Reducing Disparities at the Practice Site: Final Report Revised on Outcomes Analysis

October 29, 2012

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I. INTRODUCTION AND SUMMARY OF FINDINGS

The Reducing Disparities at the Practice Site (RDPS) initiative was developed by the Center for Health Care Strategies (CHCS) to support quality improvements in small provider practices serving a high volume of racially and ethnically diverse Medicaid beneficiaries. In some states, as many as 50 percent of Medicaid beneficiaries are served by practices with three or fewer providers.[1] RDPS tested the ability of the Medicaid agencies, health plans, primary care management programs, and other community-based organizations to improve care for Medicaid beneficiaries with diabetes at small practices. Full descriptions of the interventions are available from CHCS.[1] This report presents an outcomes analysis for three states that participated in RDPS: Oklahoma, Pennsylvania, and North Carolina.

In summary, we found little evidence of program impacts on health care utilization in the three states. Although there were some scattered statistically significant differences in outcomes between the treatment and comparison groups throughout, only some were in the expected direction but others were not. The rates of hospital or emergency department use were not different in these three states compared either to trends over time (Oklahoma) or to comparison groups (Pennsylvania or North Carolina). The most promising evidence of effects occurred in Oklahoma, where trends in prescription drug utilization by members assigned to "engaged" practices were more favorable than trends to those assigned to "non-engaged" practices. However, these changes should be interpreted cautiously because the absolute number of beneficiaries in the research sample was small, the percentage with an antidiabetic medication fill did not rise over time, and the potentially favorable effects were due to drug utilization at engaged practices remaining steady (***not*** increasing) while utilization at non-engaged practices fell. In Oklahoma, the incidence of four of six diabetes quality-of-care measures (as identified in Oklahoma disease registry data) also rose during the intervention period, also signaling potential promise for the intervention albeit among a small number of beneficiaries at a small number of practices. Findings for prescription drug use and quality-of-care measures in Pennsylvania and North Carolina do not indicate that RDPS activities had an effect on outcomes for beneficiaries enrolled at participating practices.

II. DATA AND METHODS

We obtained Medicaid claims and enrollment data from the Oklahoma Health Care Authority, the Pennsylvania Department of Public Welfare, and Community Care of North Carolina. Oklahoma also provided disease registry data aggregated at the practice level and Pennsylvania provided beneficiary-level lab data for three quality-of-care measures (hemoglobin A1c tests, eye exams, and low-density lipoprotein cholesterol tests). The amount of data available for the report varied for each state with Oklahoma providing 59 months of data (February 2006 to December 2011), Pennsylvania providing 42 months of data (July 2008 to September 2011), and North Carolina providing 66 months of data (July 2006 to December 2011).

We used different methods to evaluate RDPS activities in the three states depending on the data provided for the analysis. Specifically, the analyses for Pennsylvania and North Carolina included comparison group populations because of the data available, and the analysis for Oklahoma did not.

[1] For more information, see http://www.chcs.org/info-url_nocat3961/info-url_nocat_show.htm?doc_id=706259.

There were too few eligible practices in Oklahoma to consider assigning some to a comparison group and others to the treatment group. Because we had only treatment group data in Oklahoma, we conducted a time series analysis in which we examined trends in outcome measures over time. However, for both Pennsylvania and North Carolina, we conducted a difference-in-differences analysis that compares treatment group to comparison group trends over time. For all states, our power to detect differences in outcomes was small, particularly in Oklahoma, where the study population at the start of RDPS was less than 600 beneficiaries.[2] Because of the lack of power to detect differences, in addition to examining whether differences in outcomes were statistically significant we also examined the magnitude and direction of change in outcomes when drawing conclusions about the effectiveness of the RDPS program activities.

Design of Oklahoma Outcomes Analysis

The Oklahoma research sample included 10 practices that had four or fewer providers but had Medicaid panel sizes of more than 500 beneficiaries (with any type of medical conditions, not only diabetes). In addition, these practices served more than 30 diabetic patients (an RDPS requirement), served more than 15 minority members with diabetes, and had not participated in a similar intervention. Each beneficiary included in the study population was an eligible Medicaid member with evidence of diabetes in medical claims data. Of the 10 Oklahoma practices, 9 served more than 100 Medicaid members with diabetes at some point during the study period, and none served fewer than 89. A total of 1,963 eligible members were enrolled in the Oklahoma practices for at least one month from February 2006 to December 2011. The 10 practices began RDPS participation at different points in time with practice start dates ranging from January 2009 to October 2009.

Based on their level of engagement with RDPS activities, Oklahoma classified four practices as "engaged" (also referred to as being "high performers") in the intervention, compared to the others which were considered "non-engaged." Oklahoma identified nine criteria of engaged practices. Three of the nine criteria focus on the practice team, including the identification of a champion, having strong leadership, and having a strong focus on retaining employees. Five criteria center on the practice environment and use of information tools to provide care. The last criterion considers whether the practice had a strong patient education focus.

For the Oklahoma analysis, we conducted a segmented regression, time series analysis of aggregate measures as well as a descriptive analysis of trends in health care utilization.[3] We conducted one such analysis for the full study population and another in which we compared outcomes of members enrolled in engaged and non-engaged practices. We consider the former the primary analysis and the latter the secondary analysis because all practices participated in RDPS at some level and there is no true comparator in Oklahoma from which to compare outcomes. Using

[2] The estimated minimum detectable difference (at a 80 percent power and 5 percent confidence level) in the rate of hospital admissions for Oklahoma was greater than 50 percent, compared to 12 and 14.5 percent for Pennsylvania and North Carolina, respectively.

[3] Explanatory variables for the full sample where we do not distinguish between engaged and not engaged include a time trend, a squared time trend, an intervention period indicator, one lagged value of the dependent variable, and a time trend for the intervention period (taking the value of 0 before the intervention period and the values 1 through 35 during the intervention period). For the engaged versus not engaged analysis, we also included an engaged/not engaged indicator and three interactions of that variable—one with the full time trend, one with the intervention period indicator, and one with the intervention period time trend.

all the data available from February 2006 to December 2011, we constructed outcome measures for each research sample member in each month he or she was enrolled and aggregated those measures by their relative practice start date. Per 1,000 member months, we examined the rate of hospital admissions, the rate of emergency department visits, the number of antidiabetic drug fills, and the number of cardiovascular prescription drug fills.[4] We also investigated the percentage of members with any antidiabetic drug fills, any cardiovascular medication fills, and evidence in Oklahoma disease registry and claims data of five diabetes quality-of-care measures (hemoglobin A1c (HbA1c) tests, eye exams, low-density lipoprotein (LDL) cholesterol tests, urine protein tests, and diabetic nephropathy monitoring).

Design of Pennsylvania Outcomes Analysis

The Pennsylvania research sample included nine practices located in Philadelphia County that had five or fewer primary care providers, at least 500 Medicaid managed care members with diabetes assigned to them, and more than 60 percent racial and ethnic minority membership (not limited to those patients with diabetes). At the patient level, eligible members were between 18 and 64 years old on July 1, 2009, and were enrolled in Medicaid managed care at the intervention start date and for at least one month during the intervention period July 2009 to December 2011.

We compared outcomes of members served by treatment group practices to outcomes of a comparison group of individuals who were continuously enrolled in Medicaid managed care in a regression-adjusted, difference-in-differences analysis. Like treatment group members, comparison group members had evidence of diabetes in claims data and resided in Philadelphia County, but no comparison group member was ever enrolled in a treatment group practice during the RDPS intervention period. A total of 1,170 patients were enrolled in the Pennsylvania treatment group practices and the comparison group consisted of 2,290 individuals. We used members' first evidence of diabetes in claims data to determine when they first become eligible for RDPS. Those with a medical claim for diabetes on or before July 1, 2009, were eligible at the start of the intervention and those whose first claim came after July 1, 2009, were eligible in the month of their first claim.

We constructed average annualized measures of hospital admissions and emergency department use by 6-month intervals, and antidiabetic and cardiovascular medication use by 12-month intervals. We used claims data and state-reported lab data to measure quality-of-care indicators including HbA1c test, eye examination, LDL cholesterol test, urine protein test, and monitoring for diabetes nephropathy on a yearly basis. We used four types of independent variables in regression analysis: (1) demographic (including age, gender, and race), (2) health status in the baseline year (including claims-based evidence of up to 18 comorbid conditions), (3) health care utilization in the baseline year (including incidence of hospitalization and emergency department use), and (4) drug utilization in the baseline year (including incidence of fills and prescription coverage for antidiabetic and cardiovascular medications).

[4] Antidiabetic drugs comprised the following in the analyses for all three states: metformin, glitazones, sulfonylureas, long-acting injectables, and insulin. Cardiovascular drugs included ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular drugs.

Design of North Carolina Outcomes Analysis

The North Carolina sample included 8 treatment group practices that participated in RDPS and 22 comparison group practices selected by Community Care of North Carolina and the evaluation team. All practices in the treatment and comparison groups had three or fewer providers, served more than 200 Medicaid beneficiaries, and served more than 35 members with diabetes. Beneficiaries were eligible for the research sample if they were at least 5 years old, were enrolled in one of the eligible practices as of October 2009, and had evidence of diabetes before or during the intervention period. For purposes of the outcomes analysis, the North Carolina intervention period began in November 2009. We used members' first evidence of diabetes in claims data to determine when they first entered the research sample. Those with a medical claim for diabetes on or before November 1, 2009, were eligible at the start of the intervention and those whose first claim came after November 1, 2009, became eligible in the month of their first claim. A total of 1,132 patients were enrolled in the North Carolina treatment group practices and the comparison group consisted of 2,328 individuals.[5]

The methods used for North Carolina were similar to those used for Pennsylvania. However, additional data provided by North Carolina allowed us to control for practice-level variation by clustering standard errors at the practice level and to account for gaps in Medicaid enrollment. For members with enrollment gaps less than six months, we counted only enrolled days when we created participant weights for regression analysis. In cases in which the gap between two periods of enrollment was more than six months, we used the end of the first period of enrollment as the patient's last date of enrollment in the intervention overall. If patients were enrolled with more than one treatment practice or more than one comparison practice during the intervention period, they were assigned to the practice in which they had the most days enrolled. However, if patients were enrolled in a treatment group practice and a comparison group practice at different times, their contribution to the evaluation data was terminated at the end of their first treatment group practice enrollment period. In this way, data from a single patient was not counted toward both the treatment and comparison groups.[6]

III. FINDINGS FOR OKLAHOMA

A. The Study Population

At the start of the intervention period, three-quarters of beneficiaries enrolled in Oklahoma RDPS practices were younger than 55 years old and the average age was about 41 (Table 1).[7] Less

[5] We also received a very limited amount of lab data from North Carolina, but because the number of beneficiaries included in these data was very small, we did not conduct analysis with these data.

[6] We also included any beneficiaries with fewer than three months of dual enrollment in Medicare in either the treatment or comparison populations, but controlled for their dual enrollment through regression analysis by including an indicator for anyone with any dual enrollment as an explanatory variable.

[7] Because we conducted a segmented regression analysis to examine outcomes in Oklahoma, we also examined differences across cohorts during the pre-intervention period (Appendix Table 1). Most demographic characteristics either were similar or rose over time, as we might expect in a population of chronically ill Medicaid beneficiaries. However, differences were statistically significant primarily for cohorts separated by two or more years, suggesting that cohort characteristics were relatively similar over time. The number of member months included in this analysis ranges from 6,000 to slightly less than 10,000 per calendar year (Appendix Table 2).

than a third of the population was male, a little more than half was White, and a little more than one-third (36.6 percent) was African American. Although all of these members had evidence of diabetes in claims data, many did not have evidence of other common comorbid medical conditions based on claims data for the year prior to the start of RDPS. The most prevalent comorbid conditions included hypertension (37.8 percent), hyperlipidemia (19.2 percent), and depression (19.0 percent). In the year before RDPS, about a quarter (26.6. percent) had a hospitalization with an average of 4.0 admissions (annualized) per member. About 55 percent had an emergency department visit with an annualized average of 3.5 visits per person. Less than half (45.8 percent) filled a prescription for an antidiabetic medication and the average annualized number of 30-day fills was 4.4. Among those with evidence of cardiovascular disease, 53 percent had at least one fill for a cardiovascular medication with an average of 7.4 fills (annualized).

At the start of RDPS, members of Oklahoma's engaged practices differed in meaningful ways from the non-engaged practice members (Table 1). For example, the average age of members enrolled at engaged practices was 45 years compared to an average age of about 38 for members enrolled at non-engaged practices ($p < 0.01$). Members at engaged practices were more likely to be male (31 percent versus 28 percent) and less likely to be White (50 percent versus 52 percent) or African American (34 percent versus 39 percent); these differences were statistically significant ($p = 0.019$). Members at engaged practices had higher rates of hyperlipidemia ($p < 0.01$), chronic obstructive pulmonary disease ($p = 0.03$), and coronary artery disease ($p = 0.046$), but were less likely to have evidence of depression ($p = 0.019$). Members enrolled at engaged practices were more likely to have had a hospital admission ($p = 0.05$) before the intervention period and more likely to fill antidiabetic or cardiovascular medications (both $p < 0.01$).

B. Hospital Admissions and Emergency Department Visits

RDPS activities did not affect the trends in hospital admissions per 1,000 member months (Figure 1). Hospital admissions per 1,000 member months decreased throughout the pre-intervention period, falling 8.1 percent (from 610 to 561) during that time. This rate of decrease continued during the intervention period as hospital admissions per 1,000 member months fell 11.6 percent (from 561 to 496) when we compare the year prior to the intervention to the last year of the intervention. The difference between the pre-intervention and intervention period trends was not statistically significant. The pattern was similar for members enrolled at engaged practices and those enrolled at non-engaged practices (Appendix Figure 1).

The rate of emergency department visits per 1,000 member months fell 13.4 percent for the entire study population from 324.5 in the year before RDPS to 281.1 in the last year of the intervention (Figure 1). Although promising, this decline was not statistically significantly different. Moreover, the level of emergency department visits per 1,000 member months at the end of RDPS was similar to the level early in the pre-intervention period, indicating that we cannot rule out that this pattern is due to regression to the mean. The decline in emergency department use during the intervention period was attributable primarily to a decrease in the rate over 1,000 member months for members enrolled at non-engaged practices, rather than engaged ones (Appendix Figure 2). In fact, the rate of emergency department visits per 1,000 member months rose 29 percent for members at engaged practices and fell 20 percent for members at non-engaged practices (this difference was statistically significant at the $p < 0.01$ level). This provides further caution as to whether the drop in the overall rate of emergency department visits during the intervention period was attributable primarily to RDPS activities.

Table 1. Demographic and Health- Related Characteristics of Beneficiaries with Diabetes Assigned to Oklahoma Study Group Practices at the Start of the Intervention for Each Practice

	All Members	Engaged Practices	Non-Engaged Practices	Difference Between Engaged and Non-Engaged
Number of Beneficiaries	**579**	**231**	**348**	
Age				
Mean	40.7	45.0	37.9	7.1***
Percentage				
Under 18	12.4	8.7	14.9	-6.3†††
18 to 34	22.5	15.6	27.0	-11.4
35 to 54	41.3	43.3	39.9	3.3
55 or older	23.8	32.5	18.1	14.4
Gender (percentage)				
Male	29.2	30.7	28.2	2.6
Race (percentage)				
White	51.3	50.2	52.0	-1.8††
African American	36.6	33.8	38.5	-4.7
Other	12.1	16.0	9.5	6.5
Percentage with Evidence of Common Chronic Conditions				
Hyperlipidemia	19.2	24.7	15.5	9.2***
Chronic obstructive pulmonary disease	9.3	12.6	7.2	5.4**
Hypertension	37.8	36.8	38.5	-1.7
Coronary artery disease	6.6	9.1	4.9	4.2**
Congestive heart failure	3.8	4.8	3.2	1.6
Depression	19.0	14.3	22.1	-7.8**
Obesity	8.3	8.2	8.3	-0.1
Asthma	8.1	8.7	7.8	0.9
Number of Months Assigned to Practice in the Previous Year (Percentages)				
At least 6 but less than 9 months	18.0	13.4	21.0	-7.6††
At least 9 but less than 12 months	27.5	25.5	28.7	-3.2
12 months	54.6	61.0	50.3	10.8
Health Care Use in Previous Year				
Percentage with a hospital admission	26.6	31.1	23.7	7.4**
Average annualized number of hospital admissions	4.0	4.9	3.3	1.6
Percentage with				
0	73.4	68.9	76.3	-7.4
1	1.7	2.6	1.2	1.5
2 or more	24.9	28.5	22.5	5.9
Percentage with an emergency department visit	55.4	54.6	55.9	-1.3
Average annualized number of emergency department visits	3.5	3.0	3.9	-0.9
Percentage with				
0	44.6	45.4	44.1	1.3
1	12.3	12.2	12.4	-0.2
2 or more	43.1	42.4	43.5	-1.1
Prescription Drug Use in Baseline Year				
Use of antidiabetic drugs				
Percentage with at least one fill	45.8	54.8	39.8	15.0***
Average annualized number of fills	4.4	5.2	3.9	1.3**
Use of cardiovascular drugs				
Percentage with at least one fill	53.1	66.1	44.4	21.7***
Average annualized number of fills	7.4	10.2	5.5	4.7***

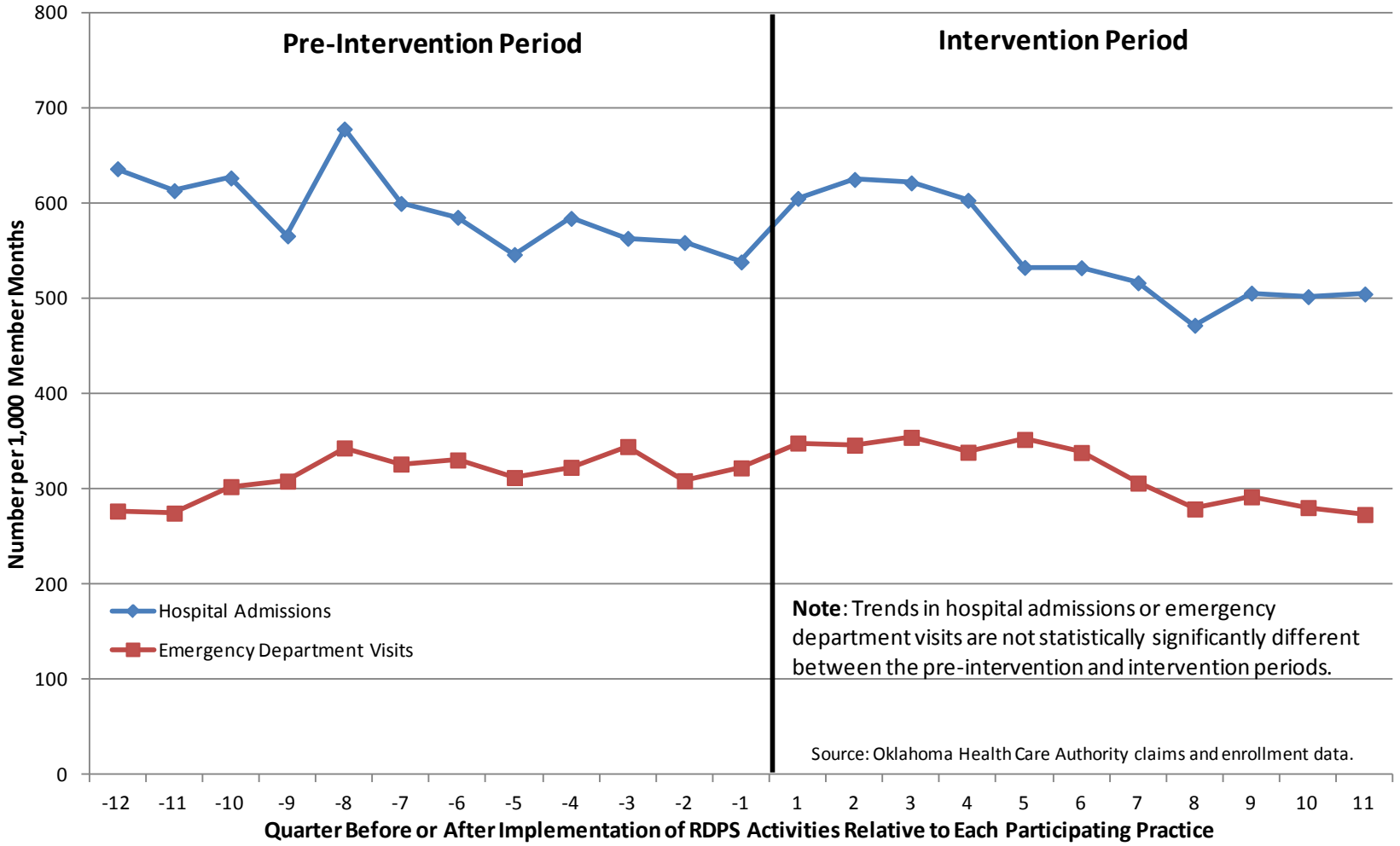
Source: Oklahoma Health Care Authority claims and enrollment data.

Note: Includes Medicaid beneficiaries who met program eligibility criteria (at least one claim for diabetes) and were enrolled at one of the study group practices for at least six months before the start of the intervention. Health care and prescription drug use outcomes are weighted to account for differential enrollment among members. We normalized weights so they sum to the number of sample members.

[a]We normalized each pharmacy claim to a 30-day supply, except for insulin. Antidiabetic drug categories include: glitazones, sulfonylureas, long-acting injectables, insulin, and other antidiabetic drugs. Cardiovascular drugs include ACE inhibitors, beta blockers, calcium channel blockers, statins, diuretics, and other cardiovascular drugs.

** Difference between the groups is statistically significantly different from 0 at the 0.05 level, 2-tailed t-test.
*** Difference between the groups is statistically significantly different from 0 at the 0.01 level, 2-tailed t-test.
†† Distributions are statistically significantly different from 0 at the 0.05 level, chi-squared test.
††† Distributions are statistically significantly different from 0 at the 0.01 level, chi-squared test.

Figure 1. Hospital Admissions and Emergency Department Visits per 1,000 Member Months, Among the Entire Oklahoma Study Population



Note: The evaluation period started as early as February 2009 for some practices and ended in December 2011 for all practices. Outcomes are regression adjusted via segmented regression analysis where explanatory variables included a time trend, a squared time trend, an intervention period indicator, one lagged value of the dependent variable, and a time trend for the intervention period. Events per 1,000 member months = (number of events for all eligible members)/(number of member months for all eligible members) x 1,000.

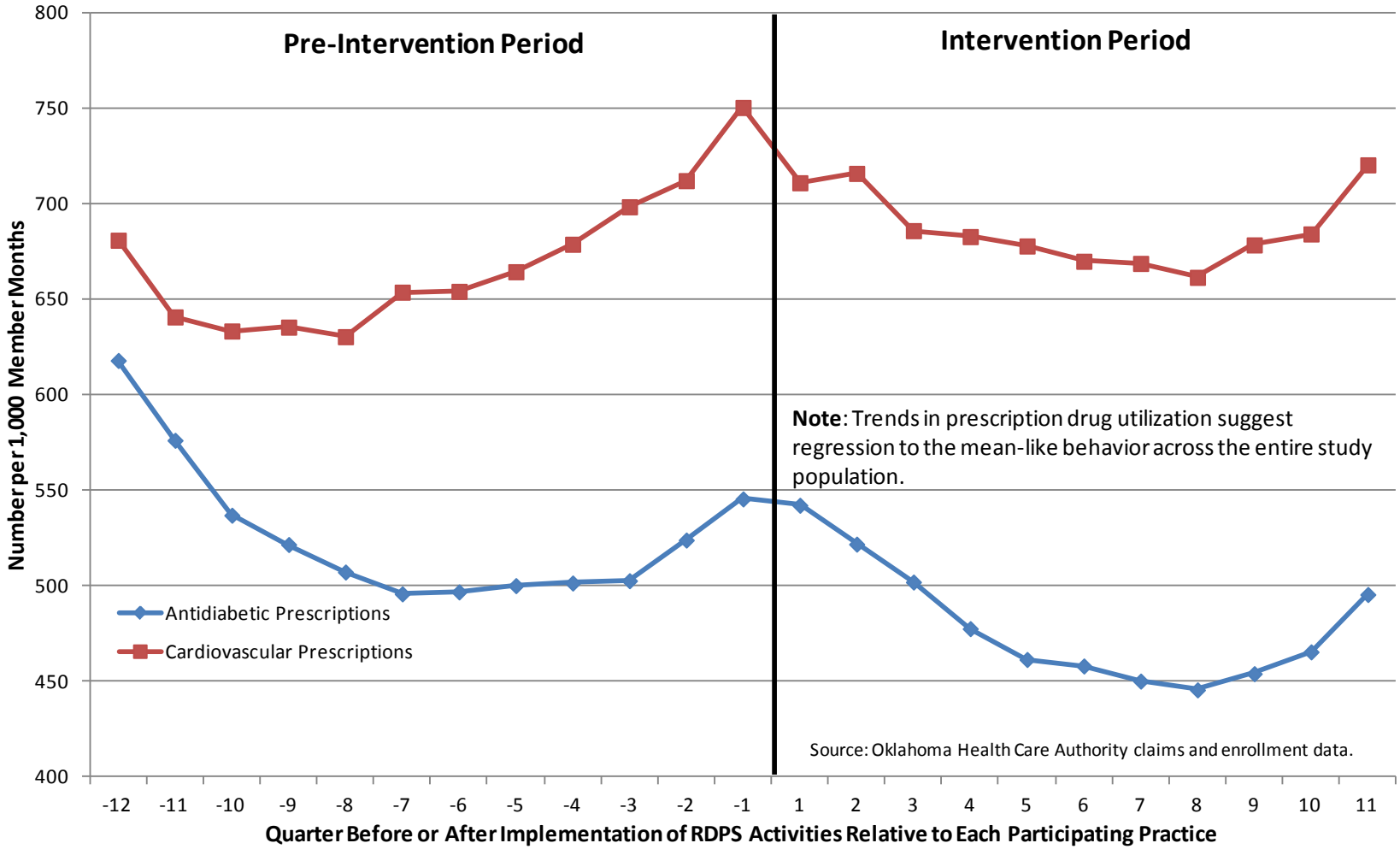
C. Prescription Drug Utilization

The overall trend in prescription drug utilization for antidiabetic and cardiovascular medications suggests that RDPS activities might not have influenced these outcomes (Figure 2). For both types of drug utilization, fills per 1,000 member months fell and then rose during the pre-intervention period and followed the same pattern during the intervention period. Generally, the trend in antidiabetic medication use was downward among all members of the study population throughout the entire study period. However, there were some potential signs that members enrolled in engaged RDPS practices improved their prescription drug filling behavior relative to members enrolled at non-engaged practices. For example, compared to the year before the intervention began, the average number of antidiabetic drug fills per 1,000 member months was slightly higher among members in engaged practices by the end of RDPS, while the trend among those at non-engaged practices fell considerably (Appendix Figure 3). The difference between the trends for the engaged and non-engaged groups was statistically significant ($p < 0.01$). We observed a similar pattern for cardiovascular medications. That is, the number of fills per 1,000 member months was stable for members at engaged practices but fell for those at non-engaged practices (Appendix Figure 4). Once again, the difference between trends was statistically significant ($p < 0.01$). Although these differences in medication use are potentially promising, they should be considered with caution for at least three reasons. First, the number of beneficiaries in each group was small; in particular, the cardiovascular medication measures included only those members with previous evidence of cardiovascular disease. Second, although trends for non-engaged practices are downward sloping, the trends for engaged practices are essentially unchanged across the pre-intervention and intervention periods. Third, the average monthly percentage of beneficiaries with any antidiabetic or cardiovascular prescription was never greater than 40 percent at any time during the study period (Appendix Figure 5), suggesting that a large proportion of members in any given month had no fills for medications.

D. Quality- of- Care Measures

Evidence of the impact of RDPS on diabetes quality-of-care measures was mixed depending on whether we examined disease registry or claims data. Based on disease registry data provided by Oklahoma, a larger proportion of members across all RDPS practices had evidence of four out of six quality-of-care measures from 2010 to 2011, suggesting that quality-of-care might have improved overall (Table 2). For example, the proportion with evidence of an LDL cholesterol test rose 19 percent (from 53.5 percent to 63.9 percent) between these two years. However, the rate of improvement was larger for persons in non-engaged practices compared to persons in engaged practices, though the absolute values for all measures were always higher at engaged practices. For example, the proportion of patients at non-engaged practices with evidence of a diabetic foot exam rose 32 percent from 2010 to 2011, but only 4 percent for those at engaged practices. However, the absolute percentage with evidence of this quality measure in 2011 was nearly 15 percentage points higher at engaged practices compared non-engaged ones (59.6 to 44.9).

Figure 2. Prescription Drug Fills per 1,000 Member Months, Among the Entire Oklahoma Study Population



Note: The evaluation period started as early as February 2009 for some practices and ended in December 2011 for all practices. Outcomes are regression adjusted via segmented regression analysis where explanatory variables included a time trend, a squared time trend, an intervention period indicator, one lagged value of the dependent variable, and a time trend for the intervention period. Events per 1,000 member months = (number of events for all eligible members)/(number of member months for all eligible members) x 1,000.

Table 2. Diabetes Quality- of- Care Measures for Study Group Practices, Percentage of Patients with a Specific Measure (Oklahoma Disease Registry Data)

Measure	2010	2011	Percentage Change
All Practices			
HbA1c Test	64.3	68.8	7.0
Blood Pressure <140/80	46.3	42.9	-7.3
Low-density lipoprotein (LDL) Test	53.5	63.9	19.4
Urine Protein Screen	55.4	57.7	4.2
Eye Exam	24.0	22.6	-5.8
Foot Exam	45.9	53.2	15.9
Engaged Practices			
HbA1c Test	70.1	74.4	6.1
Blood Pressure <140/80	43.4	44.2	1.8
LDL Test	61.1	67.0	9.7
Urine Protein Screen	66.9	63.5	-5.1
Eye Exam	28.4	24.4	-14.1
Foot Exam	57.1	59.6	4.4
Non- Engaged Practices			
HbA1c Test	55.4	61.5	11.0
Blood Pressure <140/80	50.4	41.2	-18.3
LDL Test	42.7	59.8	40.0
Urine Protein Screen	41.7	50.2	20.4
Eye Exam	19.2	20.3	5.7
Foot Exam	34.1	44.9	31.7

Source: Disease registry data provided by the Oklahoma Health Care Authority.

Note: Because disease registry data were provided aggregated by practice and not per beneficiary, we present aggregate statistics here.

Using medical claims data from 2008 through 2011, we found that the change in the percentage of members at engaged practices with evidence of diabetes quality-of-care measures was larger than for members at non-engaged practices (Table 3). For example, from 2008 to 2011, the percentage of members at engaged practices with an eye exam rose 24.5 percent compared to only 3.1 percent among those at non-engaged practices. The percentage increases among persons at engaged practices compared to those at non-engaged practices were also larger for evidence of HbA1c tests, LDL tests, and urine protein screening. Although these findings are promising, they are based on a small number of eligible beneficiaries per period, so these results should be considered in conjunction with all other findings rather than on their own. Moreover, for many of these quality-of-care measures, Oklahoma disease registry data appear to be a more reliable gauge because the percentage of members with evidence of these measures in claims data is generally much smaller than in the disease registry data.

Table 3. Diabetes Quality- of- Care Measures for Study Group Practices, Percentage of Patients with Specific Measure (Oklahoma Medicaid Claims Data)

					Change from 2008 to 2011	
Measure	2008	2009	2010	2011	Absolute	Percentage
All Practices						
HbA1c Test	9.0	12.0	16.7	14.0	5.0	55.0
LDL Test	7.9	10.5	13.2	11.4	3.5	44.9
Urine Protein Screen	2.9	2.8	3.5	2.6	-0.3	-9.8
Eye Exam	44.2	54.3	58.6	49.5	5.3	12.0
Nephropathy Monitoring	2.5	5.7	6.1	5.1	2.5	99.7
Engaged Practices						
HbA1c Test	8.6	13.6	17.9	16.1	7.5	87.2
LDL Test	7.8	11.8	16.3	14.0	6.2	79.1
Urine Protein Screen	2.5	3.4	3.2	3.0	0.4	17.3
Eye Exam	45.2	55.1	59.0	56.2	11.1	24.5
Nephropathy Monitoring	1.7	6.4	7.3	5.7	4.0	4.0
Non- Engaged Practices						
HbA1c Test	9.3	11.0	16.0	12.6	3.3	36.1
LDL Test	7.9	9.7	11.3	9.7	1.8	22.7
Urine Protein Screen	3.2	2.4	3.6	2.4	-0.7	-22.7
Eye Exam	43.6	53.8	58.3	44.9	1.3	3.1
Nephropathy Monitoring	3.0	5.4	5.3	4.8	1.7	56.9

Source: Oklahoma Health Care Authority claims and enrollment data.

Note: Includes Medicaid beneficiaries who met program eligibility criteria (at least one claim for diabetes) and were enrolled at one of the study group practices.

IV. FINDINGS FOR PENNSYLVANIA

A. The Study Population

The Pennsylvania study population consisted primarily of beneficiaries older than 34 years and was ethnically diverse. There were a number of statistically significant differences in baseline characteristics between the treatment and comparison groups in the Pennsylvania study population (Table 4). For example, the average age of treatment group members was lower than that of comparison group members, although the difference of 1.3 years was small ($p < 0.01$). However, a larger proportion of the comparison group was 55 to 64 years old compared with the treatment group (38.6 versus 31.2 percent, $p < 0.01$). The two groups had a different mix of Medicaid members based on race and ethnicity ($p < 0.01$). In the treatment group, 71 percent of members were African American, 14 percent were Latino, and 11 percent were White. In contrast, the corresponding proportions in the comparison group were 53 percent, 24 percent, and 16 percent. Comparison group members were also more likely to have a documented disability than treatment group members (78 percent versus 65 percent, respectively; $p < 0.01$). Treatment group members were more likely to have evidence of hyperlipidemia (25 percent versus 14 percent, $p<0.01$) and depression (11 percent versus 7 percent, $p < 0.01$) than comparison group members in baseline claims data, but the rates of other chronic conditions were similar between these groups.

In the 12 months before RDPS began, treatment group members had statistically significantly higher rates of emergency department use than their comparison group counterparts (3.4 versus 2.3 visits per year, respectively; $p < 0.01$, Table 5). Only about a quarter of either group had a hospital admission in the baseline year and the difference was not statistically significant. Treatment group members were less likely to have at least one fill of an antidiabetic medication (61.4 versus 65.4, $p = 0.028$) and to have at least 50 percent of enrolled days covered by an antidiabetic prescription (45.1 versus 50.2 percent, $p < 0.01$). Differences in baseline cardiovascular medication use between treatment and comparison group members were small and not statistically significant.

Table 4. Baseline Demographic Characteristics Among Treatment and Comparison Group Members for the Pennsylvania RDPS Program, Percentage Unless Otherwise Stated

	Treatment	Comparison	Difference	*p*-Value
Number of Patients	**1,170**	**2,290**		
Age				
Mean	49.1	50.4	-1.3	<0.01
Percentage				
18 to 34	10.2	9.5	0.7	<0.01
35 to 54	58.6	51.9	6.7	
55 to 64	31.2	38.6	-7.4	
Race **(Percentage)**				
White	11.0	15.9	-4.9	<0.01
African American	71.0	52.9	18.1	
Latino	13.8	23.5	-9.7	
Other	4.2	7.7	-3.5	
Months Enrolled in Baseline Year **(Percentages)**				
Fewer than 6 months	1.5	0.0	1.5	<0.01
At least 6, but fewer than 9 months	1.5	0.0	1.5	
At least 9, but fewer than 12 months	9.7	0.0	9.7	
12 months	87.3	100.0	-12.7	
Disabled **(Percentage)**	64.7	78.1	-13.4	<0.01
Percentage with Evidence of Common Chronic Conditions in Baseline Year				
Hyperlipidemia	24.6	14.3	10.3	<0.01
Chronic obstructive pulmonary disease	5.6	6.3	-0.7	0.428
Hypertension	41.5	39.6	1.9	0.294
Coronary artery disease	5.9	7.2	-1.3	0.140
Congestive heart failure	3.3	4.1	-0.8	0.288
Depression	11.1	7.4	3.7	<0.01
Obesity	4.3	5.0	-0.7	0.372
Asthma	8.7	10.3	-1.6	0.126
Arthritis/Joint Disorders	18.2	18.3	-0.1	0.943

Source: Pennsylvania Department of Public Welfare claims and enrollment data.

Note: Treatment group members are Medicaid beneficiaries who meet program eligibility criteria, including enrollment at one of the treatment group practices. In Pennsylvania, comparison group members are Medicaid beneficiaries with diabetes who reside in Philadelphia County but are not members of any of the treatment group practices. We normalized each pharmacy claim to a 30-day supply, except for insulin.

RDPS = Reducing Disparities at the Practice Site.

Table 5. Baseline Health- Related Characteristics Among Treatment and Comparison Group Members for the Pennsylvania RDPS Program, Percentage Unless Otherwise Stated

	Treatment	Comparison	Difference	*p*-Value
Number of Patients	**1,170**	**2,290**		
Health Care Use in the Year Before RDPS				
Percentage with a hospital admission	25.1	24.1	1.0	0.510
Average annualized number of hospital admissions	0.6	0.5	0.1	0.041
Percentage with				
0	75.4	75.9	-0.5	0.311
1	13.9	14.8	-0.9	
2 or more	10.7	9.2	1.5	
Percentage with an emergency department visit	55.4	52.0	3.4	0.057
Average annualized number of visits	3.4	2.3	1.1	<0.01
Percentage with				
0	45.2	48.0	-2.8	0.040
1	7.1	8.6	-1.5	
2 or more	47.7	43.4	4.3	
Prescription Drug Use in the Year Before RDPS[a]				
Use of Antidiabetic Drugs				
Percentage with at least one fill	61.6	65.4	-3.8	0.028
Percentage with at least 50% of enrolled days covered[b]	45.1	50.2	-5.1	0.005
Use of Cardiovascular Medication				
Percentage with at least one fill	78.8	78.0	0.8	0.579
Percentage with at least 50% of enrolled days covered[b]	61.3	63.4	-2.1	0.232

Source: Pennsylvania Department of Public Welfare claims and enrollment data.

Note: Treatment group members are Medicaid beneficiaries who meet program eligibility criteria, including enrollment at one of the treatment group practices. In Pennsylvania, comparison group members are Medicaid beneficiaries with diabetes who reside in Philadelphia County but are not members of any of the treatment group practices. We normalized each pharmacy claim to a 30-day supply, except for insulin.

Health care and prescription drug use outcomes are weighted to account for differential enrollment among members.

[a]Antidiabetic drug categories include: glitazones, sulfonylureas, long-acting injectables, insulin, and other antidiabetic drugs. Cardiovascular medications include ACE inhibitors, beta blockers, calcium channel blockers, statins, diuretics, and other cardiovascular drugs.

[b]Measures proportion of patients who had prescription fills covering half or more of their Medicaid enrollment days in a six month period.

RDPS = Reducing Disparities at the Practice Site.

B. Hospital Admissions and Emergency Department Visits

Difference-in-differences analysis for hospital and emergency department use identified small differences between the treatment and comparison group populations that were not statistically significant (Tables 6 and Appendix Table 3). Thirty percent to one-third of the study population had a hospital admission during the two-and-a-half year intervention period compared with a quarter in the baseline year. The percentage of beneficiaries with an emergency department visit rose in each group, but the percentage in the treatment group rose at a slightly higher rate. Changes in the average annualized number of hospital admissions and emergency department visits for both groups were similar. As noted in Appendix Table 3, there were no statistically significant differences in pre-post trends between the treatment and comparison populations in any of the six-month intervals that we examined.[8]

C. Prescription Drug Utilization

Differences in the trends of antidiabetic medication use among the treatment and comparison groups (in the first and second years of the intervention) were small and not statistically significant for any of the five antidiabetic drug classes that we examined. About 70 percent of both groups had at least one antidiabetic drug fill during the first 12 months of the intervention (Table 7). In the second year of the intervention, that figure was constant for the treatment group but grew to 75 percent for the comparison group (Appendix Table 4). Between 51 and 60 percent of both groups had at least 50 percent of enrolled days covered by any antidiabetic medication in both years, but the percentage of members with at least 50 percent days covered was always higher in the comparison group.

Among members of the study population with a cardiovascular comorbidity (about half the overall research sample), 94 to 95 percent had a fill of a cardiovascular medication. There were no significant differences in cardiovascular medication use between the treatment and comparison groups in either the first or second 12 months of the intervention period (Tables 8 and Appendix Table 5). The most commonly filled cardiovascular medications were statins—about two-thirds of the comparison group had at least one such fill in either 12-month period. Because some beneficiaries were likely to use multiple cardiovascular medications, more than 80 percent of members had at least 50 percent of enrolled days covered by any cardiovascular medications.

[8] According to information received from the state, inpatient claims data in Pennsylvania can be lagged by as much as 12 months, making the inpatient data available to us for the end of the evaluation period potentially incomplete for both the treatment and comparison groups.

Table 6. Hospital Admissions and Emergency Department Use in the Pennsylvania Study Population Through September 2011 (Regression- Adjusted)

	Treatment (Number = 1,170)		Comparison (Number = 2,290)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Admissions or Visits for Any Reason						
Percentage with a hospital admission	25.0	34.4	24.4	28.5	5.3	0.019
Average annualized number of hospital admissions	0.55	0.41	0.45	0.25	0.06	0.252
Percentage with an emergency department visit	54.2	74.8	53.3	70.2	3.7	0.060
Average annualized number of emergency department visits	3.24	3.52	2.36	2.28	0.36	0.233

Source: Pennsylvania Department of Public Welfare claims and enrollment data.

Notes: The evaluation period in Pennsylvania started in July 2009 and ended in September 2011. The difference column represents a difference-in-differences analysis. To annualize hospital admissions or emergency department visits for each period, we multiplied the actual number by 365 and divided by the number of days enrolled in that period.

Pennsylvania inpatient data is lagged as much as 12 months (or more) and may be incomplete for the end of the evaluation period.

The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

Table 7. Antidiabetic Drug Use in the Pennsylvania Study Population in the First 12 Months of the Intervention Period (Regression-Adjusted)

	Treatment (Number =1,170)		Comparison (Number = 2,290)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Percentage with at Least One Fill						
Any antidiabetic drug	62.9	68.4	64.8	70.4	-0.1	0.920
Metformin	36.6	41.4	38.4	42.3	0.9	0.685
Glitazones	18.3	20.5	13.3	14.4	-8.3	0.675
Sulfonylureas	26.8	29.4	27.8	29.0	1.4	0.520
Long-acting injectables	18.7	23.5	19.6	24.4	0.0	0.932
Insulin	20.7	21.5	21.0	23.1	-1.3	0.510
Percentage with at Least 50% of Enrolled Days Covered[a] by						
Any antidiabetic drug	54.7	51.4	56.7	55.1	-1.7	0.496
Metformin	18.9	22.9	21.3	25.1	0.2	0.816
Glitazones	10.7	13.0	7.8	9.0	1.1	0.786
Sulfonylureas	16.4	16.7	16.7	17.9	-0.9	0.619
Long-acting injectables	8.3	10.9	9.9	13.3	-0.8	0.850
Insulin	10.7	11.6	11.8	13.6	-0.9	0.600

Source: Pennsylvania Department of Public Welfare claims and enrollment data.

Notes: The interim evaluation period in Pennsylvania started in July 2009 and ended in September 2011. The difference column represents a difference-in-differences analysis for Pennsylvania.

The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

[a]Measures proportion of patients who had prescription fills covering half or more of their Medicaid enrollment in a 12-month period.

Table 8. Cardiovascular Drug Use in the Pennsylvania Study Population in the First 12 Months of the Intervention Period (Regression-Adjusted)

	Treatment (Number =629)		Comparison (Number = 1,153)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Percentage with at Least One Fill						
Any cardiovascular drug	94.5	94.1	92.8	94.3	-1.9	0.226
ACE inhibitors	43.8	43.7	44.2	46.9	-2.8	0.408
Beta blockers	34.4	38.5	39.5	41.7	1.9	0.504
Calcium channel blockers	31.8	35.5	32.5	36.4	-0.2	0.953
Diuretics	56.1	57.0	52.9	54.8	-1.0	0.777
Statins	64.9	68.6	61.8	66.1	-0.6	0.885
Other cardiovascular drugs	28.5	26.9	24.3	24.7	-2.0	0.515
Percentage with at Least 50% of Enrolled Days[a] Covered by						
Any cardiovascular drug	88.6	82.9	86.9	83.3	-2.1	0.286
ACE inhibitors	23.7	24.1	24.6	29.2	-4.2	0.179
Beta blockers	18.9	20.8	24.7	26.7	-0.1	0.940
Calcium channel blockers	19.8	21.0	19.3	23.3	-2.8	0.330
Diuretics	30.9	35.6	32.4	37.2	-0.1	0.990
Statins	42.6	45.8	40.1	45.2	-1.9	0.549
Other cardiovascular drugs	15.8	16.7	14.1	16.6	-1.6	0.520

Source: Pennsylvania Department of Public Welfare claims and enrollment data.

Notes: The interim evaluation period in Pennsylvania started in July 2009 and ended in September 2011. The difference column represents a difference-in-differences analysis for Pennsylvania. Includes members with evidence of cardiovascular disease at baseline.

The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

[a]Measures proportion of patients who had prescription fills covering half or more of their Medicaid enrollment days in a 12-month period.

D. Quality- of- Care Measures

With the exception of eye examinations, a large proportion of the study population did not receive recommended tests for diabetes in their baseline or intervention periods according to either claims or lab data. Differences between the treatment and comparison groups for quality-of-care measures calculated from claims data were generally small and not statistically significant for four of the five measures we examined (Table 9). The one exception was the proportion of members with an LDL test. For both the first and second years of the intervention period, the proportion in the treatment group *fell* faster than changes to the comparison group (which rose slightly in the first year and fell slightly in the second year). Using lab data provided by Pennsylvania, we found no evidence of statistically significant differences in the trends between the treatment and comparison populations for the incidence of HbA1c tests or eye examinations (Appendix Table 6). However, for both years, there was again a statistically significant difference-in-differences in the rate of LDL screening between the treatment and comparison populations. Test results for urine protein levels or diabetic nephropathy were not available in the state-reported lab data.

Table 9. Diabetes Claims- Based Quality- of- Care Measures for the Pennsylvania Study Group in the Intervention Period (Regression- Adjusted)

	Treatment (Year 1 N = 1,170) (Year 2 N = 869)		Comparison (Year 1 N = 2,290) (Year 2 N = 2,290)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Percentage with:						
Hemoglobin A1c test						
First 12 months	8.3	9.2	7.7	10.4	-1.8	0.210
Second 12 months	7.9	5.8	7.8	7.6	-1.9	0.180
Eye examination						
First 12 months	87.9	88.6	87.4	88.8	-0.7	0.568
Second 12 months	88.6	88.9	87.8	88.1	0.0	0.950
Low-density lipoprotein cholesterol test						
First 12 months	16.8	12.7	12.0	12.7	-4.8	0.005
Second 12 months	17.9	6.6	11.9	9.9	-9.3	<0.01
Urine protein test						
First 12 months	12.3	14.6	14.0	14.0	2.3	0.183
Second 12 months	12.5	13.8	13.8	14.2	0.9	0.631
Monitoring for diabetes nephropathy						
First 12 months	3.5	4.6	4.1	4.4	0.8	0.359
Second 12 months	3.6	4.6	4.0	4.8	0.2	0.813

Source: Pennsylvania Department of Public Welfare claims and enrollment data.

Notes: The evaluation period in Pennsylvania started in July 2009 and ended in December 2010. The difference column represents a difference-in-differences analysis. This analysis includes all research sample members with the potential of at least 12 months of program enrollment. We constructed claims-based quality-of-care measures from 2009 Healthcare Effectiveness Data and Information Set specifications. A total of 26 treatment group members became eligible for the intervention in July 2010 and do not have data for the first intervention year.

The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

V. FINDINGS FOR NORTH CAROLINA

A. The Study Population

The study population in North Carolina was generally younger than 55 years old and primarily female, and more than two-thirds were from racial or ethnic minority groups (Table 10). The treatment and comparison groups differed in a number of ways at baseline. For example, treatment group members were slightly younger, by about a year on average, than comparison group members ($p = 0.041$) and a smaller proportion of treatment group members were over age 55 (22.5 percent versus 27.4 percent $p = 0.023$). The two groups also differed in terms of race and ethnicity ($p < 0.01$). In the treatment group, 58 percent of members were African American, 32 percent were Caucasian, and 4 percent were Latino, whereas in the comparison group, the corresponding proportions were 41 percent, 25 percent, and 2 percent. Treatment group members were more likely to have evidence in claims data of congestive heart failure (15 percent versus 12 percent, $p = 0.021$) and thyroid disorder (16 percent versus 12 percent, $p < 0.01$). However, comparison group members were more likely to have evidence in claims of obesity (23 percent versus 28 percent) and hyperlipidemia (53 percent versus 58 percent).

During the baseline period, treatment and comparison group members had significantly different rates of emergency department use and fills of both antidiabetic and cardiovascular medications (Table 11). Only 34 percent of treatment group members had an emergency department visit during the baseline period, while 39 percent of comparison group members did ($p = 0.012$). Comparison group members visited the emergency department more frequently, making an average of 1.2 visits while treatment group members made 0.6 ($p < 0.01$). The proportion of members with at least one fill of an antidiabetic medication was lower in the treatment group (52 percent versus 57 percent, $p = 0.025$), as was the proportion with at least one fill of a cardiovascular drug (70 percent versus 76 percent, $p < 0.01$). Treatment group members were also less likely to have at least 50 percent of enrolled days covered by a cardiovascular prescription (46 percent versus 52 percent, $p < 0.01$).

Table 10. Baseline Demographic Characteristics Among Treatment and Comparison Group Members for the North Carolina RDPS Program, Percentage Unless Otherwise Stated

	Treatment	Comparison	Difference	*p*-Value
Number of Patients	**1,132**	**2,328**		
Demographics				
Age				
Mean	43.9	44.8	-0.9	0.041
Percentage				
Under 18	3.7	3.6	0.1	0.023
18 to 34	20.5	17.8	2.7	
35 to 54	53.4	51.2	2.2	
55 to 64	22.5	27.4	-4.9	
Gender (percentage)				
Male	33.0	33.6	-0.6	0.747
Female	67.0	66.4	0.6	
Race (percentage)				
White	32.3	24.7	7.6	<0.01
African American	58.0	41.3	16.7	
Latino	4.2	1.7	2.5	
Other	5.5	32.3	-26.8	
Months Enrolled in the Baseline Year (Percentages)				
Fewer than 6 months	14.7	15.0	-0.3	0.359
At least 6, but fewer than 9 months	7.8	6.7	1.1	
At least 9, but fewer than 12 months	7.0	8.4	-1.4	
12 months	70.6	69.9	0.7	
Percentage with Evidence of Common Chronic Conditions in the Baseline Year				
Hyperlipidemia	53.2	57.5	-4.3	0.021
Chronic obstructive pulmonary disease	20.6	18.7	1.9	0.222
Hypertension	76.9	78.1	-1.2	0.421
Coronary artery disease	18.5	20.9	-2.4	0.117
Congestive heart failure	15.2	12.2	3.0	0.021
Depression	42.3	38.9	3.4	0.069
Bipolar disorder	11.7	10.7	1.0	0.394
Thyroid Disorder	16.3	12.1	4.2	0.001
Obesity	23.2	28.2	-5.0	0.003
Anemia	24.9	25.4	-0.5	0.778
Asthma	20.4	21.8	-1.4	0.359
Arthritis/Joint Disorders	50.7	51.3	-0.6	0.741

Source: North Carolina Division of Medical Assistance claims data and Community Care of North Carolina enrollment data.

Note: Treatment group members are Medicaid members enrolled in a North Carolina participating treatment group practice. We normalized each pharmacy claim to a 30-day supply, except for insulin.

RDPS = Reducing Disparities at the Practice Site.

Table 11. Baseline Health- Related Characteristics Among Treatment and Comparison Group Members for the North Carolina RDPS Program, Percentage Unless Otherwise Stated

	Treatment	Comparison	Difference	*p*-Value
Number of Patients	**1,132**	**2,328**		
Health Care Use in the Year Before RDPS				
Percentage with a hospital admission	28.9	28.2	0.7	0.725
Average annualized number of hospital admissions	0.6	0.6	0.0	0.784
Percentage with				
0	74.0	74.9	-0.9	0.359
1	15.2	13.2	2.0	
2 or more	10.8	11.9	-1.1	
Percentage with an emergency department visit	33.7	38.9	-5.2	0.012
Average annualized number of visits	0.6	1.2	-0.6	<0.01
Percentage with				
0	69.3	64.5	4.8	<0.01
1	20.1	15.2	4.9	
2 or more	10.6	20.3	-9.7	
Prescription Drug Use in the Year Before RDPS[a]				
Use of Antidiabetic Drugs				
Percentage with at least one fill	52.3	56.5	-4.2	0.025
Percentage with at least 50% of enrolled days covered[b]	29.6	32.5	-2.9	0.097
Use of Cardiovascular Medication				
Percentage with at least one fill	69.6	76.1	-6.5	<0.01
Percentage with at least 50% of enrolled days covered[b]	46.4	52.2	-5.8	0.002

Source: North Carolina Division of Medical Assistance claims data and Community Care of North Carolina enrollment data.

Note: Treatment group members are Medicaid members enrolled in a North Carolina participating treatment group practice. We normalized each pharmacy claim to a 30-day supply, except for insulin.

Data are weighted to account for differential enrollment among members in the baseline period. For dichotomous outcomes (for example, any hospital admission), we constructed a separate weight for each outcome. Sample members received a weight of one if they were enrolled for the full 12-month period or if they were enrolled for fewer than 12 months but they experienced the outcome during that period (for example, were hospitalized). Those with fewer than 12 months enrolled who did not experience the outcome received a weight equal to the number of enrolled days, divided by the number of days in the period. For continuous outcomes, the weight is proportional to the number of enrolled days. We normalized weights so they sum to the number of sample members.

[a]Antidiabetic drug categories include: glitazones, sulfonylureas, long-acting injectables, insulin, and other antidiabetic drugs. Cardiovascular medications include ACE inhibitors, beta blockers, calcium channel blockers, statins, diuretics, and other cardiovascular drugs.

[b]Measures proportion of patients who had prescription fills covering half or more of their Medicaid enrollment days in a six-month period.

RDPS = Reducing Disparities at the Practice Site.

B. Hospital Admissions and Emergency Department Visits

Difference-in-differences analysis for hospital and emergency department use identified small differences in trends between the treatment and comparison group populations that were generally not statistically significant. The percentages of treatment or comparison group members with a hospital admission or emergency department visit rose during the intervention period compared with baseline (Table 12). Although the difference in hospital use was small and not statistically significant, the percentage of treatment group members with an emergency department visit rose at a slower rate than the percentage for the comparison group ($p < 0.01$). However, the average annualized number of emergency department visits fell at the same rate in both groups between the baseline and intervention periods. Changes to the average annualized number of hospital admissions or emergency department visits per six-month period that we examined were small and generally not statistically significant (Appendix Table 7). The one difference that was statistically significant (average annualized hospital admissions in months 7 to 12) was in larger among the treatment group than the comparison group.

C. Prescription Drug Utilization

Differences in trends of antidiabetic medication use among the treatment and comparison groups were generally small and not statistically significant overall for any of the five antidiabetic drug classes that we examined (Table 13 and Appendix Table 8). More than half and up to 61 percent of both groups had at least one antidiabetic drug fill during the first and second years of the intervention. Between 40 and 46 percent of both groups had at least 50 percent enrolled days covered by any antidiabetic medication in both years, but the percentage of members with at least 50 percent days covered was always higher in the comparison group.

Among members of the study population with a cardiovascular comorbidity (about 80 percent of the overall research sample), 94 to 95 percent had a fill of a cardiovascular medication (Table 14 and Appendix Table 9). There were no significant differences in cardiovascular medication use trends between the treatment and comparison groups in either the first or second 12 months of the intervention period. The most commonly filled cardiovascular medications were statins and diuretics. In the first 12 months of the intervention period, 30 to 35 percent of the study population filled prescriptions for these medications and this rose to nearly 40 percent (for statins) by the second year of RDPS.

Table 12. Hospital Admissions and Emergency Department Use in the North Carolina Study Population Through December 2011 (Regression- Adjusted)

	Treatment (Number = 1,132)		Comparison (Number = 2,328)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Admissions or Visits for Any Reason						
Percentage with a hospital admission	33.6	38.8	34.8	38.6	1.4	0.445
Average annualized number of hospital admissions	0.72	0.76	0.81	0.73	0.12	0.057
Percentage with an emergency department visit	35.1	38.2	38.3	48.6	-7.2	0.009
Average annualized number of emergency department visits	0.73	0.66	1.16	1.09	0.00	0.951

Source: North Carolina Division of Medical Assistance claims data and Community Care of North Carolina enrollment data.

Notes: The evaluation period in North Carolina started in November 2009 and ended in December 2011. The difference column represents a difference-in-differences analysis. To annualize hospital admissions or ED visits for each period, we multiplied the actual number by 365 and divided by the number of days enrolled in that period.

The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Each six-month interval includes beneficiaries who had the potential for that many months of enrollment. For example, beneficiaries whose period of eligibility began 12 months before the end of the intervention are included in the first and second six-month cohorts. The pre-period represents the 12 months before the start of the intervention in North Carolina.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

Table 13. Antidiabetic Drug Use in the North Carolina Study Population in the First 12 Months of the Intervention Period (Regression-Adjusted)

	Treatment (Number =1,132)		Comparison (Number = 2,238)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Percentage with at Least One Fill						
Any antidiabetic drug	52.4	56.4	56.2	61.0	-0.8	0.617
Metformin	28.0	30.5	30.8	34.2	-0.9	0.442
Glitazones	12.5	12.2	12.2	11.1	0.8	0.451
Sulfonylureas	18.0	17.7	17.4	17.6	-0.5	0.739
Long-acting injectables	22.2	27.1	23.7	27.5	1.1	0.504
Insulin	17.7	18.5	20.0	21.1	-0.3	0.820
Percentage with at Least 50% of Enrolled Days[a] Covered by						
Any antidiabetic drug	39.1	41.3	41.9	45.1	-1.0	0.496
Metformin	10.0	15.9	11.0	19.5	-2.6	0.096
Glitazones	5.5	6.2	5.8	5.6	0.9	0.194
Sulfonylureas	6.4	8.4	8.0	10.6	-0.6	0.508
Long-acting injectables	8.1	11.8	8.4	12.5	-0.4	0.769
Insulin	4.5	8.0	6.4	9.1	0.8	0.551

Source: North Carolina Division of Medical Assistance claims data and Community Care of North Carolina enrollment data.

Notes: The evaluation period in North Carolina started in November 2009 and ended in December 2011. The difference column represents a difference-in-differences analysis for North Carolina. Includes all research sample members who were eligible for at least one month of the first 12 intervention period months.

The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

[a] Measures proportion of patients who had prescription fills covering half or more of their Medicaid enrollment in a six-month period.

Table 14. Cardiovascular Drug Use in the North Carolina Study Population in the First 12 Months of the Intervention Period (Regression-Adjusted)

	Treatment (Number = 885)		Comparison (Number = 1,827)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Percentage with at Least One Fill						
Any cardiovascular drug	81.3	80.7	86.3	85.4	0.3	0.905
ACE inhibitors	38.8	39.0	41.8	40.0	-2.0	0.203
Beta blockers	34.6	34.4	36.1	36.7	-0.8	0.518
Calcium channel blockers	23.7	22.9	24.0	25.5	-2.3	0.125
Diuretics	50.5	48.1	56.5	55.1	-1.0	0.642
Statins	47.1	49.1	54.3	54.7	1.6	0.395
Other cardiovascular drugs	16.3	12.0	15.8	11.5	-1.0	0.972
Percentage with at Least 50% of Enrolled Days[a] Covered by						
Any cardiovascular drug	64.9	65.6	70.6	72.5	-1.2	0.560
ACE inhibitors	14.8	21.6	16.6	23.3	0.1	0.933
Beta blockers	15.3	20.3	17.9	22.8	1.1	0.9798
Calcium channel blockers	10.5	13.9	10.3	15.7	-2.0	0.1836
Diuretics	24.7	29.5	27.5	34.7	-2.4	0.165
Statins	23.9	29.8	27.0	34.9	-2.0	0.284
Other cardiovascular drugs	6.4	6.2	7.5	6.5	0.8	0.570

Source: North Carolina Division of Medical Assistance claims data and Community Care of North Carolina enrollment data.

Notes: The evaluation period in North Carolina started in November 2009 and ended in December 2011. The difference column represents a difference-in-differences analysis for North Carolina. Includes all research sample members who were eligible for at least one month of the first 12 intervention period months and had evidence of cardiovascular disease at baseline.

The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

[a]Measures proportion of patients who had prescription fills covering half or more of their Medicaid enrollment in a six-month period.

D. Quality- of- Care Measures

Differences in treatment and comparison group trends for all five claims-based quality-of-care measures that we examined were small and not statistically significant (Table 15). In fact, none of the measures increased markedly between the baseline and intervention periods and most measures fell over that time. The most commonly performed measure was an eye exam, with between 80 to 87 percent of sample members having one at some point during the intervention period. HbA1c and LDL cholesterol tests were also common among research sample members. For instance, in the second year of the intervention 51 percent of treatment group members had evidence of an HbA1c test and 47.2 had evidence of an LDL test, and the percentages were similar in the comparison group. In both groups, less than a quarter of members were monitored for diabetic nephropathy in either intervention year.

Table 15. Diabetes Quality- of- Care Measures for the North Carolina Study Group in the First 24 Months of the Intervention Period (Regression- Adjusted)

	Treatment (Year 1 N = 1,138) (Year 2 N=556)		Comparison (Year 1 N = 2,328) (Year 2 N=1,260)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Percentage with:						
Hemoglobin A1c test						
First 12 months	54.2	53.1	60.8	58.0	1.7	0.527
Second 12 months	58.8	50.9	67.0	57.8	1.3	0.689
Eye examination						
First 12 months	89.6	87.0	85.3	81.1	1.6	0.183
Second 12 months	90.8	85.6	87.3	79.8	2.3	0.243
Low-density lipoprotein cholesterol test						
First 12 months	58.4	52.7	59.9	47.5	8.7	0.051
Second 12 months	63.7	47.2	65.6	46.4	3.3	0.516
Urine protein test						
First 12 months	56.0	43.1	63.9	54.1	-3.1	0.232
Second 12 months	57.4	42.0	65.1	51.3	-1.6	0.685
Monitoring for diabetic nephropathy						
First 12 months	22.7	22.2	22.7	22.1	0.1	0.976
Second 12 months	25.4	19.4	24.8	23.4	-4.6	0.201

Source: North Carolina Division of Medical Assistance claims data and Community Care of North Carolina enrollment data.

Notes: The evaluation period in North Carolina started in November 2009 and ended in December 2011. The difference column represents a difference-in-differences analysis. This analysis includes all research sample members with the potential of at least 12 months of program enrollment. We constructed claims-based quality-of-care measures from 2009 Healthcare Effectiveness Data and Information Set specifications.

The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

APPENDIX

ADDITIONAL TABLES AND FIGURES

Appendix Table 1. Demographic and Health- Related Characteristics of Beneficiaries with Diabetes Assigned to Oklahoma RDPS Study Group Practices at Various Points Before the Intervention Began

	Two Years Before the Intervention	One Year Before the Intervention	Start of the Intervention
Number of Beneficiaries	**450**	**573**	**579**
Age			
Mean	36.5***	39.6	40.7
Percentage			
Under 18	19.3†††	14.5	12.4
18 to 34	27.3	23.7	22.5
35 to 54	34.2	39.8	41.3
55 or older	19.1	22.0	23.8
Gender (percentage)			
Male	23.3**	26.9	29.2
Race (percentage)			
White	55.6	50.6	51.3
African American	33.8	38.2	36.6
Other	10.7	11.2	12.1
Percentage with Evidence of Common Chronic Conditions			
Hyperlipidemia	12.7***	16.4	19.2
Chronic obstructive pulmonary disease	5.3**	9.2	9.3
Hypertension	30.2**	35.8	37.8
Coronary artery disease	4.9	8.2	6.6
Congestive heart failure	3.8	5.6	3.8
Depression	12.9***	14.7**	19.0
Obesity	6.9	6.3	8.3
Asthma	5.8	9.4	8.1
Number of Months Assigned to Practice in the Previous Year (Percentages)			
At least 6 but less than 9 months	17.6	21.1†††	18.0
At least 9 but less than 12 months	32.4	39.4	27.5
12 months	50.0	39.4	54.6
Health Care Use in Previous Year			
Percentage with a hospital admission	28.1	28.7	26.6
Average annualized number of hospital admissions	3.1	4.6	4.0
Percentage with			
0	71.9	71.3	73.4
1	3.3	2.8	1.7
2 or more	24.7	25.9	24.9
Percentage with an emergency department visit	52.5	55.2	55.4
Average annualized number of emergency department visits	2.4**	3.4	3.5
Percentage with			
0	47.5	44.8	44.6
1	14.5	13.4	12.3
2 or more	38.1	41.7	43.1
Prescription Drug Use in Previous Year[a]			
Use of Antidiabetic Drugs			
Percentage with at least one fill	33.8***	40.4	45.8
Average annualized number of fills	3.3***	3.9	4.4
Use of Cardiovascular Drugs among participants with evidence of cardiovascular disease			
Percentage with at least one fill	42.1***	49.2	53.1
Average annualized number of fills	5.5***	6.6	7.4

Source: Oklahoma Health Care Authority claims and enrollment data.

Note: Includes Medicaid beneficiaries who met program eligibility criteria (at least one claim for diabetes) and were enrolled at one of the study group practices for at least six months before each point in time.
Health care and prescription drug use outcomes are weighted to account for differential enrollment among members in the 12 months before each point of time we examined. We normalized weights so they sum to the number of sample members.

[a] We normalized each pharmacy claim to a 30-day supply, except for insulin. Antidiabetic drugs include: glitazones, sulfonylureas, long-acting injectables, insulin, and other antidiabetic drugs. Cardiovascular drugs include ACE inhibitors, beta blockers, calcium channel blockers, statins, diuretics, and other cardiovascular drugs.

RDPS = Reducing Disparities at the Practice Site.

** Difference with "Start of Intervention" group is statistically significantly different from 0 at the 0.05 level, 2-tailed t-test.
*** Difference with "Start of Intervention" group is statistically significantly different from 0 at the 0.01 level, 2-tailed t-test.
†† Distributions are statistically significantly different from 0 at the 0.05 level, chi-squared test.
††† Distributions are statistically significantly different from 0 at the 0.01 level, chi-squared test.

Appendix Table 2. Number of Member Months per Calendar Year Among Oklahoma Study Group Practices

	All Practices	Engaged Practices	Non-Engaged Practices
Number of Beneficiaries	**3,110**	**1,122**	**1,988**
2006[a]	6,965	4,178	2,787
2007	9,634	5,653	3,981
2008	9,601	5,943	3,657
2009 (Pre-Intervention Period)[b]	4,691	3,236	1,455
2009 (Intervention Period)[b]	6,678	3,843	2,834
2010	7,386	4,352	3,034
2011	6,076	3,268	2,808

Source: Oklahoma Health Care Authority enrollment data.

[a] Includes information from February 2006 to December 2006 as we did not have data for January 2006.

[b] The evaluation period started as early as February 2009 for some practices but ended in December 2011 for 8 of 10 practices. The first row includes information for only pre-intervention months as calculated on a per-practice basis. Likewise, the second row includes information for only intervention period months.

Appendix Table 3. Average Annualized Number of Hospital Admissions and Emergency Department Visits in the Pennsylvania Study Population by Six- Month Enrollment Intervals (Regression- Adjusted)

	Treatment			Comparison				
	N	Pre	Post	N	Pre	Post	Difference	*p*-Value
Hospital admissions								
Months 1 to 6	1,170	0.56	0.61	2290	0.45	0.46	0.04	0.534
Months 7 to 12	1,127	0.54	0.64	2290	0.45	0.49	0.06	0.417
Months 13 to 18	868	0.46	0.06	2290	0.45	0.05	0.00	0.934
Months 19 to 24	460	0.52	0.01	2290	0.45	0.00	0.06	0.390
Emergency Department visits								
Months 1 to 6	1,170	3.24	3.46	2290	2.37	2.30	0.29	0.326
Months 7 to 12	1,127	3.27	3.72	2290	2.39	2.32	0.52	0.143
Months 13 to 18	868	2.98	3.27	2290	2.32	2.25	0.36	0.245
Months 19 to 24	460	3.00	3.30	2290	2.31	2.35	0.26	0.429

Source: Pennsylvania Department of Public Welfare claims and enrollment data.

Notes: The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

The difference column represents a difference-in-differences analysis. To annualize hospital admissions or emergency department visits for each period, we multiplied the actual number by 365 and divided by the number of days enrolled in that period. Each six-month interval includes beneficiaries who had the potential for that many months of enrollment. For example, beneficiaries whose period of eligibility began 12 months before the end of the intervention are included in the first and second six-month cohorts. The pre-period represents the 12 months before the start of the intervention in Pennsylvania.

Pennsylvania inpatient data is lagged as much as 12 months (or more) and may be incomplete for the end of the evaluation period.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

Appendix Table 4. Antidiabetic Drug Use in the Pennsylvania Study Population in the Second 12 Months of the Intervention Period (Regression- Adjusted)

	Treatment (Number =869)		Comparison (Number = 2,290)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Percentage with at Least One Fill						
Any antidiabetic drug	61.3	70.9	64.8	75.3	-0.9	0.543
Metformin	36.3	43.2	38.5	46.2	-0.8	0.801
Glitazones	18.7	21.0	13.4	14.1	1.6	0.568
Sulfonylureas	26.2	28.9	28.0	30.1	0.6	0.812
Long-acting injectables	19.2	28.3	19.3	29.1	-0.7	0.829
Insulin	19.6	24.0	20.6	25.6	-0.6	0.841
Percentage with at Least 50% of Enrolled Days[a] Covered by						
Any antidiabetic drug	53.6	55.0	56.8	59.5	-1.3	0.614
Metformin	19.4	25.1	21.3	27.9	-0.9	0.863
Glitazones	11.2	12.8	7.9	8.9	0.6	0.905
Sulfonylureas	16.6	15.6	17.0	18.1	-2.1	0.350
Long-acting injectables	7.9	14.2	9.9	16.5	-0.3	0.732
Insulin	10.0	13.9	11.7	14.2	1.4	0.403

Source: Pennsylvania Department of Public Welfare claims and enrollment data.

Notes: The interim evaluation period in Pennsylvania started in July 2009 and ended in September 2011. The difference column represents a difference-in-differences analysis for Pennsylvania.

The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

[a]Measures proportion of patients who had prescription fills covering half or more of their Medicaid enrollment in a 12-month period.

Appendix Table 5. Cardiovascular Drug Use in the Pennsylvania Study Population in the Second 12 Months of the Intervention Period (Regression- Adjusted)

	Treatment (Number =474)		Comparison (Number = 1,153)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Percentage with at Least One Fill						
Any cardiovascular drug	95.2	95.4	92.7	93.6	-0.7	0.779
ACE inhibitors	42.5	44.4	43.5	47.0	-1.6	0.671
Beta blockers	32.6	38.0	39.3	39.9	4.8	0.150
Calcium channel blockers	31.8	37.1	32.0	37.7	-0.4	0.879
Diuretics	54.4	58.8	52.6	56.1	0.9	0.788
Statins	64.9	71.8	61.7	67.9	0.7	0.784
Other cardiovascular drugs	28.9	28.0	24.2	25.5	-2.2	0.505
Percentage with at Least 50% of Enrolled Days[a] Covered by						
Any cardiovascular drug	88.5	84.1	87.1	84.5	-1.8	0.425
ACE inhibitors	22.3	25.1	24.6	29.5	-2.1	0.591
Beta blockers	16.2	24.2	24.5	28.5	4.0	0.110
Calcium channel blockers	19.8	23.1	19.0	23.2	-0.9	0.749
Diuretics	33.3	38.9	32.2	38.1	-0.3	0.936
Statins	42.2	52.9	40.3	47.9	3.1	0.413
Other cardiovascular drugs	16.8	16.3	14.2	16.2	-2.5	0.366

Source: Pennsylvania Department of Public Welfare claims and enrollment data.

Notes: The interim evaluation period in Pennsylvania started in July 2009 and ended in September 2011. The difference column represents a difference-in-differences analysis for Pennsylvania. Includes members with evidence of cardiovascular disease at baseline.

The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

[a]Measures proportion of patients who had prescription fills covering half or more of their Medicaid enrollment days in a 12-month period.

Appendix Table 6. Diabetes State-Reported Lab-Based Quality-of-Care Measures for the Pennsylvania Study Group in the Intervention Period (Regression-Adjusted)

	Treatment (Year 1 N = 1,170) (Year 2 N = 869)		Comparison (Year 1 N = 2,290) (Year 2 N = 2,290)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Percentage with:						
Hemoglobin A1c test						
First 12 months	8.3	9.1	7.7	10.4	-1.9	0.188
Second 12 months	7.9	5.8	7.8	7.6	-1.9	0.180
Eye examination						
First 12 months	87.9	88.7	87.4	88.8	-0.6	0.616
Second 12 months	88.6	89.0	87.8	88.1	0.1	0.895
Low-density lipoprotein cholesterol test						
First 12 months	16.9	12.7	12.0	12.7	-4.9	0.005
Second 12 months	17.9	6.6	11.9	9.9	-9.3	<0.01

Source: Pennsylvania Department of Public Welfare claims and enrollment data.

Notes: The evaluation period in Pennsylvania started in July 2009 and ended in December 2010. The difference column represents a difference-in-differences analysis. This analysis includes all research sample members with the potential of at least 12 months of program enrollment. We constructed claims-based quality-of-care measures from 2009 Healthcare Effectiveness Data and Information Set specifications. A total of 26 treatment group members became eligible for the intervention in July 2010 and do not have data for the first intervention year.

The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

Appendix Table 7. Average Annualized Number of Hospital Admissions and Emergency Department Visits in the North Carolina Study Population by Six- Month Enrollment Intervals (Regression- Adjusted)

	Treatment			Comparison				
	Number	Pre	Post	N	Pre	Post	Difference	*p*-Value
Hospital admissions								
Months 1 to 6	1,132	0.72	0.82	2,328	0.81	0.80	0.11	0.099
Months 7 to 12	773	0.62	0.67	1,639	0.64	0.62	0.07	0.154
Months 13 to 18	556	0.58	0.82	1,260	0.58	0.60	0.22	0.008
Months 19 to 24	419	0.52	0.53	929	0.56	0.53	0.04	0.705
Emergency Department visits								
Months 1 to 6	1,132	0.73	0.74	2,328	1.16	1.16	0.01	0.929
Months 7 to 12	773	0.73	0.67	1,639	1.18	1.08	0.04	0.773
Months 13 to 18	556	0.66	0.64	1,260	1.18	1.02	0.14	0.275
Months 19 to 24	419	0.67	0.60	929	1.19	1.03	0.09	0.535

Source: North Carolina Division of Medical Assistance claims data and Community Care of North Carolina enrollment data.

Notes: The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

Appendix Table 8. Antidiabetic Drug Use in the North Carolina Study Population in the Second 12 Months of the Intervention Period (Regression- Adjusted)

	Treatment (Number =556)		Comparison (Number = 1,260)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Percentage with at Least One Fill						
Any antidiabetic drug	54.2	53.5	61.0	60.8	-0.5	0.767
Metformin	29.3	28.5	32.5	32.8	-1.1	0.671
Glitazones	14.6	12.2	15.6	12.3	0.9	0.635
Sulfonylureas	20.1	15.0	17.5	17.7	-5.3	0.004
Long-acting injectables	23.4	29.2	26.4	30.4	1.8	0.227
Insulin	16.4	17.9	20.6	22.3	-0.2	0.912
Percentage with at Least 50% of Enrolled Days[a] Covered by						
Any antidiabetic drug	42.0	40.3	49.1	46.2	1.2	0.521
Metformin	11.8	16.4	14.4	19.3	-0.3	0.920
Glitazones	7.7	7.1	8.9	7.2	2.3	0.335
Sulfonylureas	7.9	8.4	9.7	11.8	-1.6	0.260
Long-acting injectables	10.3	16.8	10.4	15.6	1.3	0.514
Insulin	4.6	7.4	7.2	9.1	0.9	0.487

Source: North Carolina Division of Medical Assistance claims data and Community Care of North Carolina enrollment data.

Notes: The evaluation period in North Carolina started in November 2009 and ended in December 2011. The difference column represents a difference-in-differences analysis for North Carolina. Includes all research sample members who were eligible for at least one month of the second 12 intervention period months. The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

[a]Measures proportion of patients who had prescription fills covering half or more of their Medicaid enrollment days in a six-month period.

Appendix Table 9. Cardiovascular Drug Use in the North Carolina Study Population in the Second 12 Months of the Intervention Period (Regression- Adjusted)

	Treatment (Number = 461)		Comparison (Number = 1,050)			
	Baseline	Intervention	Baseline	Intervention	Difference	*p*-Value
Percentage with at Least One Fill						
Any cardiovascular drug	84.4	79.0	90.4	84.0	1.0	0.734
ACE inhibitors	39.3	37.8	41.6	38.3	1.8	0.503
Beta blockers	33.0	32.3	35.0	35.9	-1.6	0.669
Calcium channel blockers	24.7	25.0	24.3	24.7	-0.1	0.965
Diuretics	50.0	47.8	59.5	53.7	3.6	0.079
Statins	51.6	49.3	61.5	58.0	1.2	0.630
Other cardiovascular drugs	19.5	12.0	18.1	12.0	-1.4	0.445
Percentage with at Least 50% of Enrolled Days[a] Covered by						
Any cardiovascular drug	68.0	67.9	78.4	72.0	6.1	0.008
ACE inhibitors	16.5	21.8	19.3	24.9	-0.3	0.891
Beta blockers	17.6	21.7	21.3	24.2	1.2	0.680
Calcium channel blockers	12.7	15.6	12.1	16.4	-1.4	0.545
Diuretics	26.0	30.9	33.2	34.6	3.5	0.131
Statins	27.8	29.1	35.7	38.3	-1.3	0.636
Other cardiovascular drugs	8.3	8.3	9.1	7.6	-1.5	0.428

Source: North Carolina Division of Medical Assistance claims data and Community Care of North Carolina enrollment data.

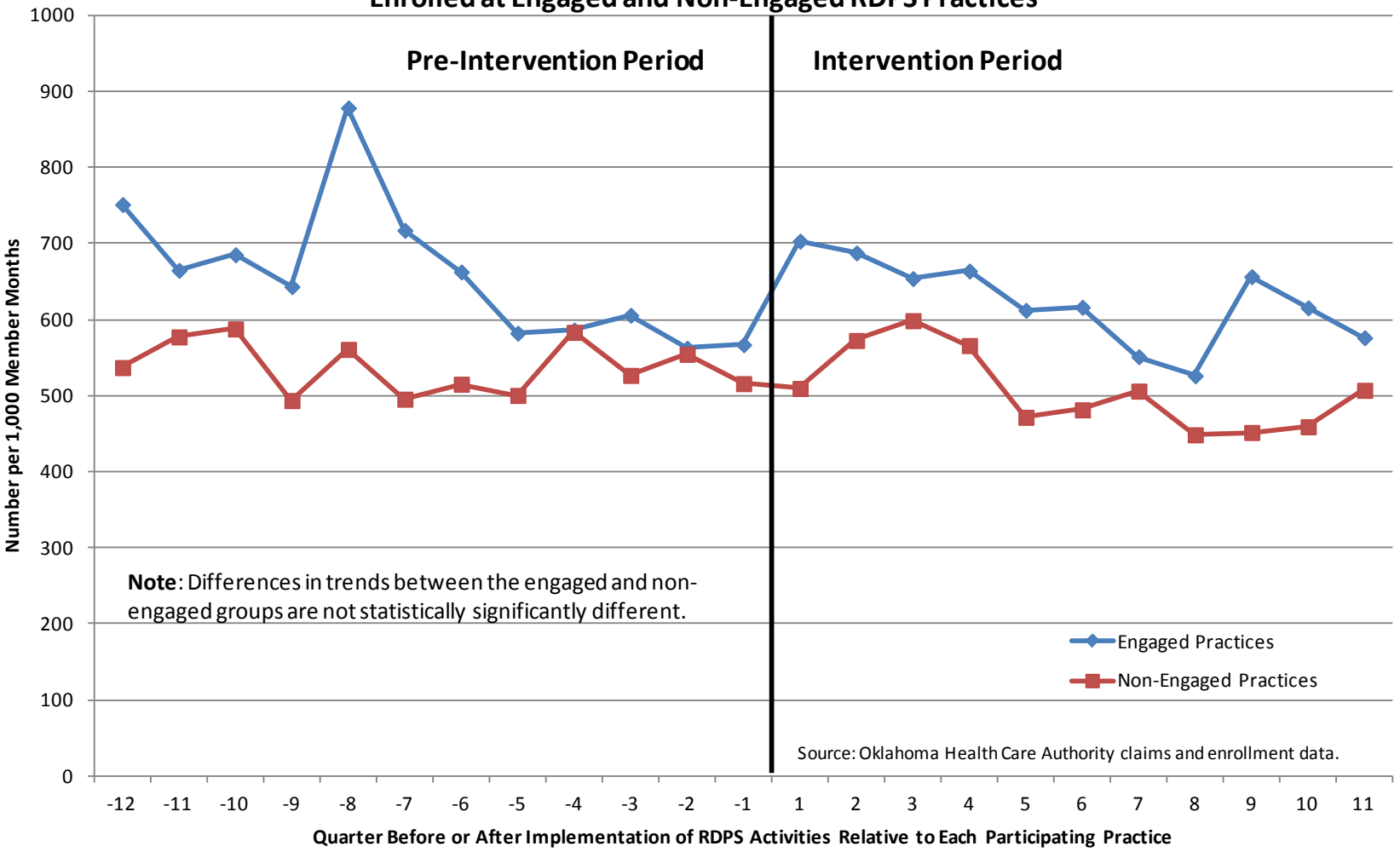
Notes: The evaluation period in North Carolina started in November 2009 and ended in December 2011. The difference column represents a difference-in-differences analysis for North Carolina. Includes all research sample members who were eligible for at least one month of the second 12 intervention period months and had evidence of cardiovascular disease at baseline.

The outcome analyses are weighted to account for differential enrollment among members of the treatment and comparison groups. Specifically, the weight is proportional to the number of enrolled months in the follow-up period. We normalized weights so they sum to the number of sample members.

Independent variables used in the regression analyses fall into three categories: (1) demographic characteristics (age, gender, and race), (2) health care utilization in the year before the intervention (including hospital and emergency department visits), and (3) drug utilization in the year before the intervention (including antidiabetic drugs [metformin, glitazones, sulfonylureas, long-acting injectables, and insulin] and cardiovascular drugs [ACE inhibitors, beta blockers, calcium channel blockers, diuretics, statins, and other cardiovascular medications]). In addition, we also controlled for evidence of the 18 chronic medical conditions that we identified from claims and complications of diabetes (retinopathy, nephropathy, and neuropathy).

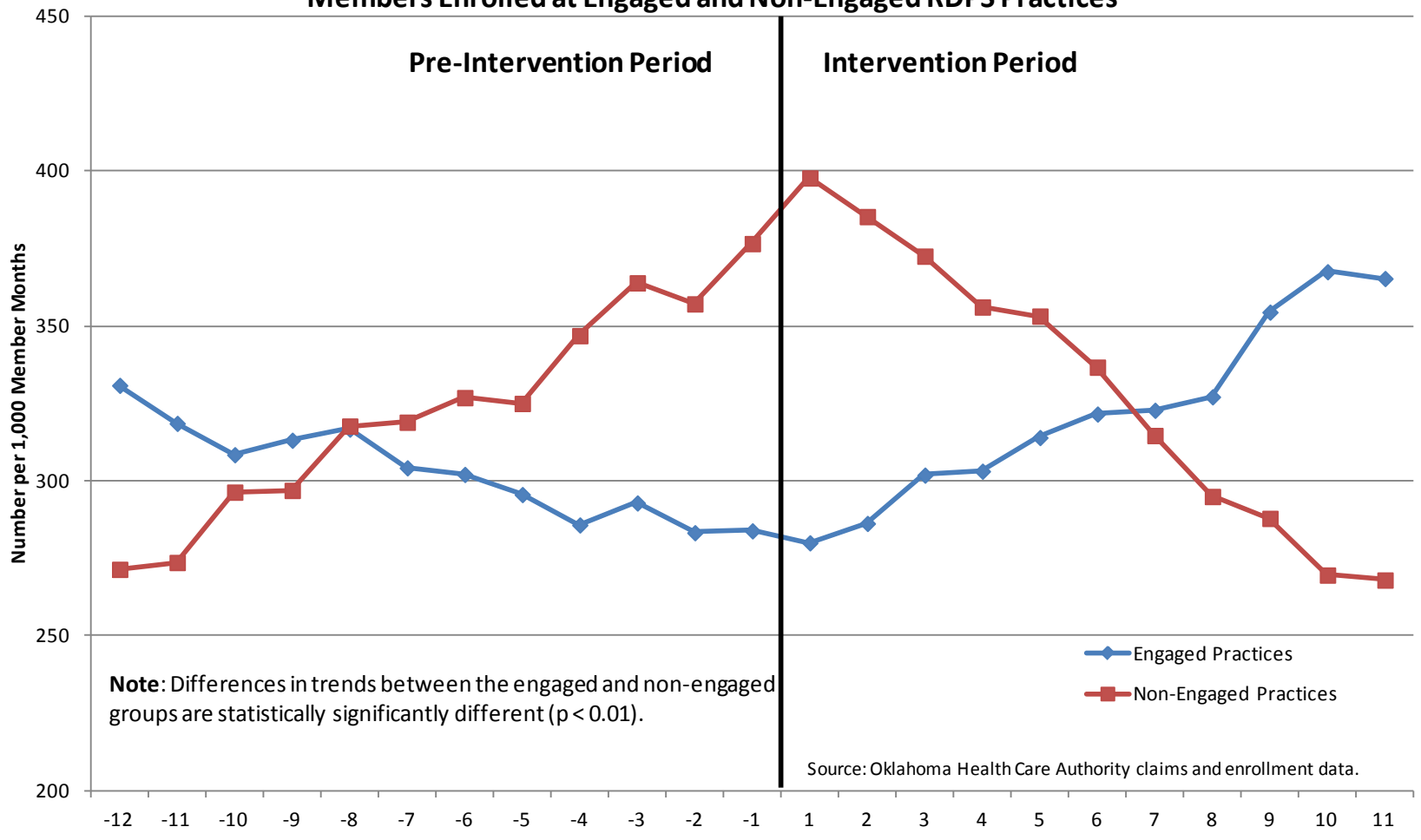
[a]Measures proportion of patients who had prescription fills covering half or more of their Medicaid enrollment days in a six-month period.

Appendix Figure 1. Hospital Admissions per 1,000 Member Months, Among Members Enrolled at Engaged and Non-Engaged RDPS Practices



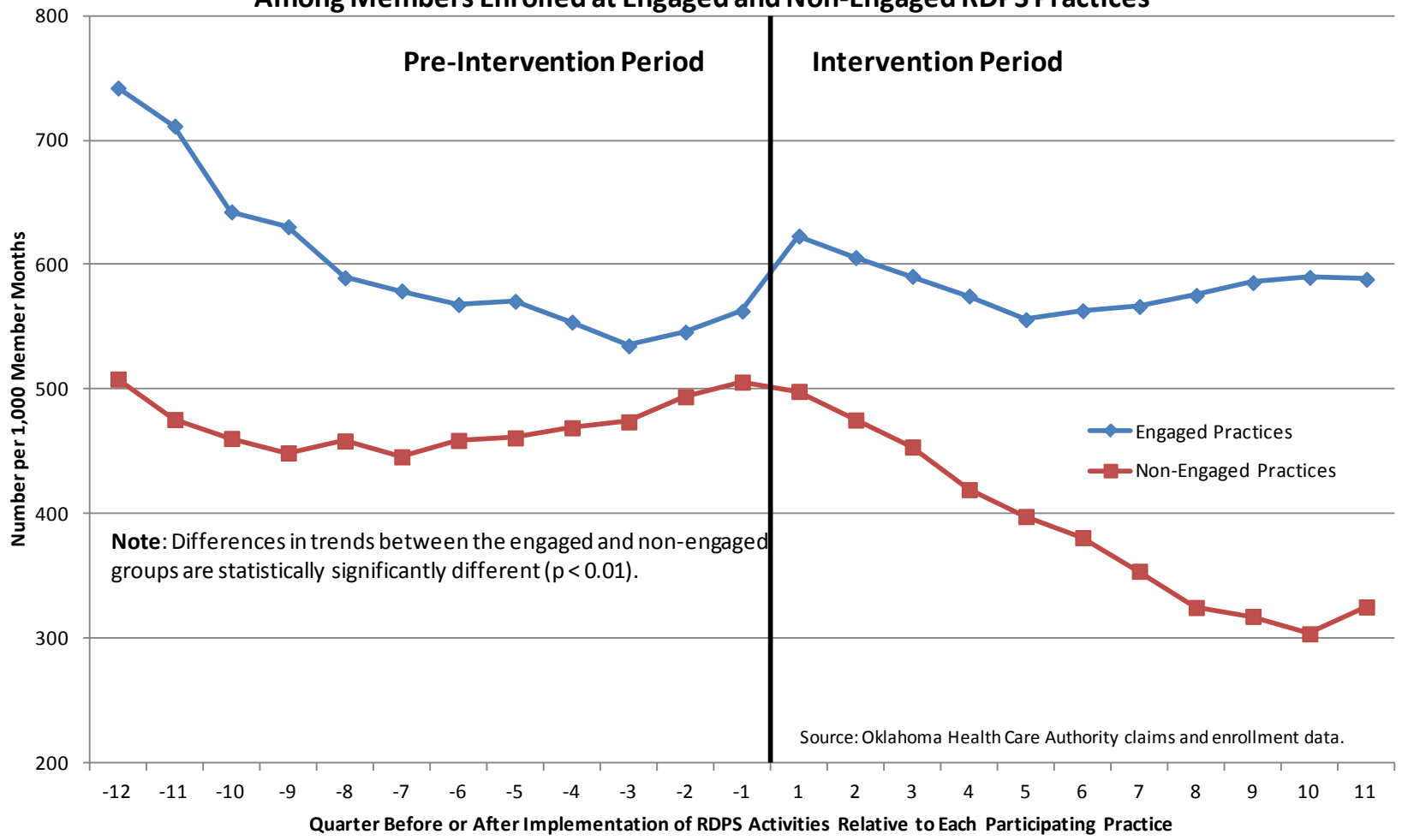
Note: The evaluation period started as early as February 2009 for some practices and ended in December 2011 for all practices. Outcomes are regression adjusted via segmented regression analysis where explanatory variables included a time trend, a squared time trend, an intervention period indicator, a time trend for the intervention period, one lagged value of the dependent variable, an indicator for engaged/non-engaged, and interactions between all trends and the engaged/non-engaged indicator. Events per 1,000 member months = (number of events for all eligible members)/(number of member months for all eligible members) x 1,000.

Appendix Figure 2. Emergency Department Visits per 1,000 Member Months, Among Members Enrolled at Engaged and Non-Engaged RDPS Practices



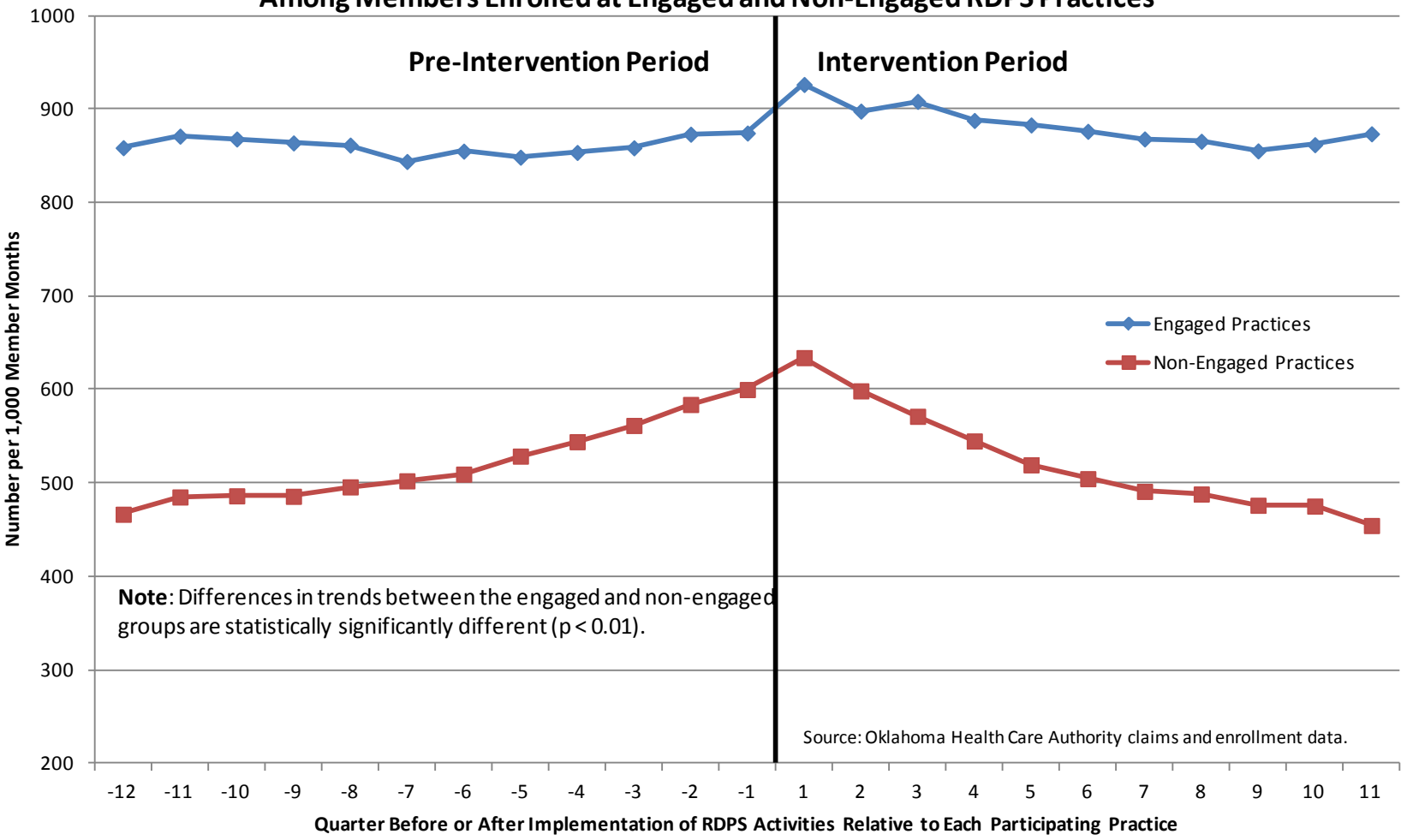
Note: The evaluation period started as early as February 2009 for some practices and ended in December 2011 for all practices. Outcomes are regression adjusted via segmented regression analysis where explanatory variables included a time trend, a squared time trend, an intervention period indicator, a time trend for the intervention period, one lagged value of the dependent variable, an indicator for engaged/non-engaged, and interactions between all trends and the engaged/non-engaged indicator. Events per 1,000 member months = (number of events for all eligible members)/(number of member months for all eligible members) x 1,000.

Appendix Figure 3. Number of Antidiabetic Prescription Fills per 1,000 Member Months, Among Members Enrolled at Engaged and Non-Engaged RDPS Practices



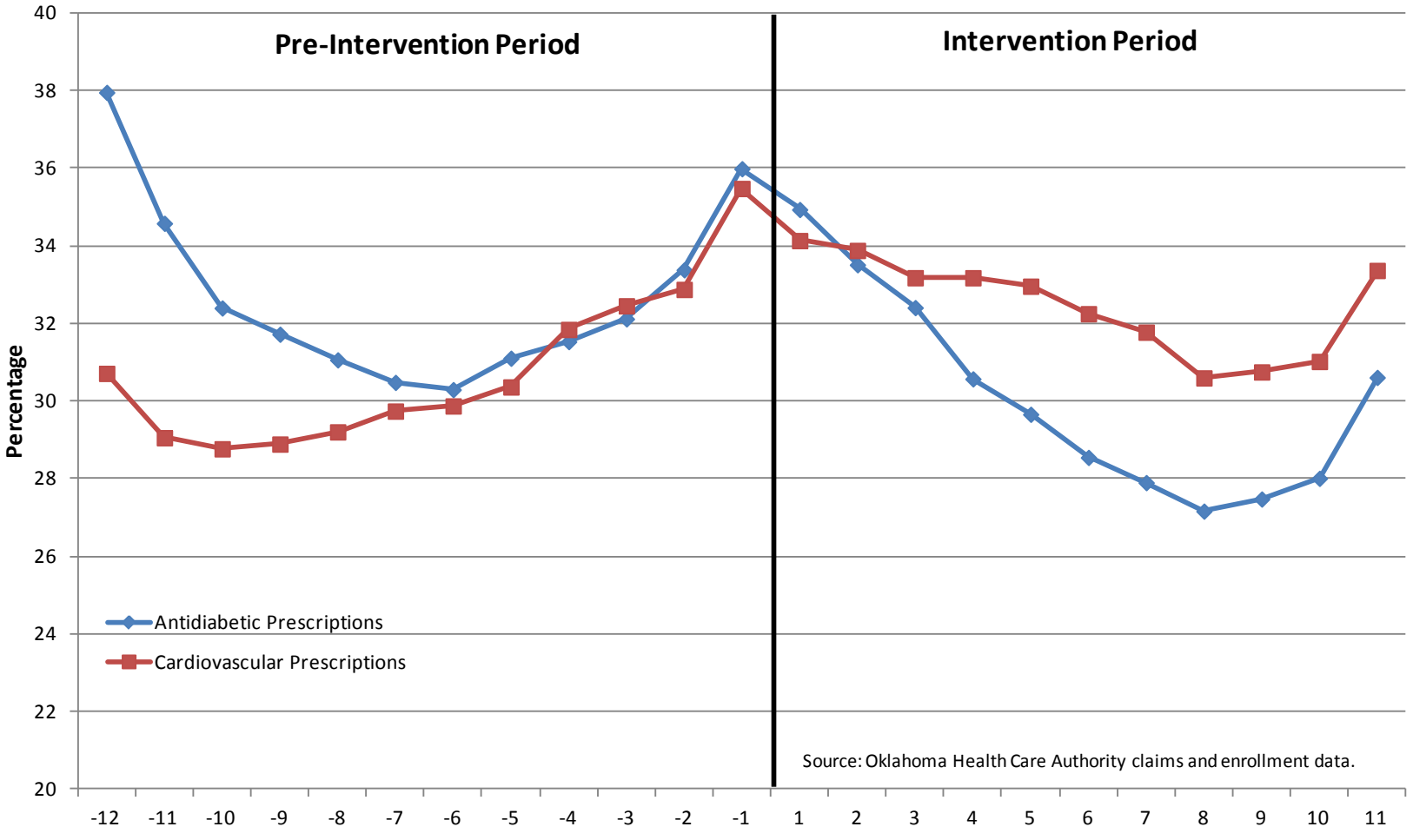
Note: The evaluation period started as early as February 2009 for some practices and ended in December 2011 for all practices. Outcomes are regression adjusted via segmented regression analysis where explanatory variables included a time trend, a squared time trend, an intervention period indicator, a time trend for the intervention period, one lagged value of the dependent variable, an indicator for engaged/non-engaged, and interactions between all trends and the engaged/non-engaged indicator. Events per 1,000 member months = (number of events for all eligible members)/(number of member months for all eligible members) x 1,000.

Appendix Figure 4. Number of Cardiovascular Prescription Fills per 1,000 Member Months, Among Members Enrolled at Engaged and Non-Engaged RDPS Practices



Note: The evaluation period started as early as February 2009 for some practices and ended in December 2011 for all practices. Includes only those memebrs who had evidence of cardiovascular disease before the start of RDPS. Outcomes are regression adjusted via segmented regression analysis where explanatory variables included a time trend, a squared time trend, an intervention period indicator, a time trend for the intervention period, one lagged value of the dependent variable, an indicator for engaged/non-engaged, and interactions between all trends and the engaged/non-engaged indicator. Events per 1,000 member months = (number of events for all eligible members)/(number of member months for all eligible members) x 1,000.

Appendix Figure 5. Percentage of Members with Any Prescription Drug Fill, Among the Entire Oklahoma Study Population



Note: The evaluation period started as early as February 2009 for some practices and ended in December 2011 for all practices. Outcomes are regression adjusted via segmented regression analysis where explanatory variables included a time trend, a squared time trend, an intervention period indicator, one lagged value of the dependent variable, and a time trend for the intervention period.

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