Published in final edited form as:

Health Aff (Millwood). 2012 January ; 31(1): . doi:10.1377/hlthaff.2011.0930.

Diabetes Management for Low-Income Patients in Los Angeles: Two Strategies Improved Disease Control In The Short Term

Peter J. Huckfeldt, PhD,

RAND Corporation, 1776 Main Street, Santa Monica, CA 90401

Daniella Meeker, PhD,

RAND Corporation, 1776 Main Street, Santa Monica, CA 90401

Anne Peters, MD,

Keck School of Medicine, University of Southern California, Los Angeles, CA 90089

Jeffrey J. Guterman, MD, MS,

Los Angeles County Department of Health Services, Kenneth Hahn Hall of Administration, 500 W. Temple St. Los Angeles, CA 90012

Guillermo Diaz Jr., MD, and

QueensCare Family Clinics, 1300 North Vermont Ave. Suite 1002, Los Angeles, CA 90027

Dana P. Goldman, PhD

Schaeffer Center for Health Policy and Economics, University of Southern California, 3335 S. Figueroa St., Unit A, Los Angeles, CA 90007

Abstract

Health care providers serving vulnerable patients in Los Angeles have developed programs intended to increase diabetes control through more intensive patient education and engagement. We examined two programs, the first using a short-term intensive intervention by a care team including nurses and a specialist, and the second integrating case management and clinical pharmacy programs into primary care in a community clinic. We show evidence that both models improved short-term disease control, as measured by reductions in HbA1c (blood glucose) and low-density lipoprotein (sometimes referred to as "bad" cholesterol). However, integrating case management and clinical pharmacy programs into a primary care setting was less labor intensive and potentially less expensive than the care team intervention. The challenge is to understand the essential aspects of these interventions; refining their design so that they are cost-effective and fiscally feasible; and identifying long-term health and cost effects.

Diabetes is a growing public health problem throughout the United States, but perhaps nowhere is the need for control quite as urgent as in Los Angeles County. The age-adjusted adult diabetes rate in the county increased almost 50 percent in just the last decade—exceeding the national average—and is estimated that it translated to \$6.4 billion annually in direct medical costs.(1) (2)

The increase in the overall diabetes rate is concentrated in low-income populations and has risen from 9.0 percent in 1997 to 14.7 percent in 2007 for adults below the federal poverty level. In contrast, the diabetes rate has only increased from 5.3 percent to 7.1 percent during the same period for adults with incomes at or above 200 percent of the poverty level. In Los

Angeles County, disparities also occur along racial and ethnic lines; diabetes prevalence for Latinos and African Americans is twice that for non-Hispanic whites.(1)

Low-income and uninsured populations in Los Angeles County receive health care primarily from two sources: primary care clinics and health centers run by the Los Angeles County Department of Health Services and independently run community clinics (predominantly federally qualified health centers or look-alikes). The patients seen in the Los Angeles County health care safety net are among the most vulnerable and disadvantaged populations in the country. Of the 730,000 patients seen in 2009 in the Department of Health Services, median annual income was between \$5,000 and \$10,000, and more than 50 percent spoke Spanish as their primary language. The 22 percent diabetes rate is considerably higher than the national level.(2),(3)

Safety-net providers in Los Angeles County have developed and implemented a series of diabetes management programs over the past decade that are designed to treat the sickest and most vulnerable people who have type 2 diabetes. In this article we contrast two programs: first, a freestanding diabetes management program in the Los Angeles County Department of Health Services; and second, a set of case management and clinical pharmacy programs that are integrated into primary care in a community clinic. We examine the impacts of these two models of diabetes management on short-term disease control and discuss the broader implications for expanding diabetes programs in the health care safety net in a cost-effective fashion, particularly in the wake of public budget cuts and health care reform.

Diabetes Management In Los Angeles County Department Of Health Services

Population

The Los Angeles County Department of Health Services forms the core of the health care safety net for indigent populations in Los Angeles County. Los Angeles County facilities include four hospitals, two large multi-specialty ambulatory care centers, six comprehensive health centers, and ten health centers.

In 2009, the Department of Health Services provided care for 730,000 patients, including 2.7 million outpatient visits. Patients seen by the Department of Health Services are of low socioeconomic status. In 2009, approximately 50 percent of the patients spoke a primary language other than English, and median income was below the poverty line. The rates of chronic disease are extremely high: 34 percent of patients are diagnosed with hypertension, 31 percent with high cholesterol, 22 percent with diabetes, and 14 percent with depression. (4)

In fiscal year 2010, across Los Angeles County outpatient settings, approximately 68 percent of patients were uninsured, 21 percent were covered by Medicaid health insurance, and 3 percent were covered by Medicare.(5)

For uninsured patients, the Healthy Way LA program covers people with incomes below 133 percent of the federal poverty level through a combination of county and federal funds. (6) Other uninsured patients ineligible for Healthy Way LA are covered through various county programs that offer services on a sliding scale at low or no out-of-pocket cost to patients.

Diabetes Management Program

The Disease Management Program in the Los Angeles County Department of Health Services offers intensive disease management programs for patients with diabetes, heart failure, and asthma. The diabetes management program originated in 2000, when the Department of Health Services brought together a team consisting of an endocrinologist, three nurses, two nurse practitioners, community workers, and pharmacists, under the guidance of the medical director of the comprehensive health center.

This team developed a program for one-stop diabetes care, through which a patient could receive assessment and treatment by a nurse educator and endocrinologist or nurse practitioner all in one visit. In addition, necessary laboratory test results were available within twenty minutes and prescriptions could be filled at no or low cost in the same clinic building. Protocols were developed and used to manage glucose, lipids, and blood pressure. Culturally sensitive educational classes and materials were developed. Forms were created to facilitate the uniform documentation of program activity.

When this one-stop program was shown to be successful, the Department of Health Services brought together a group of endocrinologists and primary care providers from all regions of the county to expand the program and create countywide guidelines and formulary policy for managing diabetes in additional diabetes management program centers throughout the county. The work culminated in the *Los Angeles County Quick Guide for the Treatment of Diabetes*, which was written with the International Diabetes Center in Minneapolis, using the center's staged diabetes management algorithms. The guide was published and distributed countywide both in hardcopy and on the Department of Health Services intranet. (7)

Patients are screened to participate in the diabetes management program as follows. An initial screening determines whether a patient meets inclusion criteria (i.e. has diabetes) and does not meet exclusion criteria, specifically that the patient exhibits reasonable cognitive ability, the patient or a proxy can communicate in English or Spanish, the patient is not psychotic, and the patient is not undergoing active chemotherapy. Next, a risk score is calculated for each patient that is a function of poor blood sugar control (HbA1c greater than 8.5 percent), emergency department use, and other unscheduled diabetes-related hospitalization. Patients with high risk scores are interviewed by program providers to determine motivation and desire to participate in the program. Finally, program providers screen potential cases and select patients to enroll in the program, based, in part, on program capacity, patient need, and patient motivation.

During an initial visit, patients are evaluated by and consult with nurses and an endocrinologist and begin treatment regimens to control glucose, lipid levels, and blood pressure. A pharmacy onsite provides access to pharmacists and free or inexpensive prescriptions. Subsequent sessions occur in the clinic and on the phone with varying frequency (monthly to weekly) depending on severity. Nurses and nurse practitioners provide treatment through a protocol and under the supervision of the diabetes specialist.

During these appointments, blood glucose results are downloaded from blood glucose meters for analysis, medications are adjusted, and program staff arrange for referrals to specialists and visits with a social worker. Patients receive personal and group instruction on diet and exercise. The program emphasizes a "team" approach to care, with expanded roles for nurses using clinical protocols and algorithms, rather than being oriented around doctor-patient visits.

Patients are treated in the diabetes management program until their blood glucose reaches the target of less than 8 percent and low-density lipoprotein (LDL) cholesterol levels are less than the target of 100 milligrams per deciliter or until six months have passed. If a patient is responding to the program but is not yet at target, they may participate in the program for an additional three months. Once a patient has reached target or 6–9 months have passed, patients “graduate” to normal primary care. The goal is that enhanced medical management, positive habit formation, and education will enable the patient to maintain control following the intervention.

The diabetes management program is now operational at six centers geographically dispersed throughout the county. Since 2007, more than 4,000 patients have been enrolled in the program countywide.

Exhibit 1 displays averages of baseline (pre-enrollment) and last-measured (at completion) blood glucose (HbA1c) and low-density lipoprotein (LDL) cholesterol levels between 2007 and 2010 across the six program sites in the county. The target values are less than 8.0 percent for HbA1c and less than 100 milligrams per deciliter for LDL. Control of LDL cholesterol is very important, as patients with type 2 diabetes are at higher risk of cardiovascular disease. (7) In tests immediately before enrollment, patients exhibit HbA1c values (in particular) that are much higher than targeted values. In each site, program enrollees exhibit substantial improvements in blood glucose control. Improvements range from 2.0 to 4.5 percent reductions across program sites. Average HbA1c at last measurement is consistently below the targeted value of 8.0 percent.

The data show large reductions in LDL across clinic sites, ranging from 12 to 17 milligrams per deciliter. Again, average LDL at completion (or last test during program participation) is well below the targeted 100 milligrams per deciliter level. In addition to these unadjusted facility-level aggregates, several studies have examined this diabetes management program at the original site at the Roybal Comprehensive Health Center and found beneficial short-term effects of the program.(8-10)

Clearly benefits are derived from intensive, short-term care management. It is yet to be determined whether or not these improvements can be sustained in primary care. Ruchi Mathur and colleagues(9) found that blood glucose control did not persist for a sample of patients followed a year after return to primary care, although LDL cholesterol reductions were maintained. That study was limited by small sample sizes in the follow-up population and included no comparison group. The results, however, highlight the need for better understanding of the long-term impacts of diabetes management in safety-net clinics, in order to calculate the full benefits of these programs and to devise maintenance interventions to sustain short-term improvements.

Diabetes Management Programs In Community Clinics

Community clinics form the second pillar of the Los Angeles health care safety net, particularly those clinics that participate in the Los Angeles County Community Partnership. Clinics in this program—primarily independently run federally qualified health centers and look-alikes—contract with Los Angeles County to treat safety net patients. The 100 clinic sites serviced over 500,000 outpatient visits in 2009 and expand the primary care capacity of the Los Angeles County system.(11)

QueensCare Family Clinics is a prominent example of a clinic in the Community Partnership. It serves more than 30,000 patients in six locations around central and eastern Los Angeles, including patients from the Department of Health Services and other vulnerable populations. QueensCare Family Clinics serves patients from disadvantaged

socioeconomic backgrounds. In 2009, 66 percent of the patients had household incomes below 200 percent of the federal poverty level, 22 percent received public assistance, and 43 percent of adults lacked any health insurance.(12)

Similar to other community clinics in Los Angeles, disease management services are organized around primary care providers rather than specialists. QueensCare Family Clinics provide disease management for diabetes patients through a combination of a case management program and a clinical pharmacy program in which pharmacists help with medication management. Referral to each of these programs occurs at the discretion of each patient's primary care provider, but generally occurs when patients exhibit problems with adherence to prescribed treatment and poor blood glucose control.

Case management appointments include lifestyle counseling and education about diet, exercise, and insulin administration. Case managers improve patient compliance to prescribed medication regimens by helping patients with educational, language, and logistical barriers to adherence.

The clinical pharmacy program was started in partnership with the University of Southern California School of Pharmacy in 2004. As in the Department of Health Services Diabetes Management Program, the clinical pharmacy program started small, with a single clinical pharmacist, but additional pharmacists were added as referrals increased. Full-time clinical pharmacists and pharmacy residents from the University of Southern California now staff the clinic.

Clinical pharmacists provide medication management for blood glucose, hypertension, and lipid management. This management includes monitoring adherence, as well as adjusting and initiating medication (including insulin). However, clinical pharmacists also provide lifestyle and diet consultation during clinical pharmacy visits.

Referral to case-management services and clinical pharmacy services are not mutually exclusive and, in contrast to the Department of Health Services Diabetes Management Program, patients have ongoing access to these programs.

We completed a study in Spring 2011 in two QueensCare Family Clinics locations to investigate determinants of blood glucose control and the association of diabetes control and economic outcomes. We obtained consent and HIPAA authorization from a convenience sample of diabetes patients who were attending the clinic for usual primary care visits, case management, and clinical pharmacy appointments, to administer a survey about their health, health care utilization, and socioeconomic characteristics, and to link health information with survey responses.

Exhibit 2 displays the characteristics of the 244 patients that completed interviews. Patients were predominantly Hispanic, with low educational attainment, and many were not citizens. Fewer than half of the respondents had worked in the previous week. Virtually none held private insurance, and most were either uninsured or received care through publicly provided insurance or health care (often county coverage through Healthy Way LA).

A large majority reported being diagnosed with hypertension and high cholesterol. Half of the patients used insulin. We estimate from appointment records that 74 percent of the respondents had received case management and 24 percent had used clinical pharmacy services, while 26 percent received usual care from their providers without clinical pharmacy or case-management services.

Exhibit 3 displays average changes in HbA1c and LDL cholesterol levels for patients in clinical pharmacy and case management programs who completed surveys in our sample. The first two columns of Exhibit 3 displays HbA1c and LDL for patients who participated in the case management program (but not clinical pharmacy). Data were evaluated for the 159 patients who had an available baseline HbA1c level measured during the year before enrollment.

The average HbA1c across patients was 9.4 percent in the year before enrollment. The average HbA1c level was 8.0 percent in the first year and 8.1 percent in the second year following continuous case management participation. The average within-person changes in HbA1c (for enrolled patients with tests in each year) were -1.5 and -1.0 percentage points for the first and second years following enrollment, respectively. Average LDL cholesterol levels decreased from a baseline of 116 milligrams per deciliter in the year before enrollment to 103 and 102 milligrams per deciliter in the first and second years of enrollment, respectively. The average within-person changes were -17 and -20 milligrams per deciliter (for people with tests in both years).

The last two columns of Exhibit 3 show changes in HbA1c and LDL cholesterol levels for patients participating in the QueensCare Family Clinics clinical pharmacy program (all but one of these patients also participated in the case management program), and shows similar improvements in HbA1c and LDL cholesterol levels. One- and two-year changes after clinical pharmacy enrollment in HbA1c were -0.9 and -1.2 percentage points respectively; these changes were -21 and -29 milligrams per deciliter for LDL cholesterol levels.

Finally, Exhibit 4 displays changes in HbA1c and LDL cholesterol levels from 2010 to 2011 for patients in neither clinical pharmacy nor case management programs and shows no statistically significant change, suggesting that patients do not exhibit improvements in blood glucose or LDL cholesterol control in the absence of these programs.

These estimates are descriptive, and focus on a convenience sample of patients that may not be representative of diabetes patients at QueensCare Family Clinics as a whole. However, other research examining the clinical pharmacy program estimated even larger effects.(13)

Discussion

We have reported reductions in HbA1c and cardiovascular risk factors after enrollment in safety-net diabetes management programs. The Los Angeles County Department of Health Services Diabetes Management Program is an intensive intervention separate from patients' primary care providers, in which nurse care coordinators treat enrollees using clinical protocols under the direction of an endocrinologist. Patients exhibited large reductions in HbA1c (ranging from 2.0 to 4.5 percentage points across sites) and LDL (ranging from 12 to 27 milligrams per deciliter) after participation in this program.

More research is needed to understand the long-term effects of this program and what are the key mechanisms leading to improvement. However, prior evidence indicates that improved medication adherence is a key predictor of improved control.(10) Providers in the program attribute improvements in adherence to the intensity of interaction with patients; nurses and nurse practitioners average around 125 cases.(14)

Due to the high labor intensity of the program and limited facility capacity, enrollment in the diabetes management program already represents a relatively small fraction of total diabetes patients seen by the Los Angeles County Department of Health Services. Moreover, the need for such services is likely to increase in Los Angeles County. Although the Affordable Care Act of 2010 expanded Medicaid eligibility to low-income adults, some patients

currently seen in Los Angeles safety-net clinics are undocumented immigrants who continue to be ineligible for MediCal coverage. One strategy for cost-effectively expanding these services includes incorporating principles of the diabetes management program into primary care clinics- in Los Angeles County and elsewhere.

The case management and clinical pharmacy programs in QueensCare Family Clinics serve as one such example of the effective integration of diabetes management program principals into routine patient management. By the metric of patient caseload, these programs are less labor intensive than the Department of Health Services Diabetes Management Program.: Average patient caseloads are approximately 400 patients per case manager and 200 patients per clinical pharmacist.(15) Despite these large caseloads, we found similar reductions in LDL cholesterol for patients in this program as those for patients in the Department of Health Services Diabetes Management Program. Although we found smaller reductions in HbA1c, another study of this clinical pharmacy program have found changes closer to those in the diabetes management program.(13)

Furthermore, unlike QueensCare Family Clinics patients, the patients admitted to the diabetes management program are rigorously selected; only patients with high but treatable levels of HbA1c are eligible. With patient selection based on capacity for improvement, we may expect greater reductions. Other research has found that nurse-directed diabetes management integrated into primary care (i.e. the QueensCare Family Clinics model) is as effective as nurse-directed diabetes management delivered separate from primary care and overseen by an endocrinologist (the diabetes management program), providing further evidence that intensive management principles can be effectively integrated into a primary care environment.(16)

Indeed, the Los Angeles County Department of Health Services is in the process of adopting a patient-centered medical home approach to disease management, in which patients are assigned a permanent primary care provider and teams including primary care physicians, nurses, care coordinators, and pharmacists jointly care for patients. This shift will support the wider incorporation of current diabetes management program principles into primary care, while patients with greater needs can still be referred for intensive diabetes management in a separate setting similar to the Los Angeles County Department of Health Services Diabetes Management Program.

Programs in the Los Angeles County health care safety net that we described demonstrate that diabetes management interventions can improve short-term control of diabetes in severely disadvantaged patient populations. Although these programs are labor intensive, they may ultimately reduce costs for the county through avoided complications and associated costs.

The ongoing challenge -both in Los Angeles County, and in the country as a whole, is refining the design of these interventions so that they are fiscally feasible but are still effective at improving short- and long-term control of diabetes. More research is needed to understand the essential aspects of these interventions, how they vary across patients with differing socioeconomic backgrounds and levels of disease control, and what are the long-term health and cost impacts of these interventions.

Acknowledgments

Disclosure

The authors acknowledge financial support from the Institute for Health Technology Studies (InHealth) and NIH grant #1RC4AG039036-01. The authors acknowledge Charlene Chen, Gloria Rodriguez, and Sarita Mohanty of COPE Health Solutions, and the staff at QueensCare Family Clinics, for their extensive assistance during this study

Notes

1. Los Angeles County Department of Public Health. LA Health: Trends in diabetes: a reversible public health crisis [Internet]. Los Angeles (CA): L.A. County Department of Public Health; 2010 Nov. Available for download from: <http://publichealth.lacounty.gov/ha/> [2011 Dec 1]
2. Centers for Disease Control and Prevention. National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2011. Available from: http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf [2011 Dec 6]
3. Data from 2009. computed by the Los Angeles County Department of Health Services Office of Planning using the Department of Health Services Enterprise Data Repository;
4. Data from 2009. computed by the Los Angeles County Department of Health Services Office of Planning using the Department of Health Services Enterprise Data Repository;
5. Average insurance status across outpatient settings in Fiscal Year 2010. computed by the Los Angeles Department of Health Services Department of Finance using the Department of Health Services Enterprise Data Repository;
6. Kominski, G.; Pourat, N.; Roby, D.; Diamant, A.; Meng, Y-Y.; Kally, Z., et al. UCLA Center for Health Policy Research Report. Los Angeles (CA): 2010. Interim evaluation report on California's health care coverage initiative.
7. Mazze, RS.; Strock, E.; Simonson, GD.; Bergenstal, RM. Prevention, detection and treatment of type 2 diabetes in adults: quick guide. 4. Minneapolis (MN): International Diabetes Center; 2008. Customized for Los Angeles County Department of Health Services
8. American Diabetes Association. Standards of Medical Care in Diabetes - 2011. Diabetes Care. 34(S1):S29.
9. Beale EO, Lee WA, Chan LS. Efficacy of a staged diabetes management programme in achieving glycaemic goal in a low socio-economic Hispanic population. Practical Diabetes Int. 2010; 27(7): 298–302.
10. Mathur R, Roybal GM, Peters LA. Short and longer term outcomes of a diabetes disease management program in underserved Latino patients. Curr Med Res Opin. 2005; 21(12):1935–41. [PubMed: 16368043]
11. Ruelas V, Roybal GM, Lu Y, Goldman D, Peters A. Clinical and behavioral correlates of achieving and maintaining glycemic targets in an underserved population with type 2 diabetes. Diabetes Care. 2009; 32(1):54–6. [PubMed: 18931097]
12. Data from 2009. computed by the Los Angeles County Department of Health Services Office of Planning using the Department of Health Services Enterprise Data Repository;
13. QueensCare Family Clinics. Annual report [Internet]. Los Angeles (CA): QueensCare Family Clinics; 2009. Available from <http://www.queenscarefamilyclinics.org/files/qfc/pdfs/2009Clinics-AR.pdf> [2011 Dec 1]
14. Johnson KA, Chen S, Cheng I-N, Lou M, Gregerson P, Blieden C, et al. The impact of clinical pharmacy services integrated into medical homes on diabetes-related clinical outcomes. Ann Pharmacother. 2010; 44(12):1877–86. [PubMed: 21119101]
15. Agency for Healthcare Research and Quality. Public health-led disease management programs improve outcomes for individuals with diabetes and children with asthma [Internet]. Rockville (MD): AHRQ; 2010. Available from: <http://www.innovations.ahrq.gov/content.aspx?id=1770> [2011 Dec 1]
16. Approximate patient caseloads extracted from QueensCare Family Clinic's practice management system. calculated by Chief Medical Information Officer; Guillermo Diaz MD: Nov. 2011

Exhibit 1

HbA1c and LDL Cholesterol Levels Before And After Participation In A Diabetes Management Program At Six Department Of Health Services Clinics, 2007-10

Clinic	Number of enrollees	HbA1c (%)			LDL Cholesterol levels (mg/dL)		
		Pre-enrollment	At completion or last test	Unadjusted change	Pre-enrollment	At completion or last test	Unadjusted change
USC Healthcare Network	1,622	9.8	7.2	-2.7	95	84	-12
Harbor/UCLA Center	490	11.9	7.4	-4.5	110	87	-23
Long Beach Health Center	135	8.8	6.8	-2.0	98	73	-27
Humphrey Health Center	500	10.5	7.9	-2.6	112	94	-18
High Desert Health Center	846	10.6	7.7	-2.7	116	97	-20
Olive View/UCLA Center	582	10.1	7.4	-2.6	114	87	-27

SOURCE Annual aggregate data from Los Angeles County Department of Health Services-Clinical Resource Management. Unadjusted change provided across patients with test values both pre- and post-enrollment. HbA1c is blood glucose. LDL is low-density lipoprotein. Mg/dL is milligrams per deciliter. USC is University of Southern California. UCLA is University of California Los Angeles.

Exhibit 2**Convenience Sample Of Diabetes Patients At QueensCare Family Clinics**

Measure	Number of responses	Mean (SD)
Age (years)	244	53.0 (8.4)
Male	244	43%
Hispanic	244	89%
Education (years)	223	8.2 (4.7)
US citizen	240	29%
Worked in past week	220	39%
Private insurance	220	1%
Public insurance (federal, state, local)	219	37%
Report no insurance	219	62%
Hypertension	244	73%
High cholesterol	223	77%
Uses insulin	240	49%
Any case management	244	73%
Any clinical pharmacy	244	24%
No case management or clinical pharmacy	244	26%

SOURCE Survey data and health records from QueensCare Family Clinics. NOTE SD is standard deviation. Total sample size is 244 survey respondents.

Exhibit 3**QueensCare Family Clinic Patients: HbA1c and LDL Cholesterol Levels Before And After Program Participation**

	Case management N = 179		Clinical pharmacy N = 59	
	HbA1c (%)	LDL cholesterol (mg/dL)	HbA1c (%)	LDL cholesterol (mg/dL)
Baseline mean, year prior to enrollment (SD)	9.4 (2.2) n = 159	116 (37) n = 145	8.8 (1.5) n = 57	118 (32) n = 51
Mean value, first year of enrollment (SD)	8.0 (1.5) n = 156	103 (31) n = 138	8.0 (1.4) n = 55	101 (34) n = 52
Mean value, second year of enrollment (SD)	8.1 (1.6) n = 128	102 (34) n = 115	7.6 (1.1) n = 48	90 (26) n = 43
Average within-person change after 1 year (SE)	-1.5 (0.2) *** n = 139	-17 (5) *** n = 112	-0.9 (0.3) *** n = 53	-21 (7) *** n = 44
Average within person change after 2 years (SE)	-1.0 (0.3) *** n = 114	-20 (5) *** n = 94	-1.2 (0.3) *** n = 48	-29 (6) *** n = 40

SOURCE Health records from QueensCare Family Clinics. NOTES Estimates show average lab value (or within-person change in lab value) with standard deviation or standard error in parenthesis. The “n” for each cell represents the number of lab values observed for participants in the corresponding year relative to program enrollment. For average changes, “n” represents number of participants with lab values in both years. HbA1c is blood glucose. LDL is low-density lipoprotein. mg/dL is milligrams per deciliter. SD is standard deviation. SE is standard error (calculated clustering at patient level).

p < 0.001

Exhibit 4

QueensCare Family Clinic Patients: HbA1c and LDL Cholesterol Levels For Usual Care Patients (N = 64)

	Mean value in 2010 (SD)	Mean value in 2011 (SD)	Average within- person change (1 year) (SE)
HbA1c (%)	8.1 (1.6) n = 51	8.1 (1.9) n = 54	-0.3 (0.3) n = 43
LDL cholesterol (mg/dl)	109 (44) n = 47	105 (41) n = 43	-10 (8) n = 31

SOURCE Health records from QueensCare Family Clinics. Estimates show average lab value (or within-person change in lab value) with standard deviation or standard error in parenthesis. The “n” for each cell represents number of lab values observed for participants in corresponding calendar year. For average changes, “n” represents number of participants with lab values in both years. HbA1c is blood glucose. LDL is low-density lipoprotein. mg/dL is milligrams per deciliter. SD is standard deviation. SE is standard error (calculated clustering at patient level).