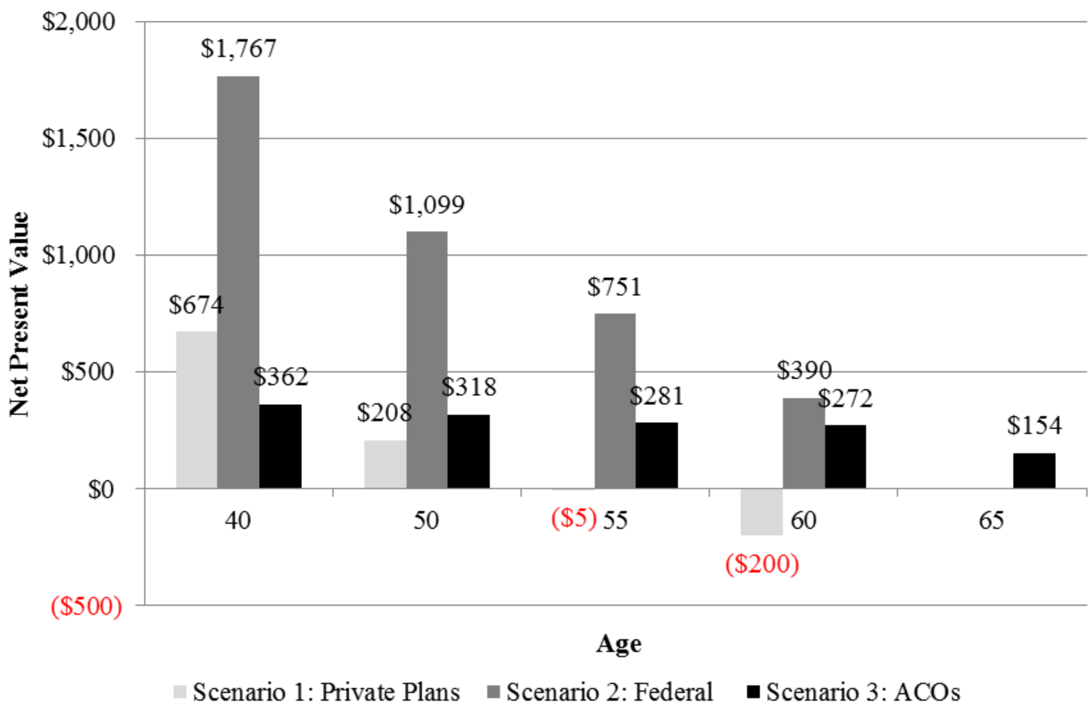
[45] The potential of a diabetes prevention program to reduce medical costs is discussed in Appendix D.

Our discussion in this section primarily focuses on results when we assume the lower ($100) estimate of initial annual medical savings associated with prevention. We note in our discussion how results change if we assume higher levels of savings, though the reader is referred to the tables below for more detail.

Plan Incentives

A focus of this report is determining what incentive a payor/ACO has in providing prevention services. This can be measured in terms of a positive return on investment. Figure 3 shows the Net Present Value (NPV) that the payor/ACO realizes under the three scenarios and hence whether they recoup enough in savings to have an incentive to participate in a prevention program. The data in the figure assume that there will be no leakage from plans, so in this sense, we provide the most optimistic estimate of what returns will be. With leakage, the NPVs will decline.

Figure 3. Net Savings* Per Person to Private Plans/ACOs Per Person (NPV) by Age Under Alternative Scenarios, Assuming No Leakage and $100 Initial Medical Cost Savings**



Source: AIR calculations.
*Net savings are calculated over a maximum 25 year period.
**Denotes the age at which an individual begins the prevention program

Figure 3 shows that for private plans under all scenarios, the Net Present Value of providing prevention services declines with age. For private plans (covered by scenarios 1 and 2), part of the decline is associated with the assumed transfer of the individual to Medicare at age 65.[46] There are three important findings that can be derived from this Figure:

- Even without any leakage, private plans under scenario 1 do not have an incentive to provide prevention services for those 55 and over; the NPV is negative at age 55, which shows that that it takes at least 10 years for prevention investment to pay off at this age (and higher ages), at which point the individual would have transferred to Medicare;

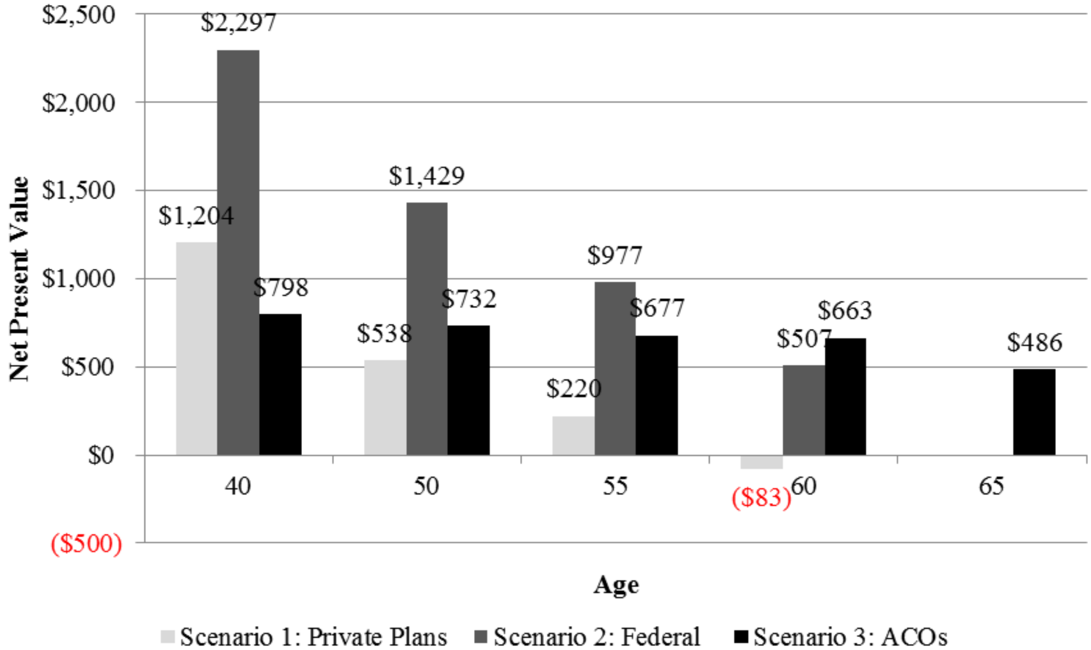
- If the Federal Government pays for prevention services (scenario 2), private health plans have an incentive to provide these services to individuals under 65, since plans receive the benefits but do not incur the costs. An appropriate question (discussed later) is whether the Federal Government receives a positive return on this investment if, for example, these services aim to reduce subsequent Medicare costs; and

- An ACO-type arrangement can support investments in prevention services among older individuals, because the ACO receives the benefits of prevention services after a person turns 65.

For comparison, Figure 4 shows the NPVs under the assumption that medical savings costs are $130 per year. As expected, the shift from $100 to $130 affects incentives. One change is in the incentive of 55 year-olds who are covered by private plans; under the assumption that there are greater initial medical cost savings ($130), plans have the incentive to provide these prevention services (i.e., NPV is $220 vs. $ -5 for an assumed $130 vs $100 savings in medical costs respectively). This small change in average savings substantially increases the NPV. ACOs continue to have incentive to provide prevention services at all levels, with higher NPVs at all ages.

[46] An additional component of the decline at higher ages is the higher levels of mortality; a larger share of individuals will die before the plan can realize a positive return to their investment in prevention services.

Figure 4. Net Savings* Per Person to Private Plans/ACOs Per Person (NPV) by Age Under Alternative Scenarios, Assuming No Leakage and $130 Initial Medical Cost Savings**



Source: AIR calculations.
*Net savings are calculated over a maximum 25 year period.
**Denotes the age at which an individual begins the prevention program

Breakeven Point

The question of when a payor/ACO begins to receive a positive return on investment is an important one. This is determined by the breakeven point at which the cumulative net benefit (medical savings minus costs) becomes positive, i.e. when the payor/ACO begins to receive an overall positive benefit from investment. Our analysis shows that for private plans under scenario 1, it would take 10 years for a plan to realize a positive return on investment for individuals who were 40 and 11 years for those 50 and over. Among ACOs, the breakeven point is 15 years for individuals less than 65 years old, and 17 years for those over 65 (reflecting higher mortality rates).[47] This is particularly important since many estimates of benefits from prevention services (such as the CBO) rely on only a ten year time frame which is not long enough to capture a positive NPV in this study.

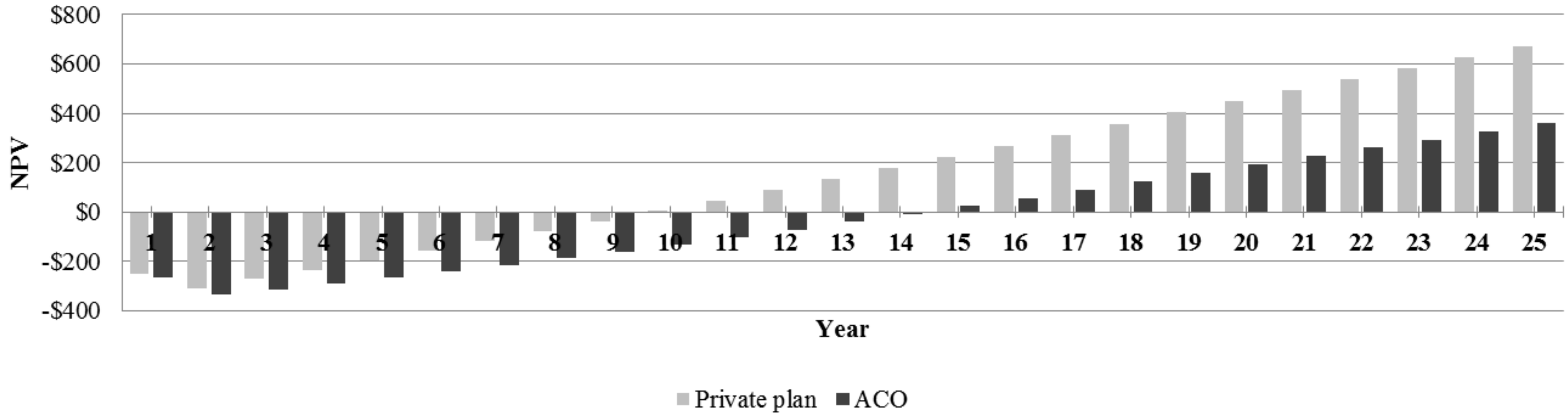
Figures 5 and 6 show how the cumulative net benefit of providing prevention varies over time for an individual after they first receive services. The figures present data for a private plan (scenario 1) and an ACO (scenario 3). Figure 5 represents an individual who was 40 years old when he/she began the program and Figure 6 represents an individual who was 55 years old when

[47] It takes longer for ACOs to break even to realize a positive return on their investment, in that we have assumed that they capture a lower portion (70%) of medical savings than private plans, which we assume capture 85 percent of these savings.

he/she began the program. The bars on the chart show what the private plan or ACO has received to date in terms of overall net benefit. A value below zero indicates total costs up to date are greater than the total savings to date; a value above zero indicates total savings to date are greater than total costs to date, i.e., the plan is beginning to realize a positive return on its investment. The breakeven point is the year at which the plan realizes a positive return, i.e. the bars in the chart are above the line. The breakeven point for a 55-year old is slightly later for the private plan than it is for a 40-year old, reflecting a difference in mortality across the two groups.[48]

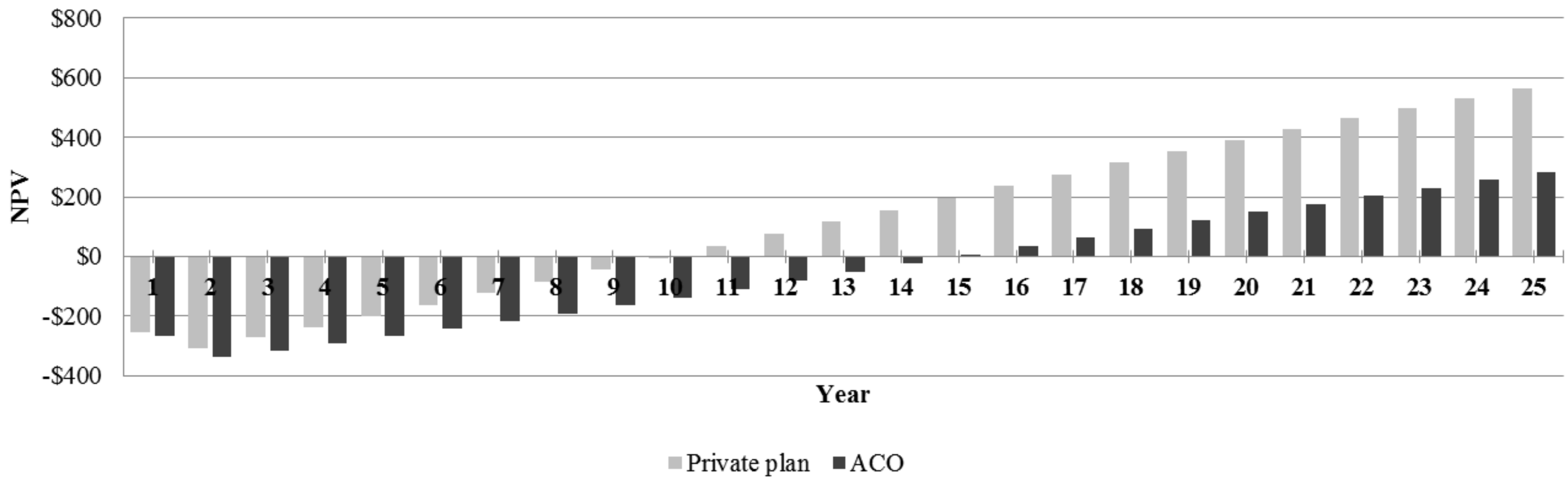
[48] For the $130 assumption of initial medical savings, the breakeven point is 7 years at all ages under Scenario 1. For Scenario 3, ACOs, the breakeven point is 9 years for all ages under 65 and 10 years for those who are 65.

Figure 5. Cumulative Net Benefit (Private and ACO) For Individuals Age* 40 (Initial medical savings of $100 per year)



*Denotes age at which an individual begins the prevention program

Figure 6. Cumulative Net Benefit (Private and ACO) For Individuals Age* 55 (Initial medical savings of $100 per year)

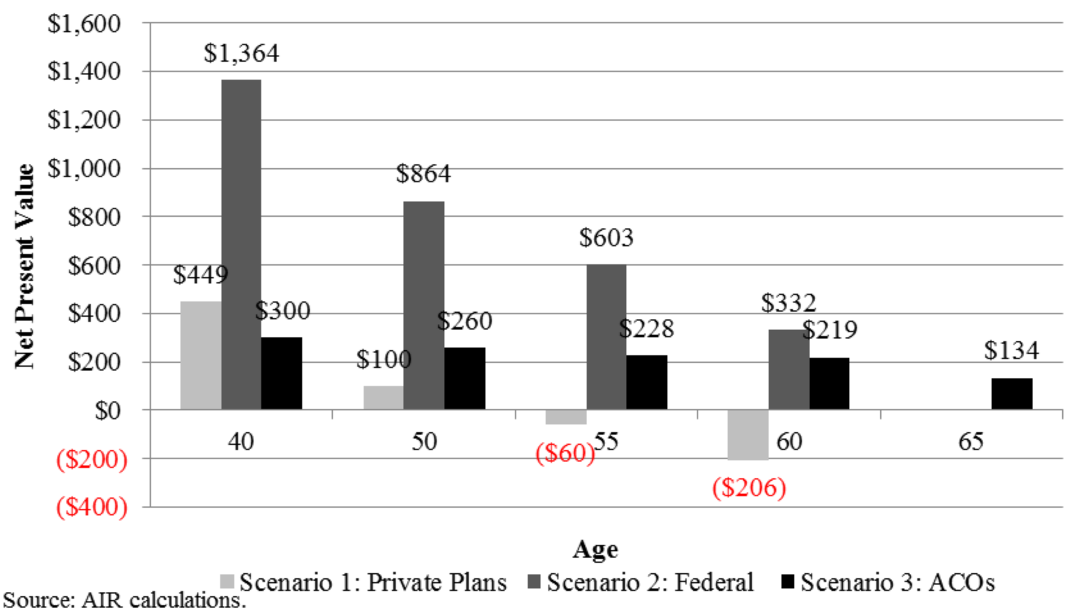


*Denotes age at which an individual begins the prevention program

Leakage

Leakage refers to the rate individuals leave a private plan or ACO over time, thus reducing the future benefits of prevention services from the perspective of plan or ACO. The tables at the end of this section address how different assumptions regarding leakage affect NPVs, and as expected, the financial incentives to provide prevention services decline with higher levels of leakage because NPVs fall with higher levels of leakage. The two figures below are similar to Figure 3 (which assumed no leakage), but Figure 7 shows NPVs for a "low leakage" assumption and Figure 8 shows NPVs for a "high leakage" assumption.[49] Model results indicate that at the assumed values of leakage, overall incentives to provide prevention services change little, at least based on the estimated sign (positive or negative) of the NPV. For example, in the case of a 40 year old covered by a private plan (scenario 1), the plan's NPV drops from $674 under the assumption of "no leakage", to $449 under "low leakage," and $224 under "high leakage." The only change in incentives for private plans comes for 50 years olds as we move to "high leakage," at which point NPV changes from $208 for "no leakage" to $-8 under a "high leakage" assumption.[50] The modeling shows that ACOs maintain their incentive to provide prevention services, even with assumptions of leakage. We note that the leakage assumption is lower for the ACO for reasons discussed in the Key Assumptions section.

Figure 7. Net Savings* Per Person to Private Plans/ACOs Per Person (NPV) by Age Under Alternative Scenarios, Assuming Low Leakage*****



Source: AIR calculations.
Note: Assumes $100 initial medical cost savings.
*Net savings are calculated over a maximum 25 year period.
**Denotes the age at which an individual begins the prevention program
***Low leakage is 5 percent a year for private plans for the first five years and 2 percent a year for ACOs for the first five years.

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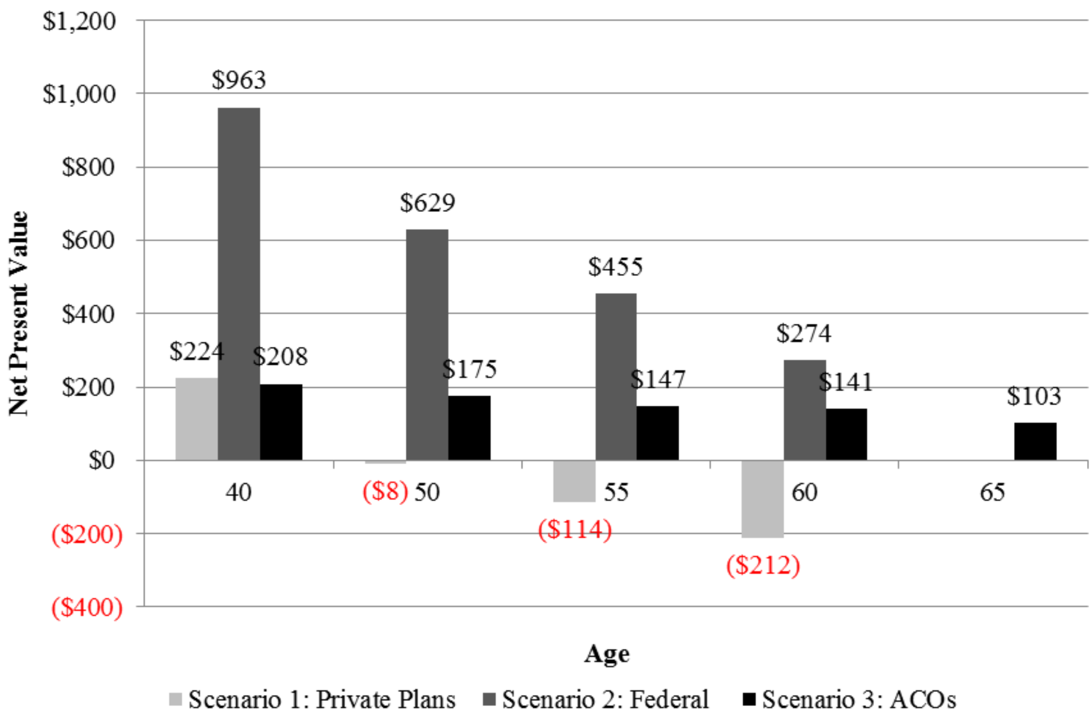
[49] "Low leakage" assumes that private plans lose 5 percent of the members in each of the first 5 years and that ACOs lose 2 percent of their enrollees in each of the first 5 years; "high leakage" assumes that private plans lose 10 percent of the members in each of the first 5 years and that ACOs lose 5 percent of their enrollees in each of the first 5 years.
[50] Under the assumption that the initial medical cost savings are $130 per year, plans would have an incentive to provide prevention services to those 55 and under, even at high levels of leakage.

Figure 8. Net Savings* Per Person to Private Plans/ACOs Per Person (NPV) by Age Under Alternative Scenarios, Assuming High Leakage*****

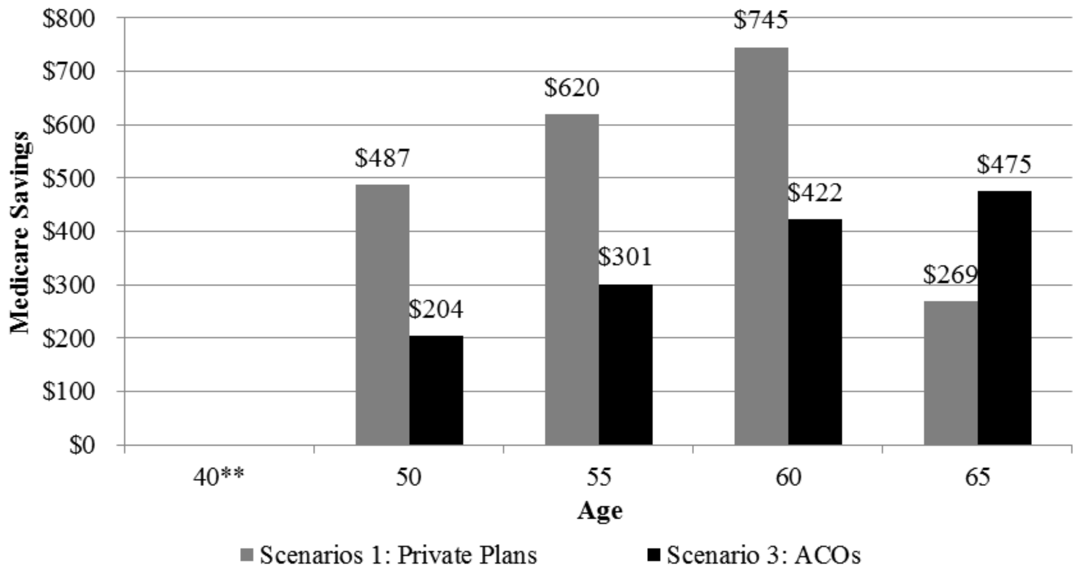


Source: AIR calculations.
Note: Assumes $100 initial medical cost savings.
*Net savings are calculated over a maximum 25 year period.
**Denotes the age at which an individual begins the prevention program
***High leakage is 10 percent a year for private plans for the first 5 years and 5 percent a year for ACOs for the first five years

Savings to Medicare

Prevention programs provided to those under 65 years of age can potentially create benefits to the Federal Medicare program in terms of reduced medical spending once individuals attain the age of 65. Figure 9 presents these estimated savings under scenarios 1 and 3, based on the age at which individuals first enroll in the prevention program. Scenario 2 is omitted since it is not clear how to appropriately attribute the costs from the Federal Government (i.e., program costs could be attributed to Medicare or to another Federal Government funding source). Under these scenarios, the savings to Medicare increase by age when the individual first receives prevention services, as more time is spent in Medicare. Scenario 3 assumes that individuals are covered by an ACO-type organization, and a portion of the benefits of the program are shared with the Medicare program. Under scenario 3, benefits to the program increase with age, including those who first receive prevention services at 65.

Figure 9. Estimated Medicare Savings by Age* Under Alternative Scenarios, Assuming No Leakage



Source: AIR calculations.
Note: Assumes $100 initial medical cost savings.
*Deontes the age at which an individual begins the prevention program
**Age 40 cohort has no Medicare savings because model assumes entry to Mediare at age 65 (end of 25 year model)

Overall Federal Savings

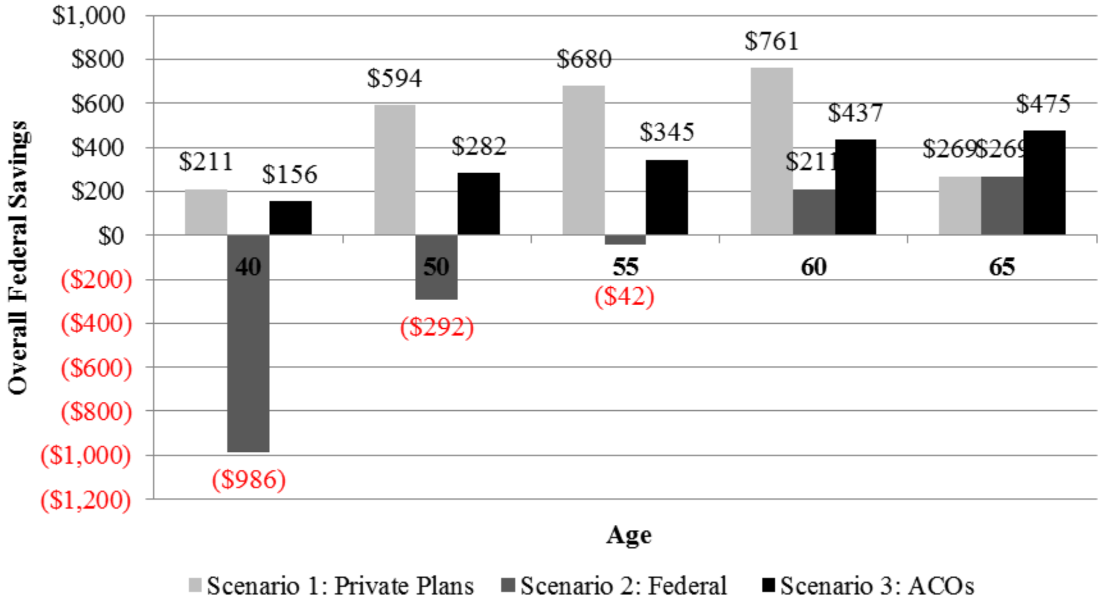
A key assumption is whether the Federal Government could potentially benefit from providing prevention services to those under age 65 in order to receive benefits once these individuals become Medicare beneficiaries at age 65. This is covered by scenario 2. Using the assumption that initial medical savings costs are $100, the Federal Government would realize a net savings ($124 per person for a 60-year old) by providing prevention services to individuals who are 60 or over, but would not realize a benefit for providing these services to a 55-year individual (there would be a net loss of $210).[51]

In addition to Medicare savings discussed above, the Federal Government can potentially recognize additional savings if payor/ACOs are able to reduce their spending and subsequently reduce premiums charged to employers who can then offer employees higher wages and salaries. This will have the effect of increasing tax revenue on this wage and salary income, reducing the tax expenditures implicitly associated with employee health benefits. Estimates of overall tax expenditure changes are presented in Tables 1 and 2 at the end of this section. These expenditures decrease with the age of the individual, reflecting the smaller number of years in the workforce. Figure 10 adds together all components of federal spending (Medicare savings, prevention funding under scenario 2, and potential increases in tax revenue). Federal tax

[51] The net savings is calculated by subtracting the tax expenditure reduction from the overall federal savings in Tables 1B and 2B. If we assume that initial medical savings are $130 per year, then the Federal Government would realize a positive net savings for those 55 and older ($115 for a 55-year old).

expenditures are different under scenarios 1 and 2. Thus, this reflects the full net costs or benefits to the Federal Government from the scenarios.

Figure 10. Overall Federal Savings by Age* Under Alternative Scenarios, Assuming No Leakage



Source: AIR calculations.
Note: Assumes $100 initial medical cost savings.
*Denotes the age at which an individual begins the prevention program

Results from the modeling are summarized in the tables below that delineate assumptions about the age of an individual at the time he/she is first enrolled in the prevention program and benefits in terms of reduced medical costs, as well as the share of savings (in terms of reduced medical costs) that a payor/ACO will realize.

Table 1A. Scenario 1: Net Savings per Person (NPV) by Age* over 25 Years for Alternative Leakage Assumptions, Assuming Initial Medical Savings of $100 per Year

Model Assumptions	Net Savings			
		Federal Perspective		
	Plan Perspective	Tax Expenditure Reduction (pre-65)	Medicare Savings (post-65)	Overall Federal
Age 40				
No leakage from plans	$674	$211	-	$211
Private plans lose 5% a year for 5 years	449	159	-	159
Private plans lose 10% a year for 5 years	224	106	-	106
Age 50				
No leakage from plans	208	107	487	594
Private plans lose 5% a year for 5 years	100	81	487	568
Private plans lose 10% a year for 5 years	(8)	54	487	541
Age 55				
No leakage from plans	(5)	60	620	680
Private plans lose 5% a year for 5 years	(60)	45	620	665
Private plans lose 10% a year for 5 years	(114)	30	620	651
Age 60				
No leakage from plans	(200)	16	745	761
Private plans lose 5% a year for 5 years	(206)	13	745	758
Private plans lose 10% a year for 5 years	(212)	9	745	754
Age 65**				
No leakage from plans	-	-	269	269

*Denotes the age at which an individual begins the prevention program
**Assumes Medicare is paying for the prevention program

Table 1B. Scenario 2: Net Savings per Person (NPV) by Age* over 25 Years for Alternative Leakage Assumptions, Assuming Initial Medical Savings of $100 per Year

Model Assumptions	Net Savings				
		Federal Perspective			
	Plan Perspective	Prevention Funding	Tax Expenditure Reduction (pre-65)	Medicare Savings (post-65)	Overall Federal
Age 40					
No leakage from plans	$1,767	($1,380)	$394	-	($986)
Private plans lose 5% a year for 5 years	1364	(1134)	304	-	(830)
Private plans lose 10% a year for 5 years	963	(889)	215	-	(674)
Age 50					
No leakage from plans	1099	(1024)	245	487	(292)
Private plans lose 5% a year for 5 years	864	(867)	193	487	(188)
Private plans lose 10% a year for 5 years	629	(710)	140	487	(83)
Age 55					
No leakage from plans	751	(830)	168	620	(42)
Private plans lose 5% a year for 5 years	603	(721)	134	620	(33)
Private plans lose 10% a year for 5 years	455	(613)	101	620	109
Age 60					
No leakage from plans	390	(621)	87	745	211
Private plans lose 5% a year for 5 years	332	(564)	74	745	254
Private plans lose 10% a year for 5 years	274	(509)	61	745	297
Age 65**					
No leakage from plans	-	-	-	269	269

*Denotes the age at which an individual begins the prevention program
**Assumes Medicare is paying for the prevention program

Table 1C. Scenario 3: Net Savings per Person (NPV) by Age* over 25 Years for Alternative Leakage Assumptions, Assuming Initial Medical Savings of $100 per Year

Model Assumptions	Net Savings			
		Federal Perspective		
	ACO Perspective	Tax Expenditure Reduction (pre-65)	Medicare Savings (post-65)	Overall Federal
Age 40				
No leakage from plans	$362	$156	-	$156
ACOs lose 2% a year for 5 years	300	141	-	141
ACOs lose 5% a year for 5 years	208	118	-	118
Age 50				
No leakage from plans	318	78	204	282
ACOs lose 2% a year for 5 years	260	71	204	275
ACOs lose 5% a year for 5 years	175	59	204	263
Age 55				
No leakage from plans	281	44	301	345
ACOs lose 2% a year for 5 years	228	40	301	341
ACOs lose 5% a year for 5 years	147	34	301	334
Age 60				
No leakage from plans	272	15	422	437
ACOs lose 2% a year for 5 years	219	14	422	436
ACOs lose 5% a year for 5 years	141	12	422	434
Age 65				
No leakage from plans	154	-	475	475
ACOs lose 2% a year for 5 years	134	-	475	475
ACOs lose 5% a year for 5 years	103	-	475	475

*Denotes the age at which an individual begins the prevention program

Table 2A. Scenario 1: Net Savings per Person (NPV) by Age* over 25 Years for Alternative Leakage Assumptions, Assuming Initial Medical Savings of $130 per Year

Model Assumptions	Net Savings			
	Plan Perspective	Federal Perspective		
		Tax Expenditure Reduction (pre-65)	Medicare Savings (post-65)	Overall Federal
Age 40				
No leakage from plans	$1,204	$313	-	$313
Private plans lose 5% a year for 5 years	859	236	-	236
Private plans lose 10% a year for 5 years	513	158	-	158
Age 50				
No leakage from plans	538	165	725	890
Private plans lose 5% a year for 5 years	359	124	725	849
Private plans lose 10% a year for 5 years	181	84	725	809
Age 55				
No leakage from plans	220	94	945	1039
Private plans lose 5% a year for 5 years	121	71	945	1016
Private plans lose 10% a year for 5 years	22	48	945	993
Age 60				
No leakage from plans	(83)	27	1166	1193
Private plans lose 5% a year for 5 years	(106)	20	1166	1187
Private plans lose 10% a year for 5 years	(130)	15	1166	1181
Age 65**				
No leakage from plans	-	-	696	696

*Denotes the age at which an individual begins the prevention program
**Assumes Medicare is paying for the prevention program

Table 2B. Scenario 2: Net Savings per Person (NPV) by Age* over 25 Years for Alternative Leakage Assumptions, Assuming Initial Medical Savings of $130 per Year

Model Assumptions	**Net Savings**				
	Plan Perspective	**Federal Perspective**			
		Prevention Funding	**Tax Expenditure Reduction (pre-65)**	**Medicare Savings (post-65)**	**Overall Federal**
Age 40					
No leakage from plans	$2,297	($1,380)	$512	-	($868)
Private plans lose 5% a year for 5 years	1774	(1134)	396	-	(739)
Private plans lose 10% a year for 5 years	1252	(889)	279	-	(609)
Age 50					
No leakage from plans	1429	(1024)	319	725	19
Private plans lose 5% a year for 5 years	1123	(867)	250	725	108
Private plans lose 10% a year for 5 years	818	(710)	182	725	197
Age 55					
No leakage from plans	977	(830)	218	945	333
Private plans lose 5% a year for 5 years	784	(721)	175	945	398
Private plans lose 10% a year for 5 years	591	(613)	132	945	464
Age 60					
No leakage from plans	507	(621)	113	1166	659
Private plans lose 5% a year for 5 years	431	(565)	96	1166	698
Private plans lose 10% a year for 5 years	356	(508)	79	1166	737
Age 65*					
No leakage from plans	-	-	-	696	696

*Denotes the age at which an individual begins the prevention program
**Assumes Medicare is paying for the prevention program

Table 2C. Scenario 3: Net Savings per Person (NPV) by Age* over 25 Years for Alternative Leakage Assumptions, Assuming Initial Medical Savings of $130 per Year

Model Assumptions	Net Savings			
		Federal Perspective		
	ACO Perspective	Tax Expenditure Reduction (pre-65)	Medicare Savings (post-65)	Overall Federal
Age 40				
No leakage from plans	$798	$244	-	$244
ACOs lose 2% a year for 5 years	697	220	-	220
ACOs lose 5% a year for 5 years	546	185	-	185
Age 50				
No leakage from plans	732	130	265	395
ACOs lose 2% a year for 5 years	638	118	265	383
ACOs lose 5% a year for 5 years	496	99	265	364
Age 55				
No leakage from plans	677	77	391	468
ACOs lose 2% a year for 5 years	588	70	391	461
ACOs lose 5% a year for 5 years	454	59	391	450
Age 60				
No leakage from plans	663	28	548	576
ACOs lose 2% a year for 5 years	576	26	548	574
ACOs lose 5% a year for 5 years	444	22	548	570
Age 65				
No leakage from plans	486	-	617	617
ACOs lose 2% a year for 5 years	433	-	617	617
ACOs lose 5% a year for 5 years	352	-	617	617

*Denotes the age at which an individual begins the prevention program

Appendix A. DPP Models

The Diabetes Prevention Program (DPP) is a prevention program targeted at high-risk individuals to delay or prevent the onset of the disease. There have been two distinct models of the DPP implemented:

- *Original Model:* An individually oriented, intensive intervention. This model was implemented via a multi-site clinical trial. The clinical trial also evaluated the efficacy of an oral medication[52]
- *Group-Based YMCA DPP (GO-YDPP):* A less resource-intensive, group-based intervention carried out by the YMCA. The YMCA study, referred to as GO-YDPP, was implemented as a pilot cluster-randomized trial at YMCA community based settings. [53,54]

Eligibility and Enrollment

Original Model

Participants were considered eligible if they were:

- At least 25 years old;
- Overweight or obese - BMI of at least 24 kg/m^2 (at least 22 kg/m^2 for Asians);
- Had pre-diabetes – the study used the 1997 criteria from the American Diabetes Association (ADA) to ascertain pre-diabetes; an impaired glucose tolerance (IGT), defined by a fasting plasma glucose concentration of 95 to 125 mg/dl and a concentration of 140 to 199 mg/dl two hours after a 75 g oral glucose load; and
- Not determined to have pre-existing conditions that would interfere with the conduct of the trial.[55]

GO-YDPP

Participants were recruited for the GO-YDPP program via the mailing of a 1-page letter sent to random households within a set radius of a YMCA. The letter gave background on pre-diabetes and listed risk-factors for the disease. If potential participants determined themselves to be at risk, they were invited to a screening event at the YMCA. Participants were eligible if they were:

- Determined to have an ADA risk score of 10 or higher. [56]

[52] Diabetes Prevention Program Research Group. (1999). The Diabetes Prevention Program, Design and methods for a clinical trial in the prevention of type 2 diabetes. *Diabetes Care*, 22(4); 623-634.
[53] Ackermann, (2007)
[54] Ackermann, (2008)
[55] Diabetes Prevention Program Research Group. (2002a). Reduction in the Incidence of Type 2 Diabetes with Lifestyle Intervention or Metformin. *New England Journal of Medicine*, 346(6), 393–403.

- Overweight or obese - BMI of at least 24 kg/m^2 or higher; and

- Determined to have a casual capillary blood glucose of 110-199 mg/dL, via the administration of a finger stick to collect blood.[57]

Current Eligibility

Many YMCA centers have since implemented the GO-YDPP model in their communities. They require that a participant be over 18, have a BMI of 25 kg/m^2 or more, and have 2 of the seven following risk factors:

- High cholesterol

- High blood pressure

- Being physically active 2 or less days per week

- Being told by a doctor that the person has pre-diabetes

- Having had gestational diabetes (diabetes in pregnancy) or having had a baby weighing more than nine pounds at birth.

- Being 45 years of age or older.

- Having a parent or sibling who is/was diagnosed with Type 2 diabetes.[58]

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The BPC has recommended that for the purposes of this evaluation, the eligibility criteria used should be the YMCA risk factor eligibility criteria (i.e. no test results required).

Activities of the Intervention

Original Model

The lifestyle intervention of the original clinical trial included eight key features:

- Individual lifestyle coaches

- Frequent contact with participants

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[56] ADA risk test takes into consideration overweight and obesity status, age, gender, family history, and personal history of gestational diabetes for women. American Diabetes Association. (2012). Are you at risk for type 2 diabetes? Retreived January 23, 2013 from www.diabetes.org/diabetes-basics/prevention/diabetes-risk-test/risk-test-flyer-2012.pdf
[57] Ackermann, (2008).
[58] YMCA of Greater Rochester (n.d) Prevention for a Healthier Tomorrow. Retrieved January 19, 2013 from http://rochesterymca.org/diabetesprevention

- A 16-session core-curriculum focused on behavior change to achieve weight-loss and physical activity
- Supervised physical activity sessions
- A flexible maintenance component
- A "toolbox" of adherence strategies
- Tailoring of intervention materials to address ethnic diversity
- A network of training, feedback, and clinical support.[59]

GO-YDPP

The YMCA model translated the original clinical trial intervention into a group format with 3 phases of intervention:

- A 16-session core-curriculum delivered over 20 weeks
- A 4-week training and refinement phase
- A long-term maintenance phase for reinforcement.[60]

[59] The Diabetes Prevention Program Research Group. (2002b). The Diabetes Prevention Program – Description of Lifestyle Intervention. *Diabetes Care*, 25(12), 2165-2171.
[60] Ackermann, (2007)

Appendix B: Short Term and Long Term Effects of the DPP Program

According to the Centers for Disease Control and Prevention (CDC), diabetes is the seventh leading cause of death in the United States (U.S.). In 2010, diabetes affected an estimated 8.3%, or 25.8 million people in the U.S. There were 18.8 million diagnosed and 7.0 million undiagnosed cases.[61] Diabetes prevalence differs amongst age groups, racial/ethnic groups, and type of diabetes. Further, Type 2 diabetes accounts for 95% of diagnosed cases amongst adults.[62]

Diabetes prevention programs focus on delaying and, if possible, preventing diabetes among those with pre-diabetes. The pre-diabetic population includes individuals who have blood glucose or A1c levels higher than normal but not high enough to be considered diabetic. A person with pre-diabetes has a higher chance of developing diabetes, heart disease, and stroke. People with pre-diabetes have impaired glucose tolerance levels such that when they ingest 75 grams of glucose, their blood sugar level rises higher than normal, but is still below the level of those who have diabetes.[63,64] The CDC estimated that 79.0 million people aged 20 years or older had pre-diabetes in 2010.[65]

1. Short-Term Effects of the Program

The original DPP randomized clinical trial identified the relatively short-term (less than 3 year effects) of DPP and found that the intervention reduced the cumulative incidence of diabetes by 58 percent compared to the placebo group. Participants in this study included adults at least 25 years old, with a BMI ≥ 24 kg/m^2 (≥ 22 kg/m^2 in Asians), a plasma glucose concentration of 95 to 125 mg/dL, and 140 to 199 mg/dL two hours after a 75-g oral glucose load. Fifty (50) percent of participants in the DPP achieved the goal of weight loss of 7 percent or more by the end of the 24 week curriculum.[66]

There is limited evidence on the efficacy of the GO-YDPP community, group-based version of the DPP as it has recently been implemented. In a cluster-randomized trial of the group-based DPP intervention at the YMCA among adults who had a BMI ≥ 24 kg/m^2, more than 2 diabetes risk factors, and a random capillary blood glucose of 110 to 199 mg/dL, a body weight reduction of 6.0 percent was observed in intervention participants after 6 months and was sustained at the twelve month follow-up.[67] These weight reductions are similar to those observed in the original DPP study.

2. Long-Term Effects of the Program

There is also limited evidence on the longer term effects of diabetes prevention programs in delaying the onset of diabetes beyond the 3-4 years covered by the original DPP study. A study on the 10-year follow-up results of the DPP randomized clinical trial found that, while DPP participants partly regained some of

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[61] Centers for Disease Control and Prevention (CDC). (2011). National Diabetes Fact Sheet: National Estimates and General Information on Diabetes and Prediabetes in the United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.

[62] Centers for Disease Control and Prevention. (2012). Diabetes Report Card 2012. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services.

[63] American Diabetes Association. (2013). Prediabetes FAQS. Retrieved January 19, 2013 from: http://www.diabetes.org/diabetes-basics/prevention/pre-diabetes/pre-diabetes-faqs.html#QA-8.

[64]International Diabetes Federation. (2011). Retrieved from: https://www.idf.org/fact-sheets/impaired-glucose-tolerance

[65] CDC, (2011)

[66] Diabetes Prevention Program Research Group, (2002a)

[67] Ackermann, (2008)

the weight they had previously lost (6 kg loss, 4 kg regained), their *combined incidence* of diabetes was lowest (5.3 cases per 100 person-years, 95% CI 4.8-5.8) in the lifestyle group compared with the metformin (6.4, 95% CI 5.9-7.1) and placebo (7.8, 95% CI 7.2-8.6) groups. [68] This suggests that the effects of the DPP in preventing or delaying diabetes can persist for 10 years.

There are two notable simulation studies that examine long-term effects of the DPP, using clinical data on the progression of diabetes. In the first study, Eddy, Schlessinger, and Kahn used data to assess the cost-effectiveness of the DPP on individuals at high risk for diabetes over the course of 30 years (BMI >24 kg/m^2, fasting plasma glucose level of 5.2725 to 6.9375 mmol/L, and 2-hour glucose tolerance test result of 7.77 to 11.0445 mmol/L). These authors concluded that, compared with no intervention, the DPP program reduced a high-risk person's 30-year chances of developing diabetes from about 72 percent to 61 percent and the chances of a serious complication from about 38 percent to 30 percent. [69] Data are presented in the first figure below.

In the second study, Herman et al. show that approximately 83% of the people who did not receive any kind of treatment to prevent diabetes would develop Type 2 over a lifetime. In contrast, 63% of those who received the lifestyle interventions would develop diabetes over a lifetime. Data are presented in the second figure below.[70]

Both of these studies show that lifestyle intervention programs would prevent or delay the onset of diabetes amongst the population with pre-diabetes.

[68] Diabetes Prevention Program Research Group, (2009)
[69] Eddy, D. M., Schlessinger, L., & Kahn, R. (2005). Clinical Outcomes and Cost-Effectiveness of Strategies for Managing People at High Risk for Diabetes. *Annals of Internal Medicine*, 143(4), 251–264.
[70] Herman WH, Hoerger TJ, Brandle M, Hicks K, Sorensen S, Zhang P, et al. (2005). The cost-effectiveness of lifestyle modification or metformin in preventing type 2 diabetes in adults with impaired glucose tolerance. *Ann Intern Med*, 142, 323-32.

Figure B-1. Effects of 4 programs on progression to diabetes.[71]

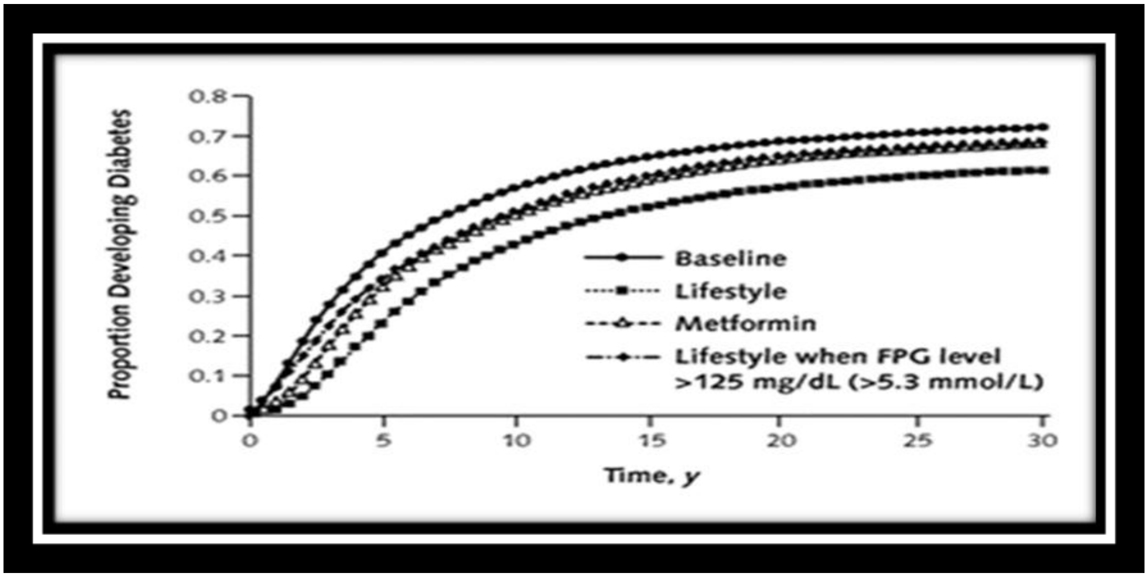
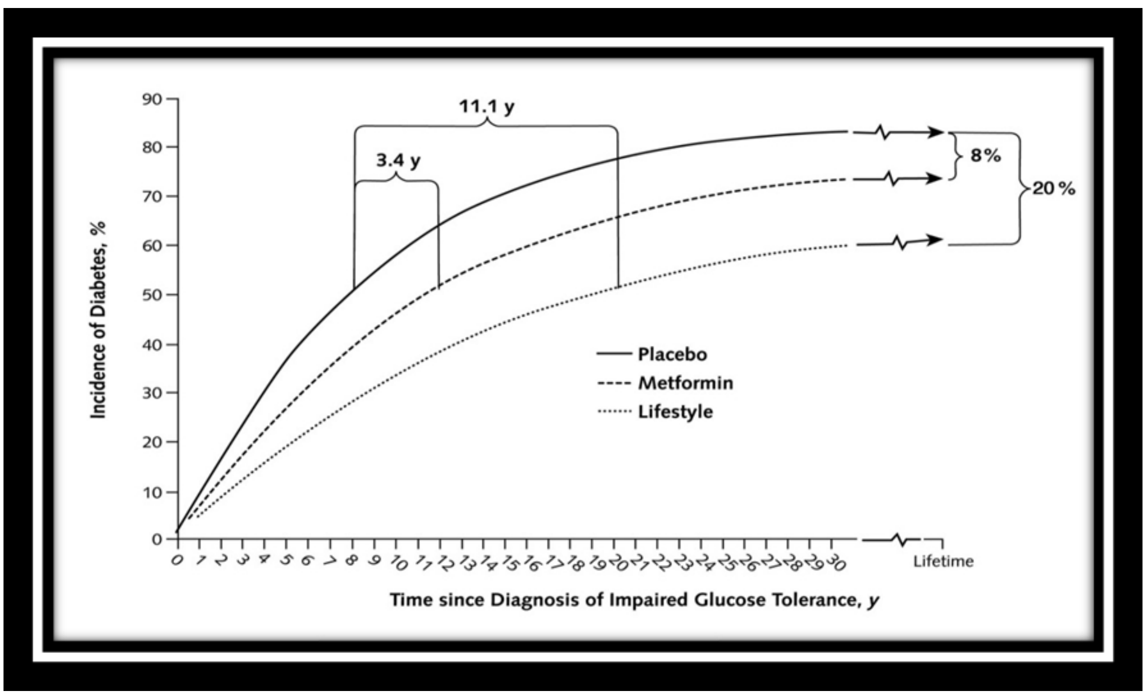


Figure B-2. Simulated cumulative incidence of diabetes among adults with impaired glucose tolerance by the Diabetes Prevention Program treatment group. [72]



[71] Eddy, (2005)
[72] Herman, (2005)

Appendix C: Estimates of the Size of the Population with Pre-diabetes, Age 20 and Older

The National Health and Nutrition Examination Survey (NHANES) assesses the health and nutritional status of the American population on an ongoing basis and the data is collected through in-person interviews and physical examinations.[73] For our analyses, AIR combined various files from NHANES. Information on participant's Body Mass Index (BMI) level was obtained from the Examination component of the survey. Blood sugar measures of Fasting Plasma Glucose (FPG) and Glycohemoglobin (HbA1c) levels were found in the Laboratory component of the survey, and information pertaining to whether a doctor or health care professional told an individual he/she had pre-diabetes was taken from the Questionnaire component of the survey. In combination, BMI and blood sugar information are criteria that could be used in a screening program.

In estimating the size of the population with pre-diabetes, age 20 and older, AIR assumed that individuals who were told by their doctors or health care professionals that they had diabetes would not be enrolled in the prevention program. Hence, these individuals are not included in Table C-1. Table C-1 shows that the NHANES data represented an estimated 200 million people in the United States age 20 and older in 2009-2010, and 190 million of them had complete BMI, FPG and HbA1c data from the various components of the survey. In order to meet the criteria for pre-diabetes for this table, an individual had to have a BMI equal to or greater than 25 kg/m^2 and FPG level of 100-125 mg/dl ***or*** HbA1c level of 5.7-6.4%. Approximately 54 million of 190 million (28.3%) Americans have pre-diabetes by these criteria.[74] When applied to the total population of 200 million, this percentage translates to an estimate of 57 million who have pre-diabetes. The share that has pre-diabetes by these criteria is lower at younger ages and generally increases with age.

NHANES also asks people if they have been told by a doctor or a healthcare professional that they have pre-diabetes. A sample representing 97.9% (186 million people age 20 and older) of the population within the Questionnaire component responded to this question. Of these, a sample representing about 9 million people (4.9%) reported they had been told that they had pre-diabetes. Applied to the full population, this would indicate that about 10 million people have been told that they have pre-diabetes, in comparison to the 57 million who have pre-diabetes based on BMI and blood sugar measures.

[73] CDC, (2012)

[74] There are other factors that may be associated with pre-diabetes, such as family history, cholesterol level, or blood pressure that are not included in this analysis. Thus, this may understate the percentage that has pre-diabetes. American Diabetes Association, (2013)

Table C-1. Pre-diabetes Only: Distribution of people, age 20 and older, with Pre-diabetes risk factors and Diagnosis by Age and Gender[a,b]

	# of people in total population[c]	# of people who had BMI[d], FPG[e] and HbA1c[f] measured[g]	# of people with Pre-diabetes risk factors			# of people who meet BMI criteria AND (FPG OR HbA1c) criteria	% of people who meet BMI criteria AND (FPG OR HbA1c) criteria [h]	# of people who have been told that they have pre-diabetes	% of people who have been told that they have pre-diabetes[i]
			# of people with BMI of ≥ 25 kg/m^2	FPG level of 100-125 mg/dl	HbA1c level of 5.7%-6.4%				
Age									
20-24	20,120,021	18,785,489	9,414,109	1,661,359	1,155,718	1,661,960	8.8%	203,917	1.1%
25-29	21,375,184	20,185,428	12,187,130	2,138,278	1,850,849	2,481,042	12.3%	357,640	1.8%
30-34	18,318,919	17,371,166	11,391,417	2,422,151	1,920,346	3,208,938	18.5%	365,873	2.1%
35-39	20,044,140	18,917,720	13,694,687	2,401,460	3,795,115	4,566,255	24.1%	577,547	3.1%
40-44	21,274,036	20,240,043	13,865,501	3,834,960	3,793,485	5,798,494	28.6%	973,922	4.9%
45-49	19,658,151	18,701,161	12,647,424	4,071,258	5,829,681	5,910,500	31.6%	922,409	5.0%
50-54	19,581,179	18,699,326	13,512,985	3,082,084	5,612,239	5,466,993	29.2%	1,059,448	5.9%
55-59	16,563,608	16,156,816	11,948,698	4,011,188	6,347,784	7,062,081	43.7%	1,260,141	8.2%
60-64	12,780,225	12,454,742	9,594,614	2,791,356	5,258,297	5,454,078	43.8%	1,249,258	10.6%
65-69	9,637,605	9,153,772	6,413,199	2,006,661	4,406,959	3,758,870	41.1%	576,696	6.5%
70-74	7,749,271	7,301,950	5,836,854	1,991,742	3,329,356	3,581,958	49.1%	574,742	8.3%
75+	13,360,299	12,528,444	7,969,291	3,188,890	6,045,608	4,997,182	39.9%	956,893	8.0%
Gender									
Male	96,144,123	91,045,994	66,459,437	18,984,627	22,760,419	28,740,931	31.6%	4,169,255	4.7%
Female	104,318,514	99,450,063	62,016,471	14,616,759	26,585,019	25,207,419	25.3%	4,909,232	5.0%
Total	200,462,637	190,496,057	128,475,908	33,601,386	49,345,438	53,948,350	28.3%	9,078,487	4.9%

Data Source: 2009-2010 NHANES data.

[a] The weighted population estimates for these variables were calculated using the Mobile Examination Center (MEC) weights.

[b] Individuals who were told by a doctor or healthcare professional that they have diabetes are not included in this table because AIR assumed that these individuals would not enroll in the prevention program.

[c] This is the weighted population from the NHANES data.

[d] BMI: Body Mass Index – calculated from a person's weight and height.

[e] FPG: Fasting Plasma Glucose – this test requires a person to fast overnight. The blood glucose is measured in the morning before eating.

[f] HbA1c: Hemoglobin A1c – this test is a blood test that gives the average amount of glucose in the blood over the past 3-4 months.

[g] The people in this column represents a subset of the weighted population in the NHANES survey who we have complete BMI, FPG, and HbA1c measurements.

[h] The figures in this column are estimated by taking the number of people who meet the BMI and (FPG or HbA1c) criteria divided by the # of people who had BMI, FPG, and HbA1c measured.

[i] The figures in this column are estimated by taking the number of people who were told by a doctor or healthcare professional that they were pre-diabetic divided by the # of people who responded to this question.

Appendix D: Estimating DPP Medical Cost Savings

There is well developed literature on the overall cost of diabetes and its components (e.g., hospitalization). A widely cited study by Dall and colleagues used multiple sources of data to estimate an overall cost of diabetes (Type 1 and Type 2) in the US in 2007 of $174 billion, of which $116 billion could be attributed to medical costs that were above average costs for the non-diabetic population. The study separately estimated the costs associated with Type 2 diabetes, and found that they were $105 billion for medical costs (along with $54 billion for non-medical costs such as lost work days).[75] These costs were also presented on a per-case basis with a breakdown by age group. In the aggregate, average per-case medical costs for Type 2 were $6,414 in 2007 dollars and ranged from $3,837 for those 18-34 years of age to $9,061 for those 65 and over.[76]

To compute the potential medical cost savings of a diabetes prevention program, one would ideally compare costs of individuals enrolled in a prevention program to comparable individuals not enrolled in the program. Although the per-person figures cited above provide an estimate of what treating a case of diabetes may cost in a population that develops diabetes, it likely overstates any cost savings from a prevention program for two reasons.

The first reason is that the appropriate comparison group for those enrolled in a DPP program is not the general, non-diabetic population but rather the population of individuals who are similar to those enrolled in a DPP program, i.e., those with high BMIs and elevated blood sugar in addition to other risk factors for chronic disease. Even if all people with diabetes had medical costs $6,000 higher than the general population, it could well be that comparable individuals (i.e., those prone to diabetes) had costs that were $4,000 per year higher than the general population over the course of their disease. The appropriate estimate of savings from avoiding or delaying a case of diabetes would not be $6,000, but rather $2,000 – the difference between $6,000 and $4,000. Using an average that compared costs of the population with diabetes to the general population would overstate savings from prevention programs.

The second reason that these average values likely overstate cost savings of a prevention program is that the average includes full-blown diabetes cases that have progressed over time. Those individuals enrolled in a prevention program who go on to develop diabetes will be in earlier, less complicated stages of the disease and will likely have lower medical costs than the average.

Third, diabetes is a progressive disease in which complications develop over time. A diabetes prevention program does not prevent diabetes in most people but rather delays its onset. Most individuals in a well-targeted diabetes prevention program will eventually develop diabetes, and the program will have the effect of shifting the costs of diabetes (including complicated cases) into the future. The major part of the savings will be the difference between cases of different severity at a point in time, with the less severe cases "catching up" over time in terms of their cost. The comparison group is not those who do not have diabetes, but rather individuals who were similar at the time the prevention program began and who will likely have developed diabetes.

[75] Dall, T.M, Zhang, Y., Chen, Y.J., Quick, W.W., Yang, W.G., Fogli, J. (2010). The Economic Burden of Diabetes. *Health Affairs*, 29(2), 297-303.

[76] The Dall et al., study estimated the costs of diabetes for a single year. Huang, et al. (2009) projected total future costs of diabetes through 2033, identifying those who would be newly diagnosed as having diabetes. These figures represent a base of costs that could be reduced through a prevention program. We see these as useful contextual information.

As noted, a prevention program will mostly delay the onset of diabetes, but there will be some individuals with pre-diabetes who do not go on to develop diabetes. These individuals potentially represent a valid comparison group for a prevention program, but only if we have information on how medical costs of these individuals progress over time. An average cost estimate such as the one published by Dall[77] may understate medical costs over time for individuals as they live with pre-diabetes. The overall average will include individuals who have recently been diagnosed with pre-diabetes and for whom the average may not be representative of longer-term costs.

There are several studies that have used data from the original (resource-intensive) DPP to examine cost-effectiveness of the program. As part of the original DPP studies, the study by Herman et al. (2005) used data on program and treatment costs over a three-year period and projected these costs over patient lifetime. The authors used a baseline estimate of annual direct medical costs of Type 2 diabetes of $1,684 for non-obese white males who are treated with diet and exercise and have no cardiovascular risk factors and no current complications and modeled progression of the disease over time (cost used for women was 25 percent higher). The study found that per-case savings in medical costs over a lifetime across all individuals were about $6,200 in 2000 dollars, which needed to be compared to lifetime intervention costs of $6,800 for a resource intensive prevention program. The differences in medical costs for the first three years (before significant complications) were on the order of $128 per year for men and $86 per year for women. The intervention was cost-saving only for those in the 25-44 year old group, but the authors argued in general the program increased quality of life by reducing complications and was relatively cost effective as a means of increasing quality adjusted years of life (i.e., costing $1,100 per QALY gained compared to a metformin intervention costing $31,300 per QALY gained). [78]

It is important to note that the Herman study covered a resource-intensive implementation of DPP. We can potentially take the $6,200 estimate of long-term medical savings (adjusted to 2013 values – about $10,000) as an estimate of what a prevention program could save and compare this to the per-person cost of an estimated per-cost prevention program, assuming that the less resource intensive program produces the same outcomes.

The study by Zhuo et al. (2012) used a similar approach to Herman and estimated potential savings for a community-based lifestyle modification program. The study explicitly assumed that the effects of community-based program would be less effective than suggested by data covering the first 3-4 years of the original DPP studies. Zhuo's study found that total discounted gross medical savings over a 25-year period for an individual was approximately $2,400 in 2011 per participant in the program (assuming a discount rate of 3 percent), which was then reduced by estimates of screening and intervention costs to produce net savings[79] estimates of per-person savings of $640 for those aged 18 to 64 and $330 for those aged 65 to 84.[80] Zhuo indicated that discounted costs used in his model were about $100 gross medical savings per year over 25 years, indicating that undiscounted, average per-person costs, grew at three percent a year.

AIR regards Zhuo's work as careful and quite conservative in its assumptions. For the illustrative examples we have developed in this report, we have used the estimate that the program would save $100 a year per individual in terms of medical costs in its first year, and that this savings would grow by three percent a year, with additional adjustment for real growth beyond inflation. This is consistent with Zhuo. As an alternative to this estimate, we have also considered an estimate of $130 per year in the first year to

[77] Dall, (2010)
[78] Herman, (2005)
[79] Net savings refers to medical costs less program costs.
[80] Zhuo, (2012)

illustrate the sensitivity to our assumed savings.[81] It would of course be possible to use higher estimates of medical savings, though given the relatively low cost of the community intervention ($500[82] in total for the first two years and $50 per year subsequently), the program would be cost effective within 5 years from the private payor perspective at all ages if medical savings costs were on the order of $150 per year.

We also note that there are additional studies that discuss diabetes medical cost savings. The 2011 article by Thorpe and Yang estimated potential savings to Medicare for providing a diabetes prevention program to individuals who were currently 60-64 years of age.[83] Their overall estimate of net savings to Medicare was approximately $3,600 per person (i.e. $9.3 billion dollars in net lifetime savings for 2.6 million estimated participants).[84] There are several ways in which Thorpe and Yang approach differs from AIR's:

- Thorpe and Yang provide lifetime estimates, which go beyond the 25 years covered by AIR; adding additional years will increase estimates of savings;
- The study assumes that the only program costs are $240 per person to cover a 16-20 week program, presumably only in the first year. AIR has estimated for a 60 year old, program costs over 25 years are about $1,700 total with no discounting or $1,300 when discounted (at 3 percent);
- It is not clear that Thorpe and Yang apply any sort of discounting to their analysis; this increases their estimate of net savings by approximately 50 percent;
- They indicate that they do not account for inflation; this does have an effect on decreasing net savings, given the assumption that these savings will experience real growth over time; and
- Finally, the analysis appears to assume Medicare would realize all savings from a prevention program; AIR has made an assumption that 65 percent of savings will be retained by the Federal Government as plans reduce their rates.

For comparison, we have run our model (over a 25 year period) for assumptions that otherwise match what we believe were used in the Thorpe and Yang study. When we assume a $100 per year annual medical savings in the first year, our model estimates an individual net savings of $2,800 for a 60 year old. Using an estimate of $130 annual medical savings in the first year, our model produces an estimated nest savings of $3,700. Given that the Thorpe and Zhang model covers "lifetime savings," we believe the AIR model produces similar outputs at the $100 per year estimate of initial medical savings.

The article by Goldman, et al (2009) focuses on economic benefits of various types of prevention programs, including diabetes prevention, beginning at ages 51 and 52.[85] The article focuses on medical cost savings and does not consider the costs of prevention programs. In terms of diabetes, the article estimated that baseline lifetime medical spending (discounted by 3 percent per year) was $170,000 under the status quo and would be reduced to $155,000 if the treatment were effective for 100% of the at-risk population. A 10 percent reduction in diabetes would lead to a $1,200 reduction per-person in medical

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[81] The medical cost savings of the YMCA version of the DPP program over three years was estimated to be $400 (i.e., 4 Million for 10,000 Medicare beneficiaries). Source: Longjohn, M. (2013, February 6). Telephone interview. YMCA (June 18, 2012) The Y Receives Innovation Grant to Test Cost Effectiveness of Diabetes Prevention Program Among Medicare Population. Retrieved February 12, 2013 from http://www.ymca.net/news-releases/20120618-innovation-grant.html.
Based on this, we estimated $130 gross medical cost savings per year.

[82] The $500 comprises $50 for screening and $300 for program activities in the first year as well as $150 for program activities in the second year.

[83] Thorpe, K.E. and Yang, Z. (2011). Enrolling People with Prediabetes Ages 60-64 in a Proven Weight Loss Program Could Save Medicare $7 Billion or More. Health Affairs. 30(9): 1-7

84 Thorpe, (2011).

[85] Goldman, D.P., Zheng, Y., Girosi, F., Michaud, P., Olshansky, J., Cutler, D. (2009). The Benefits of Risk Factor Prevention in Americans Aged 51 Years and Older. American Journal of Public Health. 99(11): 2096-2101.

spending and a 25 percent reduction in diabetes would lead to a $3,700 reduction in medical spending.[86] Studies based on original DPP results (cited in Appendix B of our report) estimated that the program could reduce the prevalence of diabetes by 11 percent (Eddy, et al) [87] to 20 percent (Herman, et al).[88] Using the assumption of $100 medical saving in the first year, the AIR model estimates per-person medical savings of $2,850 for a 50-year old over a 25-year period, which is between the values associated with a 10 and 25 percent reduction in prevalence of diabetes and also consistent with estimated impact of the prevention program from the studies cites above. The Goldman study does cite a larger savings to prevention programs that include both the reductions in medical costs and also the increase in quality adjusted life years (QALYs) that are valued at $100,000 per year.[89] The AIR study does not consider the effects of a diabetes prevention program on QALYs or their additional value beyond reduction in medical costs.

The Urban Institute[90] and Trust Fund for American's Health[91,92] studies reflect a cumulative estimate of savings for multiple chronic conditions including diabetes. Thus, they do not specifically focus on diabetes. Our approach is benchmarked against the Zhuo study, which focused on diabetes and not other conditions, which could also benefit from a prevention program targeted at diabetes.

The YMCA was recently awarded a Health Care Innovation Award by the Center for Medicare and Medicaid Innovation to implement the Y-DPP program for 10,000 Medicare enrollees.[93] The YMCA estimates that the program will save Medicare $4.2 million over three years and $53 million over six years.[94] The YMCA's data modeling[95] focused on average medical costs, relying on the Dall[96] and Zhang[97] estimates. As noted above, we believe that medical costs for diabetes care are unlikely to be constant (ie., at an average value) over the course of the disease. Therefore, use of an average value for all people with diabetes would likely overstate costs for diabetes cases in early years (which are not heavily discounted in a financial model), and therefore overstate the long-term benefits of the program.

[86] Goldman, (2009).
[87] Eddy, D. (2005).
[88] Herman WH, (2005).
[89] Goldman, (2009).
[90] The Urban Institute Health Policy Center. (2011). The Role of Prevention in Bending the Cost Curve. Washington, D.C.
[91] Levi, J., Segal, L. M., & Juliano, C. (2009). Prevention for a Healthier America: Investments in Disease Prevention Yield Significant Savings, Stronger Communities. Issue Report. Washington, DC: Trust for America's Health.
[92] Levi, J., Segal, L.M., St. Laurent, R., Lang, A., & Rayburn, J. (2012). F as in Fat: How Obesity Threatens American's Future. Issue Report. Washington, DC: Trust for America's Health.
[93] YMCA (June 18, 2012) The Y Receives Innovation Grant to Test Cost Effectiveness of Diabetes Prevention Program Among Medicare Population. Retrieved February 12, 2013 from http://www.ymca.net/news-releases/20120618-innovation-grant.html
[94] YMCA (June 18, 2012)
[95] From email communication with Matt Longjohn, YMCA, February 7, 2013. Attached document: Revised Appendix D: Data Modeling for DPP Intervention
[96] Dall, (2010)
[97] Zhang, Y., Dall, T.M., Chen, Y., Baldwin, A., Yang, W., Mann, S., Moore, V., Le Nestour, E., Quick, W.W. (2009). Medical Costs Associated with Prediabetes. Population Health Management, 12(3): 157-163.

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