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Effects of an enhanced primary care program on diabetes outcomes

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Abstract

Objectives—To evaluate the effectiveness of *Buena Salud*, a multidisciplinary enhanced primary care program for Medicaid Managed Care patients at a community health center serving a low-income Hispanic community.

Study Design—Controlled “before and after” observational study.

Methods—We extracted data from the electronic health record for patients ages 18-64 with type 2 diabetes (T2D) enrolled in the *Buena Salud* program between August 2011 and January 2012. Matched controls were randomly selected from patients seen at the health center during the same time frame. Outcomes included process measures (e.g., hemoglobinA1C assessment), target lab and blood pressure values, and utilization measures (e.g., emergency department visits). Demographics and other potential confounders were also extracted. We used a difference-in-difference analysis to estimate the effect of the intervention.

Results—A total of 72 patients with diabetes and 247 matched controls were included in the analysis. There was a significant difference between groups in the change in percent of patients with guideline-concordant measurement of microalbumin/creatinine compared to controls (difference-in-difference=22.2%; p=0.008), there was a trend toward fewer hospitalizations, and mean diastolic blood pressure rose in the intervention group. We did not find differences in other outcome or utilization measures.

Conclusions—A recently implemented enhanced primary care program had minimal impact on T2D process, outcome, and utilization measures for patients in this study. However, there were some promising trends; it is possible that a greater effect could be observed as the program matures.

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Keywords

enhanced primary care; diabetes; real-world; Hispanic

Introduction

Case management, peer health coaching, and other team-based systems of care such as the Patient Centered Medical Home have been implemented in an effort to improve care coordination and patient outcomes in the ambulatory setting.[1–9] These programs are often created and implemented by health care delivery systems. However, given their financial interests, insurance companies have increasingly played a role in developing and funding strategies to improve chronic disease management as well.[10] The term 'enhanced primary care' refers to a team-based care model used to improve care processes and outcomes.[11] This multi-disciplinary team model includes use of clinical tools such as practice guidelines, patient monitoring and tracking systems, and measures of resource use. Team-based care models often focus on management of chronic diseases such as type 2 diabetes (T2D), because of their higher associated morbidity, mortality, and costs.[12] T2D has proven particularly challenging to manage in the primary care setting, with less than 20% of T2D patients achieving targets for HbA1C, LDL cholesterol, and blood pressure.[13] While team-based care coordination programs for patients with T2D have shown promise,[8,9] disease management remains sub-optimal, particularly for vulnerable populations.[12]

Racial, ethnic, and economic disparities in T2D prevalence, care, and outcomes in the U.S. cause a disproportionate burden of disease and morbidity in vulnerable populations.[14,15] Patients with the highest risk for poor outcomes may arguably benefit most from the additional resources provided by an enhanced primary care team. In this study, we aimed to determine the impact of a newly implemented insurance company-sponsored team-based enhanced primary care program (*Buena Salud (Be Healthy)*) on process measures, patient outcomes, and health care utilization for a low-income racial and ethnic minority population of patients with T2D.

Methods

We conducted a controlled "before and after" study to assess the effect of the *Buena Salud* program on T2D process, outcome and utilization measures. Although the Buena Salud team provided support for patients with other chronic diseases and promoted preventive care, this analysis is limited to patients with T2D.

Design, Setting, and Participants

Buena Salud is a bilingual enhanced primary care program financed by the Health New England (HNE) insurance company and implemented by Brightwood Health Center (BHC) in Springfield, MA. *Buena Salud* serves Medicaid Managed Care patients at the health center. BHC is an urban community health center with a largely Hispanic population (88%) that is primarily insured by either Medicaid (59%) or Medicare (28%). More than 50% of BHC patients prefer Spanish as their spoken language and 17% of those over the age of 18

years have T2D. Patients were enrolled in *Buena Salud* primarily by a referral from their primary care provider, but they also could have been enrolled through a periodic process whereby eligible patients were automatically assigned to Buena Salud, or through self-referral. The *Buena Salud* enhanced primary care team consisted of two registered nurses, two medical assistants trained as outreach workers, and a case manager. Each team member was bilingual (Spanish-English) and from the same racial/ethnic group as the majority of BHC patients. The team sought to engage patents in self-management of chronic diseases and provided complementary support outside of provider visits. A total of 450 patients were enrolled in the *Buena Salud* program between August 2011 and January 2012. Each *Buena Salud* nurse was expected to actively manage up to 50 patients at any given time, not all of whom had T2D. Care intensity varied depending on individual need, but care intensity was not formally documented by the team.

We reviewed eligible patients' electronic health records, with eligibility defined as follows. We identified all BHC patients ages 18-65 with T2D who were newly enrolled in the *Buena Salud* program between August 1, 2011 and January 31, 2012. We then identified all BHC patients ages 18-65 years who had T2D, had been seen for a clinical encounter at BHC between August 1, 2011 and January 31, 2012, and were not enrolled in *Buena Salud*. From this list of potential controls, we randomly selected and matched three patients for every one enrolled in *Buena Salud* based on the patient having been seen in the same month that a *Buena Salud* patient was enrolled in the program. This form of matching was done because the population is relatively homogeneous and this would reduce the potential for differences in unmeasured confounders related to temporal changes in practice at the health center. *Buena Salud* patients and controls must have also had at least one visit at BHC in the 12 months prior to the enrollment/index visit so that baseline data could be extracted. Because there were fewer T2D patients enrolled in *Buena Salud* than anticipated, we had slightly higher than a 3:1 ratio. This study was approved by the Baystate Institutional Review Board, which waived informed consent.

Time period studied and outcome variables

We identified target clinical outcomes, care processes, and health care utilization measures for patients with T2D using the national American Diabetic Association diabetes care guidelines that were in place in 2011 when the study was designed, as well as previous studies.[16] Clinical outcome measures included values for Hemoglobin A1C (HbA1C), systolic and diastolic blood pressure (SBP/DBP), and low-density lipoprotein (LDL). Care processes included the number of times HbA1C, microalbumin/creatinine ratio, and lipids were measured. Utilization measures included emergency department visits and unplanned hospitalizations, defined as any hospitalization other than for a non-emergent procedure. (Fig 1) Baseline data were collected from the year prior to enrollment/index visit beginning with the first day of the month in which they were enrolled, while the intervention period was defined as a window ranging from 12-15 months following the enrollment/index month. Timing of this window varied slightly in order to account for the earliest time after enrollment the intervention would have been expected affect the outcome measured and to provide grace periods for guidelines requiring a certain frequency of a measure. (Fig. 1) In addition to T2D care and outcomes data, we extracted demographic data and potential

confounders such as co-morbidities and the number of years a patient received care at BHC. (Table 1)

Data Extraction

We oriented data extractors to the study's data dictionary and extraction protocol, which included where to locate pertinent data in the electronic health record (EHR). Standardized extraction forms were used. After establishing consistency at baseline, two extractors independently reviewed 20 randomly selected health records to assess inter-extractor consistency at six and 18 months into the course of data extraction to test whether consistency was maintained. Study data were collected and managed using REDCap electronic data capture tools.[17]

Analysis

Participant characteristics are presented as means and standard deviations for continuous variables and frequencies and percentages for categorical variables. To estimate differences between the groups studied, we used a difference-in-difference approach (the difference between the pre-post- change in the *Buena Salud* compared to the control groups) Study outcomes were modeled using generalized estimating equations (GEE) with exchangeable correlations and robust standard errors (clustering on patient). Continuous outcomes were modeled using the identity link and Gaussian family, binary outcomes were modeled using the logit link and binomial family, count outcomes were modeled using the log link and negative binomial family. Models were estimated with main effects for the intervention group and time period with an interaction term between these two representing the difference-in-difference. As *Buena Salud* participants were frequency matched to controls based on enrollment month we addressed matching using enrollment month as an indicator variable in the model. This term was not significant in the models, therefore was removed. Predicted outcomes and 95% confidence intervals are presented in their original metrics using Stata's -margins- post-estimation command. Statistical significance was set at an alpha of 0.05.Multivariable models considered factors which we considered to be confounders (demographic data, co-morbidities, and number of years receiving care at BHC). Using Wald tests, models were reduced to include variables that were significant at the 0.05 level. To control for possible residual confounding and for face validity, we retained age, mental health and substance use in all models. Original power calculations estimated that if at least 100 *Buena Salud* patients and 175 controls were included, this sample size would provide >85% power to detect a medium effect size (Cohen's d = 0.40) at an alpha of 0.05. Clinically, this would be the equivalent of a difference-in-difference estimate for Hba1c of 0.75 assuming a pooled standard deviation of change = 1.70. Our achieved sample size was less than the estimated 100, but there was still 85% power to detect the same effect size. The analysis was conducted using Stata v13.1, StataCorp LP, College Station, TX.

Results

A total of 319 patients with T2D were included in the study: 72 were in the *Buena Salud* (intervention) group and 247 were in the matched control group. The median age was 53 (IQR=45-59) years; 63.6% were female; and Spanish was the preferred language for 57.7%.

(Table 1) There were baseline differences between the groups: patients in the control group were older (54 vs. 50 years), more likely to be HIV infected (11.3% vs. 2.8%), and less likely to have been diagnosed with anxiety or depression (49.8% vs. 73.6%). (Table 1) Baseline HbA1c was lower in the control group (7.8%; SD=2.1) compared to the *Buena Salud* group (8.1%; SD=2.2) and the baseline number of emergency department visits per person per year for those with any visit was also lower in the control group (2.1/year; SD=3.5) compared to *Buena Salud* (3.5/year; SD=3.7). Baseline unplanned hospitalizations also differed with 17.8% of controls and 26.4% of *Buena Salud* participants having had at least one hospitalization in the year preceding enrollment. All other variables were similar at baseline. Inter-rater consistency was greater than 90%.

Clinical outcomes

HbA1c—There was no difference in the change in HBA1C values between intervention and control patients in either unadjusted or adjusted models (absolute difference in difference 0.38; 95% CI=-0.13 to 0.88; p=0.15). (Table 2) The difference in the change in the percent of patients achieving the target HbA1C was −0.9% (95% CI=−10.4% to 8.6%; p=0.85) in unadjusted models and −1.4% (95% CI=−10.5% to 8.1%; p=0.78) in adjusted models. (Table 2)

Blood Pressure and Lipids—With the exception of DBP, we found no differences in the change in hemodynamic or lipid profiles between control and *Buena Salud* groups in unadjusted or adjusted models. (Table 2) For DBP, there was a significant difference in the changes for each group of 2.6 (95% CI=0.8 to 4.3; p=0.004) in both adjusted and unadjusted models. This reflected a rise in mean DBP for the *Buena Salud* group and a fall for controls. (Table 2)

Process Measures and Utilization

We found that the percentage of *Buna Salud* patients having HbA1C measures did not change during the study period, and that although the percent of controls with the recommended number of measures dropped, the the change between the two groups was not statistically significant. (Table 3) Similarly *Buena Salud* patients saw a 4.2% increase in patients with guideline concordant LDL measures while controls dropped by 5.7%, for a difference-in-difference of 9.8%, but this was also not a significant change. (Table 3) There was a significant difference in the percent of patients with the recommended number of microalbumin/creatinine ratio measures in the *Buena Salud* group increasing by 25.0% (95% CI=(11.4% to 38.8%)) compared to a 2.8% increase (95% CI = (−4.6% to 10.2%)) amongst controls ($p<0.01$). Change in the annual rate of emergency department visits did not differ between groups, but unplanned hospitalization rates decreased by 2.8% (95% CI=(−13.7 to 8.1) in the *Buena Salud* group while rates increased by 8.9% (95% CI=(2.9% to 15.0%) amongst controls for a difference-in-difference of 11.7% (p=0.06). After adjustment, the difference remained the same but the p-value increased to 0.11. (Table 3)

Discussion

In this controlled “before and after” study, we found that a team-based enhanced primary care program, *Buena Salud*, did not appreciably improve T2D process, outcome, or utilization measures for low-income Hispanic patients during the program’s first 15 months of existence in comparison to matched controls. Positive effects included a greater increase in the percent of patients with appropriate measurement of microalbumin/creatinine ratios. There was also a trend towards fewer unplanned hospitalizations for *Buena Salud* patients compared to controls.

Diabetes affects nearly 10% of the U.S. population and generated $245 billion dollars in health care costs in 2012, a 41% increase from 2007.[18] A number of studies have tested innovative approaches to improving care for the patients from populations with the worst T2D outcomes. For example, investigators assessed the effectiveness of a computer-based support system in the context of primary care team-based management of T2D in a controlled natural experiment. Similar to the current study, which also could be categorized as a natural experiment, the investigators found improvement in process measures, such as rates of microalbumin/creatinine and HbA1C testing in the intervention group (n=435) compared to controls (n=435) after 12 months, but a limited effect on patient outcomes or health care costs.[19] In a study conducted with 165 Mexican-American patients in rural Texas, the investigators tested whether the addition of a nurse case manager to a diabetes education and self-management program improved patient outcomes by addressing socio-cultural barriers to accessing the successful self-management program.[1] The study used a pre-/post- controlled design, similar to the current study except that is was a prospective cohort. The outcomes included changes in HbA1C, fasting blood sugar, lipids, blood pressure, diabetes related knowledge, health behaviors and body mass index over a six month time period. The study found no difference in changes in outcome measures between groups. Conversely, in a randomized clinical trial of 299 patients in six health centers serving low-income patients in San Francisco, CA, the investigators tested the impact of trained peer health coaches on HbA1C levels.[8] Patients in the peer health coach group experienced an absolute reduction in HbA1C of 1.1% while controls’ HbA1Cs dropped by only 0.3% (p=0.01, adjusted). The same research team also tested the effect of medical assistants trained as health coaches in a randomized clinical trial of 441 patients with T2D in two safety net primary care clinics in San Francisco, CA.[20] They found that patients in the intervention group had lower HbA1c and lipid levels after 6 months of exposure to the intervention, but diastolic blood pressure changes did not differ between groups. The results of prior studies and the current study suggest that team-based interventions to improve diabetes care and outcomes may be successful in the controlled setting of a randomized clinical trial, but that it may be challenging to translate these interventions into practice.

What factors might be responsible for the very modest intervention effects seen in the current study? Although some randomized clinical trials studies have shown improvements in HbA1C in as little as six months, an enhanced primary care model implemented outside of a clinical trial may require a longer exposure to the intervention for an effect to be realized. The current study tested *Buena Salud’s* effectiveness in its first fifteen months of existence. It is possible that it may take longer than this for the team to become optimized.[21]

We followed patients for a relatively brief time period after enrollment, and it may take more time for team members to develop trusting relationships with care recipients. We learned through interviews with the *Buena Salud* team that there was no systematic process for documenting their interactions with patients during the time period studied. This meant that we could not accurately measure the intervention "dose" individuals received. In a small study such as this, variation in expertise amongst the *Buena Salud* team members also could have influenced the outcomes observed.

This study's strengths included the following: comparison with a control group, use of a difference-in-difference analysis that adjusted for secular trends in care and outcomes, and risk-adjustment using a broad array of clinical and demographic data. The latter allowed us to address the non-random assignment of patients to intervention and control groups. This study should also be considered in light of its limitations. First, this was an observational study and not a randomized clinical trial. The *Buena Salud* program was intended to provide support for the sickest patients, as evidenced by the measured baseline differences found between *Buena Salud* patients and controls, but there may have been other unmeasured important differences not accounted for in our extensive risk-adjustment. Second, this study evaluated patients from one health center. This allowed us to focus on the population of interest, but the intervention might have different effects in other populations or in other health centers with a similar population. Third, many primary care interventions are intended to decrease costs while improving care quality and outcomes. We elected not to explore cost savings in this study with a relatively short follow-up period because additional expenditures may be needed in populations that experience significant health disparities and high burdens of chronic disease, particularly in the early phase of an intervention.[22] Fourth, we had a substantial amount of missing LDL data, due largely to many lipid screens having only total and high-density lipoproteins documented. Finally, several diabetes guidelines have changed since the study's inception, making some of the measures assessed no longer consistent with current diabetes care guidelines.

In conclusion, a team-based, enhanced primary care program delivered by a multidisciplinary bilingual team culturally similar to the majority of patients enrolled in the program had a limited effect on care processes, outcomes, and utilization for lower income Hispanic patients with T2D. Care should be taken in drawing conclusions from outcomes assessed in the first year of a new program since there is likely a learning curve to engaging and partnering with patients in this context. Longitudinal effectiveness and implementation studies will contribute additional important information to our understanding of the potential benefits of enhanced primary care team interventions for vulnerable patients with T2D.

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Take away points

As risk for population health is increasingly shared, insurance companies are exploring use of interdisciplinary care teams in primary care to improve chronic disease and population health management. In this study, we evaluated the outcomes of a new, insurance company-sponsored enhanced primary care program, *Buena Salud* in a controlled before and after study. *Buena Salud* targeted Hispanic patients with diabetes at a community center serving largely a low income population. We found limited effect on diabetes outcomes, including process, utilization, and patient outcome measures, in the program's first year of existence.

- Implementation studies of team-based primary care programs may enhance program effectiveness outside of an experimental setting
- Policy makers may want to allow more time for programs implemented a natural setting to mature before determining effectiveness
- Policies that address the social determinants of health may be necessary for enhanced primary care programs to have sustained substantial impact

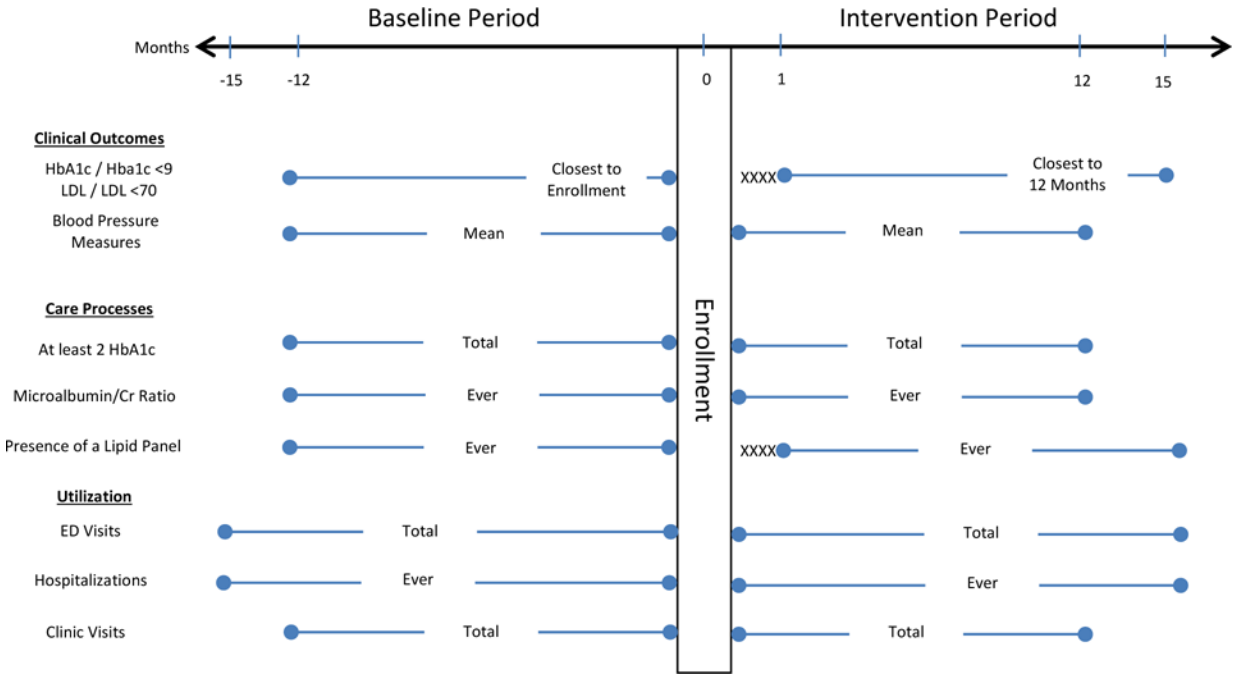

Figure 1.
Process, outcome and utilization measures and timing

Table 1

Baseline Characteristics of Participants

Characteristic	Overall	Be Healthy Participant	
	n=319 n (%)	No n=247 (77.4%) n (%)	Yes n=72 (22.6%) n (%)
Male	116 (36.4%)	93 (37.7%)	23 (31.9%)
Preferred Language			
English	134 (42.0%)	106 (42.9%)	28 (38.9%)
Spanish	184 (57.7%)	140 (56.7%)	44 (61.1%)
Other	1 (0.3%)	1 (0.4%)	0 (0.0%)
HIV Infection	30 (9.4%)	28 (11.3%)	2 (2.8%)
Substance Use	58 (18.2%)	45 (18.2%)	13 (18.1%)
Suboxone Use	20 (6.3%)	17 (6.9%)	3 (4.2%)
Tobacco Use	90 (28.2%)	67 (27.1%)	23 (31.9%)
Anxiety or Depression	176 (55.2%)	123 (49.8%)	53 (73.6%)
Other Mental Health Problems	68 (21.3%)	55 (22.3%)	13 (18.1%)
Obesity	229 (71.8%)	176 (71.3%)	53 (73.6%)
Homeless	6 (1.9%)	4 (1.6%)	2 (2.8%)
Deceased during study	2 (0.6%)	0 (0.0%)	2 (2.8%)
Age			
n	319	247	72
Mean(sd)	51.3 (9.1)	51.6 (9.4)	50.3 (7.9)
Median(range)	53 (26–65)	54 (26–65)	50 (31–63)
Years receiving care at Brightwood			
n	319	247	72
Mean(sd)	3.6 (0.9)	3.7 (0.9)	3.4 (1.0)
Median(range)	3.9 (0.3–4.8)	3.9 (0.3–4.8)	3.7 (0.5–4.8)
Charlson Comorbidity Index:			
n	319	247	72
Mean(sd)	2.6 (1.9)	2.7 (2.0)	2.4 (1.4)
Median(range)	2 (1–15)	2 (1–15)	2 (1–8)

Table 2

Clinical Outcomes

	Subjects	Control Change (95% CI)	Be Healthy Change (95% CI)	Difference in Difference (95% CI)	*p-value*
HbA1c					
HbA1c Change					
Unadjusted	314	−0.24 (−0.46 to −0.02)	0.14 (−0.32 to 0.59)	0.38 (−0.13 to 0.88)	*0.145*
Adjusted[a]	314	−0.24 (−0.47 to −0.02)	0.13 (−0.33 to 0.59)	0.38 (−0.13 to 0.88)	*0.147*
HbA1c ≤ 9					
Unadjusted	314	0.3% (−4.8 to 5.4)	−0.6% (−8.6 to 7.4)	−0.9% (−10.4 to 8.6)	*0.845*
Adjusted[b]	313	0.4% (−4.8 to 5.6)	−0.9% (−8.9 to 7.0)	−1.4% (−10.8 to 8.1)	*0.777*
Systolic					
Unadjusted	319	−0.8 (−2.0 to 0.4)	0.6 (−1.9 to 3.1)	1.4 (−1.4 to 4.2)	*0.316*
Adjusted[c]	319	−0.8 (−2.0 to 0.4)	0.6 (−1.9 to 3.1)	1.4 (−1.4 to 4.2)	*0.311*
Systolic <130					
Unadjusted	319	−0.9% (−5.6 to 3.9)	−5.3% (−17.0 to 6.5)	−4.4% (−17.1 to 8.3)	*0.513*
Adjusted[d]	319	−0.8% (−5.6 to 3.9)	−5.3% (−17.2 to 6.5)	−4.5% (−17.3 to 8.3)	*0.510*
Diastolic					
Unadjusted	319	−1.8 (−2.6 to −1.0)	0.8 (−0.8 to 2.3)	2.6 (0.8 to 4.3)	*0.004*
Adjusted[e]	319	−1.8 (−2.5 to −1.0)	0.8 (−0.8 to 2.3)	2.5 (0.8 to 4.3)	*0.004*
Diastolic <80					
Unadjusted	319	2.9% (−2.2 to 8.0)	4.6% (−6.9 to 16.0)	1.7% (−10.9 to 14.2)	*0.807*
Adjusted[f]	319	2.9% (−2.2 to 8.0)	4.4% (−6.7 to 15.6)	1.5% (−10.8 to 13.8)	*0.812*

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	Subjects	Control Change (95% CI)	Be Healthy Change (95% CI)	Difference in Difference (95% CI)	*p-value*
LDL					
Unadjusted	268	0.3 (−4.6 to 5.1)	−1.0 (−9.4 to 4.5)	−1.2 (−11.0 to 8.5)	*0.805*
Adjusted[g]	268	0.0 (−4.8 to 4.8)	−0.5 (−8.9 to 8.0)	−0.5 (−10.2 to 9.2)	*0.922*
LDL <70					
Unadjusted	268	0.6% (−6.2 to 7.3)	−3.1% (−15.4 to 9.2)	−3.7% (−17.7 to 10.4)	*0.608*
Adjusted[h]	268	0.9% (−5.7 to 7.5)	−5.1% (−17.5 to 7.3)	−6.0% (−20.1 to 8.1)	*0.406*

[a] adjusted for years of care, language, age, mental health and substance use.

[b] adjusted for baseline ED visits, language, age, mental health and substance use.

[c] adjusted for: age, mental health and substance use.

[d] adjusted for: language, age, mental health and substance use.

[e] adjusted for: language, obesity, age, mental health and substance use.

[f] adjusted for: tobacco use, obesity, homelessness, age, mental health and substance use.

[g] adjusted for: language, sex, homelessness, age, mental health and substance use.

[h] adjusted for: baseline ED visits, age, mental health and substance use.

Table 3

Process and Utilization Outcomes

	Subjects	Control Change (95% CI)	Be Healthy Change (95% CI)	Difference in Difference (95% CI)	*p-value*
2+ HbA1c					
Unadjusted	319	−5.3% (−13.0 to 2.5)	0.0% (−15.0 to 15.0)	5.3% (−11.5 to 22.1)	*0.531*
Adjusted[a]	319	−5.3% (−13.0 to 2.5)	0.0% (−14.3 to 14.3)	5.3% (−11.0 to 21.6)	*0.524*
Documented Lipid Panel					
Unadjusted	319	−5.7% (−13.3 to 1.9)	4.2% (−8.9 to 17.2)	9.8% (−5.3 to 24.9)	*0.195*
Adjusted[b]	318	−5.7% (−13.3 to 2.0)	4.2% (−8.8 to 17.1)	9.9% (−5.2 to 24.9)	*0.195*
Documented Microalbumin:Creatinine Ratio					
Unadjusted	319	2.8% (−4.6 to 10.2)	25.0% (11.2 to 38.8)	22.2% (6.5 to 37.8)	*0.009*
Adjusted[c]	319	2.8% (−4.6 to 10.2)	25.1% (11.4 to 38.8)	22.2% (6.7 to 37.8)	*0.008*
Emergency Department Visits (Annual Rate)					
Unadjusted	173	−0.7 (−1.2 to 0.1)	−1.5 (−2.4 to −0.6)	−0.8 (−1.8 to 0.2)	*0.377*
Adjusted[d]	173	−0.7 (−1.1 to 0.2)	−1.2 (−1.8 to −0.5)	−0.5 (−1.2 to 0.3)	*0.319*
Hospitalizations					
Unadjusted	319	8.9% (2.9 to 15.0)	−2.8% (−13.7 to 8.1)	−11.7% (−24.1 to 0.8)	*0.055*
Adjusted[e]	319	8.6% (2.8 to 14.5)	−3.1% (−15.2 to 9.0)	−11.7% (−25.1 to 1.7)	*0.106*

[a] adjusted for: years of care, HIV status, age, mental health and substance use.

[b] adjusted for: language, age, mental health and substance use.

[c] adjusted for: Charlson comorbidity index, baseline hospitalizations, age, mental health and substance use.

[d] adjusted for: baseline hospitalizations, sex, age, mental health, suboxone use and substance use.

[e] adjusted for: Charlson comorbidity index, baseline ED visits, years of care, age, mental health and substance use.