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Effect of Advanced Access Scheduling on Processes and Intermediate Outcomes of Diabetes Care and Utilization

Usha Subramanian, MD, MS,[1,2,3,8] Ronald T. Ackermann, MD, MPH,[2,3] Edward J. Brizendine, MS,[4] Chandan Saha, PhD,[4] Marc B. Rosenman, MD,[3,5] Deanna R. Willis, MD, MBA,[6] and David G. Marrero, PhD[3,7]

[1]Roudebush VAMC, Indianapolis, IN USA
[2]Division of General Internal Medicine and Geriatrics, Department of Medicine, Indiana University School of Medicine, Indianapolis, IN USA
[3]Regenstrief Institute for Healthcare, Inc, Indianapolis, IN USA
[4]Division of Biostatistics, Department of Medicine, Indiana University School of Medicine, Indianapolis, IN USA
[5]Department of Pediatrics, Indiana University School of Medicine, Indianapolis, IN USA
[6]Department of Family Medicine, Indianapolis, IN USA
[7]Division of Endocrinology, Department of Medicine, Indiana University School of Medicine, Indianapolis, IN USA
[8]IF-122, 250 University Blvd, Indianapolis, IN 46202 USA
Usha Subramanian, Phone: +1-317-2781602, Fax: +1-317-2780911, Email: usubrama@iupui.edu.
Corresponding author.

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ABSTRACT

BACKGROUND

The impact of open access (OA) scheduling on chronic disease care and outcomes has not been studied.

OBJECTIVE

To assess the effect of OA implementation at 1 year on: (1) diabetes care processes (testing for A1c, LDL, and urine microalbumin), (2) intermediate outcomes of diabetes care (SBP, A1c, and LDL level), and (3) health-care utilization (ED visits, hospitalization, and outpatient visits).

METHODS

We used a retrospective cohort study design to compare process and outcomes for 4,060 continuously enrolled adult patients with diabetes from six OA clinics and six control clinics. Using a generalized linear model framework, data were modeled with linear regression for continuous, logistic regression for dichotomous, and Poisson regression for utilization outcomes.

RESULTS

Patients in the OA clinics were older, with a higher percentage being African American (51% vs 34%) and on insulin. In multivariate analyses, for A1c testing, the odds ratio for African-American patients in OA clinics was 0.47 (CI: 0.29-0.77), compared to non-African Americans [OR 0.27 (CI: 0.21-0.36)]. For urine microablumin, the odds ratio for non-African Americans in OA clinics was 0.37 (CI: 0.17-0.81). At 1 year, in adjusted analyses, patients in OA clinics had significantly higher SBP (mean 6.4 mmHg, 95% CI 5.4 – 7.5). There were no differences by clinic type in any of the three health-care utilization outcomes.

CONCLUSION

OA scheduling was associated with worse processes of care and SBP at 1 year. OA clinic scheduling should be examined more critically in larger systems of care, multiple health-care settings, and/or in a randomized controlled trial.

KEY WORDS: diabetes, open access, process of care, outcomes, utilization

INTRODUCTION

Open ("advanced") access (OA) scheduling was proposed as an organizational strategy intended to enhance timeliness and access to providers, increase clinical productivity, and improve patient satisfaction.[1–7] OA is a patient-centered strategy that basically offers same-day scheduling, thus avoiding access delays, and this model of health care is being implemented nationwide.[8] Studies investigating OA systems have noted decreased wait times in specialty clinics.[9,10] However, achieving therapeutic goals in chronic illnesses such as diabetes may require a series of scheduled patient-provider visits over time. In this context, traditional "pre-booked" scheduling approaches may offer advantages for chronic disease monitoring. And although past investigators have suggested that OA scheduling may empower chronic care patients and enhance patient-centered care,[11] some have argued that these changes in the organization and delivery of care have adversely impacted continuity of care and patient satisfaction.[12–14] Thus, whether OA scheduling may help promote patient access to health care without compromising important chronic disease quality of care or outcomes has not yet been investigated.

Indiana University Medical Group–Primary Care (IUMG-PC) management directed six of its primary care practice sites to transition to OA scheduling in July 2005. The decision to convert the six clinics to OA was the result of a business decision by the provider group based on perceived market changes, perceived patient desire, less than optimal provider productivity, and high missed appointment rates. We studied the effect of this transition to OA scheduling on processes and outcomes of diabetes care and health-care utilization by comparing OA clinics to control clinics that used a traditional scheduling format. We hypothesized that OA implementation would improve access to care, without adversely affecting quality of diabetes care, outcomes or health-care utilization.

METHODS

Study Design We conducted a retrospective cohort study comparing processes and outcomes of diabetes care before and after OA implementation. The study was approved by the Institutional Review Board of Indiana University School of Medicine.

Participating Clinics IUMG-PC is the largest primary care group in Indiana. Six clinics that implemented OA were classified as 'OA' clinics. Six clinics that continued to use a traditional scheduling approach were classified as 'control clinics.' All sites accepted patients with the Wishard Advantage health, a county tax-funded health-care program for uninsured patients in the greater Indianapolis area. Point of care testing for hemoglobin A1c (A1c) with immediate availability of results was available at all participating sites.

Participating Patients The patient sample consisted of all adult patients with type 2 diabetes from the OA and control clinics continuously enrolled in the Wishard Advantage Health Plan from July 1, 2004 to June 30, 2006. Patients were identified as having diabetes if they met one or more of the following three criteria: (1) diagnosis of diabetes established by International Classification of Diseases (ICD–9) codes 250.xx, 357.2, 362.0, 366.41;[15,16] associated with two outpatient visits (or one inpatient visit); (2) prescription fill for one or more glucose-lowering medication without a diagnosis of polycystic ovarian disease (ICD-9 256.4x); (3) elevated glycosylated HbA1c (A1c) of 9% or higher or

elevated fasting glucose level ≥200 mg/dl.[16–18]

We restricted our analysis to patients of the Wishard Advantage Health Plan.[19] Since Wishard Health plan eligibility is based on income (<200% Federal Poverty Level), socio-economic status (SES) is less likely to differ across sites. Thus, access to care and the benefits available to these patients should be identical across clinics. This health plan also uses a primary care referral management policy that makes it less likely that patients will transition between clinical care sites with different scheduling policies. Moreover, for care to be reimbursed by the plan, it must be delivered within the IUMG-PC or Wishard Hospital system. This allows for near-complete capture of all utilization records, clinical laboratory, and prescribing data for participating patients in both the OA and control clinic sites. Similar to previous studies measuring quality of care for diabetes,[20,21] we restricted our analytic sample to continuously enrolled health plan members because it provided critical "pre-intervention" data necessary for adequate case-mix adjustment.[17,22] We excluded patients (2.4%) if they were missing all relevant laboratory, vital sign, or visit data over the study period.

Data Sources We used two main sources of data. Patient demographics, comorbidity, laboratory and medication data, and inpatient and outpatient utilization were obtained from the Regenstrief Medical Record System (RMRS).[23,24] This system interfaces with inpatient and outpatient scheduling and administrative databases for the entire Wishard Health Services system.

Continuous enrollment in the Wishard Advantage Health Plan and the organizational characteristics of the OA and control clinics, including clinic level characteristics such as the number of physician full-time equivalents (MD FTEs), the registered nurse (RN) FTEs, the number of trainee FTEs, and the annual number of clinic visits at each site, were determined from the IUMG data warehouse.[25]

Procedures The index date for the OA clinics was the date of OA implementation. For the control clinics the index date was June 1, 2005, the date when the last OA clinic began using OA. The 'pre' period was the 12 months before the index date. The 'post' period was the 12 months after the index date.

Outcome Measures Primary outcomes included process and intermediate outcomes for diabetes and (inpatient and outpatient) health-care utilization.

Process measures included documentation of annual A1c, low density lipoprotein cholesterol (LDL), and urine protein tests during the 12 months before and after the index date.[26–29] We measured A1c, LDL, and systolic blood pressure (SBP) as intermediate outcomes of diabetes care.[30–33] Each patient could have zero, one, or multiple values available for each laboratory variable. If multiple values were available on the same day, we used the mean of the measures. We used the last value of A1c, LDL and SBP prior to the 'index' date as the value for the 'pre-intervention' period and the last value between 3 months and 12 months of post 'index' date as the value for the 'post- intervention' period, under the assumption that it would take at least 3 months for system level changes to affect outcomes (especially A1c, LDL). For the measures of SBP, we used sitting BP.

Inpatient utilization (total number of hospitalizations) and outpatient utilization [ED, urgent care (UVC), and primary care visits] were determined in the 12-month period preceding and following the index date of OA implementation. No information was available for outpatient or inpatient utilization outside of the Wishard system. Such utilization, however, is rare.

Independent Variables Selected covariates included age, sex, and race. Since we were already including a relatively homogenous group of patients (with regards to their SES), we did not additionally control for income and education. To adjust for illness severity, we used the Charlson index of comorbidity.[34,35] Each hospitalization record in the RMRS contains up to ten discharge

diagnosis codes. We used the discharge diagnoses codes 2 through 10 from the hospital admission to construct the Charlson Index, according to the Deyo scheme.[36] To control for DM-related severity, we assessed whether patients were on insulin or oral agents for their diabetes. Adjustment using medication intensity has become a standard in Translating Research into Action for Diabetes (TRIAD) and other studies of diabetes care quality.[31,33]

Clinic level variables included the number of annual visits per clinic site, ratio of support staff full time equivalent (FTEs) to MD FTE,[37–39] and physician productivity, which is defined as the ratio of total Relative Value Units (RVUs) to MD FTE. Clinical systems may differ in process and outcomes of care when there are differences in the overall case mix of the clinic (i.e., provider exposure to other patients beyond the analytic sample). To adjust for these possible differences, we included percentage of managed care patients at each site. The system employs fewer than five primary care physician extenders (NP/PA) overall. Resident physicians provided care at both the open access and non-open access clinic sites. Hence, we did not control for provider type.

Statistical Analyses

Baseline characteristics of the study patients were compared between the OA clinics and control clinics using a Pearson's chi-square test for categorical data and a Student's t-test for continuous data. Clinic characteristics were compared using either a Student's t-test or a Wilcoxon rank-sum test. SAS version 9.1 (SAS Institute, Cary, NC) was used for all statistical analyses.

A generalized linear model (GLM) framework was used to assess the impact of OA on the processes of diabetes care, intermediate clinical outcomes, and health-care utilization.[40] Within this GLM framework, generalized estimating equations (GEE)[41] were used to adjust parameter estimates for within-clinic correlation (clustering) of the patients. All multivariable models were similar in the covariates that were included. For each outcome measure that was modeled, terms were included to compare the OA clinics to the control clinics and to adjust for the pre-intervention (baseline) value of each outcome. Because patients with worse outcomes attributable to disease severity would also typically have worse intermediate risk factor levels at baseline, it is likely that any residual bias is low after adjusting for differences in both medication intensity and baseline risk factor levels. Patient and clinic characteristics were also simultaneously included in the models as covariates and left in the models irrespective of statistical significance. Patient characteristics included were age, sex, race, Charlson co-morbidity index, and diabetes severity. Clinic characteristics included the percentage of managed care patients, the ratio of support staff FTEs to physician FTEs, annual number of visits at clinic site, and physician productivity (defined as the ratio of total RVU to number of MD FTE's).

An additional term was included in the logistic models to account for the interaction of race with clinic type. This is a pre-specified hypothesis given the known disparities in both processes and outcomes of diabetes care for African Americans.[42,43] Thus, race-specific adjusted odds ratios (OR) and 95% confidence intervals were estimated for the clinic types (OA or control). A multivariate logistic regression model was used to assess the effect of OA on the diabetes processes of care measures. A linear regression model was used to assess the effect of OA on the intermediate outcomes of diabetes care. The adjusted least square mean differences (95% CI) between OA and control clinics were estimated. A Poisson regression model was used to assess the effect of OA on health-care utilization (number of ED/UVC visits, number of hospitalizations, and total number of outpatient visits). Adjusted rate ratios were estimated from these models along with 95% confidence intervals (CI).

RESULTS

Sample Characteristics

We identified 13,045 patients with diabetes who had a visit to an IUMG clinic from any health plan. Once the sample was restricted to include only those in the Wishard Advantage Health Plan (N = 9,122) and then who were continuously enrolled, we identified 4,160 eligible patients. Of these 4,160 patients, we excluded 100 patients with missing outcome variables [28 patients with no laboratory data, 77 patients without any outpatient visits during the study period (5 patients with no clinic or laboratory data)] for a final analytic sample of 4,060 patients from the 12 study clinics.

The baseline characteristics of these clinics and their patients are presented in Table 1. Patients seen in the OA clinics were slightly older, more likely to be African American (51% vs 34%; $p < 0.001$), and had a higher Charlson comorbidity, with a higher percentage being on insulin. The six OA clinics had a significantly lower percentage of managed care patients (1.3% vs 17.1%, $p = 0.002$) and higher support staff to MD FTE ratio (4.7 vs 3.8; $p = 0.01$) than the six control clinics.

Unadjusted Analyses

Processes of Diabetes Care Table 2 shows descriptive statistics for processes of diabetes care, intermediate outcomes, and health-care utilization by clinic type. Testing for A1c slightly improved in both the control and OA clinics, and testing for urine microalbumin improved in the control clinics compared to the year before the index date.

Intermediate Outcomes of Diabetes Care Between OA and Traditional Scheduling

LDL level improved in both control and OA clinics, while A1C level only improved in the OA clinics in the year after the index date. SBP worsened a little only in the OA clinics at 1-year follow-up.

Health-care Utilization

There was no difference in ED visits or hospitalizations between the years before and after among the OA and control clinics, although outpatient primary care visits decreased in the OA clinics more than in the control clinics (5.6 to 5.0 vs 5.0 to 4.8, respectively).

Adjusted Analyses Comparing OA to Traditional Scheduling

Processes of Diabetes Care Table 3 provides results on the process of care comparison between OA and control clinics at 1-year follow-up after adjusting for baseline patient and clinic level characteristics. We observed a significant interaction effect between type of clinic and race for process of care in testing for A1C and urine microalbumin. The odds ratio for African-American patients in OA clinics was 0.47 (CI: 0.29-0.77, $p < 0.05$) for A1c testing, but for non-African Americans the odds ratio was 0.27 (CI: 0.21-0.36, $p < 0.05$). While African Americans in OA and control clinics had similar odds for being tested for urine microablumin, the odds ratio for non-African Americans in OA clinics was 0.37 (CI: 0.17-0.81, $p < 0.05$). There was no significant difference between the two clinic types for LDL testing.

Intermediate Outcomes and Health-care Utilization

For diabetes outcome measures at 1-year follow-up, patients in the OA clinic had significantly higher SBP (6.4 mmHg; $p < 0.05$) than the control clinics (Table 4). Patients in the OA clinics had lower A1c, though the difference was clinically small (A1c difference of 0.5% is considered clinically meaningful). These results were similar when we adjusted for the number of outpatient visits in the model.

Though the OA clinics showed a 3% lower rate at 1 year for ED visits and a 5% lower rate in hospitalizations, none of these health-care utilization differences were statistically significant.

DISCUSSION

Our study, which controlled for important patient and organizational factors, showed that OA

scheduling significantly affected diabetes-related clinical outcomes in the short term. Specifically, we studied patients who had identical access to care and benefits across sites and controlled for disease severity. Although we did not control for provider type, the system employs fewer than five primary care physician extenders (NP/PA) overall. We believe the number is not significant enough to impact the results. Resident physicians provided care at both the open access and non-open access clinic sites. Hence, it is unlikely that our outcomes differed due to the presence of resident physicians.

The findings from our study reinforce fears of those who have speculated whether timely access to care for some patients came at the expense of those with chronic illnesses. It is possible that timely follow-up for chronic disease management may be compromised if patients are required to remember and schedule their appointments at a suggested interval. In addition, if there are not planned visits that focus on the management of the chronic condition, then acute problems crowd out chronic care management during visits. There is no question that primary care clearly needs to solve the problem of prompt access. Whether OA scheduling is the solution is unclear. In this context, a recent study by Mehrotra et al. found that none of the (six) sites that implemented OA achieved same day access and that patient no-show rates were unchanged,[44] and recommended broader evaluation of OA scheduling in primary care. Our study was the natural next step, which evaluated processes and clinical outcomes with OA implementation. Our result also emphasizes the need to examine OA implementation more critically in larger systems of care, multiple health-care settings, and/or in a randomized controlled trial, and over a longer duration of follow-up.

The most striking finding is the worsening SBP noted among diabetes patients in OA clinics. It is known that control of blood pressure is probably the single most important medical intervention to improve mortality, morbidity, and reduce health-care costs for those with diabetes.[45–47] Moreover, the worsening intermediate outcome (SBP) was accompanied by lower rates of performance on process measures for diabetes (testing for A1c and microalbumin) in the OA clinics. Our findings reinforce the need to adjust, customize, and/or stratify processes of scheduling specifically for patients with chronic disease.

An important question when designing practice change is whether these system-level interventions might reduce racial and ethnic disparities in processes of diabetes care. Previous studies have reported on the effects of system-level interventions such as disease management in attenuating disparities in diabetes care.[48,49] Similarly, our study found that for African-American patients, OA clinics had a higher odds of testing for A1c than for non-African-American patients; thus, the quality of care worsened for non-African Americans. Future studies may need to further explore the effect of OA implementation among different racial groups of patients.

Similar to a recent longitudinal cohort study by Solberg et al., we found no difference in ED visits or hospitalization associated with OA implementation for diabetes patients.[50] However, contrary to their study, OA implementation in our setting was associated with decreased outpatient visits compared to the year prior. Our study design was similar and adjusted for similar patient factors. It may be possible that our study setting (county clinics) contributed to the differences in our findings.[51] This is a plausible explanation given that a recent study evaluating impact of OA on access and primary care visits found mixed results among different OA clinics.[52] Therefore, there is certainly a need to investigate the effect of OA on primary care visits more deeply in different settings.

There were some improvements in the processes of diabetes care over time in both OA and control clinics, a finding consistent with studies in other health-care settings.[53–55] Our observed processes of care were also similar to national norms. A recent study conducted by Tuncelli et al. evaluating 5-year trends from 1997 to 2001 found that LDL testing improved from 37% to 67%.[56] Our study conducted between the years 2003 to 2005 found that LDL testing ranged from 60-65%. Further analyses are

needed to understand how OA implementation can affect improvement efforts in diabetes care.

To our knowledge, this is the first study that has evaluated the impact of an OA scheduling system on diabetes processes of care and outcomes as well as utilization. There are, however, some important limitations. The study was conducted among patients in a single health plan localized in one city who mostly had a low socio-economic status, so results may not generalize to all other settings or patient groups. Similarly, although implementation of OA scheduling impacted all clinic patients, our analyses only included patients continuously enrolled in the Wishard Advantage Health Plan. We do not yet have suitable data to evaluate continuity of care,[12,57] patient satisfaction,[10] or patient-reported access to care, factors shown to be important in influencing the process and outcomes for diabetes. We did not have a measure of the degree of OA implementation and whether this varied across sites. If so, we don't yet know if diabetes processes or outcomes achieved in clinics with higher fidelity to the OA model were significantly different from those with lower fidelity. Finally, we were unable to measure the reason for the visit and whether OA specifically affected diabetes-related visits.

In this study, OA had a significant impact on intermediate outcomes of diabetes care, especially SBP, but no impact on ED visits or inpatient utilization in the short term. Future studies should add to this evaluation and examine OA clinic scheduling more critically through rigorous study designs, conducted in multiple health-care settings and incorporating measures for patient satisfaction, continuity of care and access to care. These studies would provide additional insight about how changes in scheduling policies intended to improve provider access will affect health-care processes and outcomes for a variety of people and conditions.

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Conflict of Interest None disclosed.

Footnotes

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Figures and Tables

Table 1

Baseline Characteristics of Patients and Clinics

	OA clinics	Control clinics	P value†
Patient characteristics			
Number of patients[a]	3,147	913	
Age, mean (SD)	56 (13)	55 (13)	0.003
Race, N (%)			<0.001
African-American	1,599 (50.8%)	308 (33.7%)	
White	1,277 (40.6%)	442 (48.4%)	
Other/unknown	271 (8.6%)	163 (17.9%)	
Female	2,079 (66.1%)	604 (66.2%)	0.959
Charlson index, N (%)			0.004
0	2,747 (87.3%)	808 (88.5%)	
1	143 (4.5%)	55 (6.0%)	
2	129 (4.1%)	33 (3.6%)	
3+	128 (4.1%)	17 (1.9%)	
DM risk factors, N (%)			
On insulin	989 (31.4%)	253 (27.7%)	0.032
On oral medications	2,043 (64.9%)	629 (68.9%)	0.026
Clinic characteristics			
Number of clinics	6	6	
Percent managed care patients,‡ median (range)	1.3 (0.3, 1.6)	17.1 (2.1, 24.6)	0.002
Physician visits, mean (SD)	19,668 (7,131)	18,770 (6,188)	0.821
Number of MD FTEs, mean (SD)	51.5 (20.2)	44.6 (14.5)	0.511
Support staff to MD FTE ratio, mean (SD)	4.7 (0.48)	3.88 (0.47)	0.018
MD productivity, mean (SD)	787.1 (167.0)	776.8 (182.6)	0.922

OA = open access, DM = diabetes mellitus, FTE = full-time equivalents

a: Although implementation of OA scheduling impacted all clinic patients, our analyses only include patients continuously enrolled in the Wishard Advantage Health Plan, because patients in this plan had case mix similarities across clinics, and we could ensure complete capture of process, outcome, and utilization data for these patients only

†P-value from Pearson chi-square for categorical data, Student's t-test for data reported as mean (SD), and exact Wilcoxon test for data reported as median (range)

‡Managed care patients: patients with health insurance

Table 2

Diabetes Processes of Care, Intermediate Outcomes of Diabetes Care, and Health-care Utilization

		OA clinics (N = 3,147)		**Non-OA clinics (N = 913)**
Diabetes processes of care		N (%)		N (%)
Testing for A1c				
1-year before		2,391 (76.0%)		757 (82.9%)
1-year after		2,456 (78.0%)		815 (89.3%)
Testing for LDL				
1-year before		1,912 (60.8%)		561 (61.4%)
1-year after		1,881 (59.8%)		596 (65.3%)
Testing for urine microalbumin				
1-year before		762 (24.2%)		232 (25.4%)
1-year after		728 (23.1%)		266 (29.1%)
Health-care utilization		Mean (SD)		Mean (SD)
ER and urgent care visits				
1-year before		1.1 (1.9)		0.9 (2.0)
1-year after		1.1 (2.1)		0.9 (1.9)
Hospitalizations				
1-year before		0.30 (0.80)		0.24 (0.73)
1-year after		0.35 (1.54)		0.27 (0.79)
Total outpatient visits				
1-year before		5.6 (4.6)		5.0 (4.1)
1-year after		5.0 (4.2)		4.8 (3.6)
*Intermediate outcomes	N	Mean (SD)	N	Mean (SD)
HbA1c (mg/dl)				
1-year before	1,843	7.73 (1.83)	675	7.52 (1.71)
1-year after	1,843	7.54 (1.80)	675	7.49 (1.84)
LDL (mg/dl)				
1-year before	1,124	110 (36.1)	349	106 (34.2)
1-year after	1,124	104 (35.3)	349	102 (34.0)
SBP (mmHg)				
1-year before	2,396	136 (21.2)	674	132 (20.8)
1-year after	2,396	137 (21.7)	674	130 (18.1)

OA = open access, SBP = systolic blood pressure, LDL = low density lipoprotein, ED = emergency department

*For each outcome, subjects were included if they had measurements from both 1-year before and 3 to 12 months after the OA program

Table 3

Multivariate Analyses Comparing OA to Control Clinics on Processes of Diabetes Care

	African American odds ratio (95% CI)†	Non-African American odds ratio (95% CI)†
A1c testing	0.47* (0.29, 0.77)	0.27* (0.21, 0.36)
LDL testing	1.10 (0.77, 1.54)	0.66 (0.42, 1.05)
Urine microalbumin testing	0.64 (0.34, 1.22)	0.37* (0.17, 0.81)

*P < 0.05

OA = open access, SBP = systolic blood pressure, LDL = low density lipoprotein

†The control clinics served as the reference group. The odds ratios were adjusted for patient and clinical characteristics through a logistic regression model. Testing time frame was 1 year after OA implementation

Table 4

Multivariate Models Comparing OA to Non-OA Clinics on Intermediate Outcomes of Diabetes Care and Health-care Utilization

Intermediate outcomes††	Mean difference (95% CI)†
A1c	−0.12* (−0.21, −0.03)
SBP	6.4* (5.4, 7.5)
LDL	−0.2 (−2.0, 1.5)
Health-care utilization	Rate ratio (95% CI)†
ER and urgent care visits	0.97 (0.92, 1.02)
Hospitalizations	0.95 (0.81, 1.11)
Total outpatient visits	1.00 (0.92, 1.08)

*P < 0.05

OA = open access, ER = emergency room, SBP = systolic blood pressure, LDL = low density lipoprotein

†The non-OA clinics served as the reference group. Effect size estimates were adjusted for patient and clinical characteristics through either a linear regression model for the intermediate outcomes or a Poisson regression model for health-care utilization

††Last value of outcome measure was used, and the value had to be within the last 9 months