7-9-2020

Evaluation of a Type 2 Diabetes Mellitus Care Coordination Program

Carrie Smith
University of Missouri-St. Louis, cesxb6@umsl.edu

Evaluation of a Type 2 Diabetes Mellitus Care Coordination Program

Carrie E. Smith

B.S.N., Nursing, Goldfarb School of Nursing at Barnes-Jewish College, 2013

D.M.A., Oboe and Musicology, University of Wisconsin-Madison, 2003

B.S., Music and English, Indiana University-Bloomington, 1998

A Dissertation Submitted to the Graduate School at the

University of Missouri-St. Louis

in partial fulfillment of the requirements for the degree

Doctor of Nursing Practice

August
2020

Advisory Committee

Committee Chairperson, Natalie Murphy, PhD, ARNP, FNP-BC

Committee Faculty Member, Louise C. Miller, PhD, RN

Committee Faculty Member, Pamela Talley, MSN, APRN-BC

Abstract

Purpose: This Quality Improvement (QI) project evaluated the impact of an existing Diabetes Care Coordination (DCC) program at an urban clinic for clients with no health insurance in the Midwest. Diabetes related indicators of those enrolled in the DCC program and client reported barriers were documented over a 19 month period.

Sample: Clients included were 18 years and older, with no insurance, having the diagnosis of Type 2 diabetes mellitus, and were enrolled in the DCC program within the first six months of the program's initiation.

Methods: A retrospective chart review of 24 clients recording diabetes related outcome indicators and client reported barriers to care was performed from January 2020 to March 2020 covering the 19- month time period.

Results: There was a statistically significant association between being enrolled in the DCC program and HgA1c outcomes using an alpha value of 0.05, $t(23)=2.15$, $p=.042$. There were no statistically significant associations between being in the DCC program and body mass index (BMI), total cholesterol, and LDL outcomes. All 24 clients reported barriers during their enrollment in the program, with 'unable to take medications' being the most prevalent reported barrier ($n=49$, 35%).

Implications: Results suggest that the DCC management strategy is effective in lowering HgA1c for this at-risk, underserved population needing diabetes care. Providing increased support to improve medication adherence and adding regular consults with a dietitian may improve overall health outcomes, including BMI, total cholesterol, LDL, and blood pressure.

Introduction

Type 2 diabetes mellitus (T2DM) is the seventh leading cause of death in the United States affecting more than 34 million people (Centers for Disease Control and Prevention [CDC], 2020). Approximately 28% of Americans with T2DM remain undiagnosed, increasing their risks for serious health complications including heart attack, stroke, kidney disease, limb amputations, and blindness (Office of Disease Prevention and Health Promotion [ODPHP], 2019). Prevalence of T2DM is therefore underreported, and approximately one in five adults in the United States have T2DM without being aware (CDC, 2020). This project evaluated a Diabetes Care Coordination program at an urban underserved clinic in the Midwest where 95% of the population is African American and 54% live below the national poverty line (Washington University in St. Louis, 2018).

Healthy People 2020 identifies socioeconomic position as an important factor to consider when evaluating interventions for T2DM (ODPHP, 2019). The CDC (2020) reports the prevalence of T2DM is more common amongst African Americans, people of lower socioeconomic positions and people with less education. In the Midwest city where this QI intervention took place, there are alarming rates of health disparities among African Americans who disproportionally have lower socioeconomic status and less education than Caucasians (Washington University in St. Louis, 2018). Death rates due to T2DM amongst African Americans in this city are 45% compared to Caucasians at 15% (Washington University in St. Louis, 2018). The average life expectancy of a child born in the neighborhood where the clinic is located is 18 years less than that of a child born just a few miles apart (Washington University in St. Louis, 2018).

To improve health and social disparities in this urban underserved area where critical social determinants of health negatively influence the community, a nurse-managed clinic was established in the 1990's to serve impoverished clients. For an annual fee of $35.00, clients who are uninsured can receive primary care services and specialty visits with providers in mental health, endocrinology, ophthalmology, women's health, podiatry, and dentistry.

The Diabetes Care Coordination program offered at the clinic was developed in June 2018 to provide support for the large number of clients with diabetes who are uninsured and experiencing barriers to healthcare. These services include regular access to providers and follow up care, diabetes education, support, and medication (Spencer, 2019). The nurse coordinator’s role is to provide support and management of the clients' diabetic care plan following the CDC's National Diabetes Education Program (NDEP) and ensure clients have the necessary resources to manage their chronic illness (CDC, 2016). In addition, clients receive assistance from clinic nurses and volunteers to apply for insulin from pharmaceutical companies' patient assistance programs. These programs are complex to navigate, requiring resources such as a computer, internet, and detailed provider information, all of which the client population is not equipped to manage independently. At the clinic, diabetes education is routinely provided to all clients during their appointments, including discussions of risk factors of the disease, healthy lifestyle modifications, and importance of consistently attending scheduled appointments.

Purpose of the Project

The purpose of this Quality Improvement project was to evaluate the Diabetes Care Coordination program at an urban underserved clinic in the Midwest from June

2018 to December 2019. In this retrospective chart review, the following standard clinical indicators for diabetes monitoring as recommended by the National Diabetes Education Program (NDEP) were collected from 24 medical charts: HgA1c, total cholesterol, LDL, BMI, blood pressure, primary care exams, dilated eye exams, annual foot and dental exams, annual urine microalbumin tests, and completed influenza and pneumococcal vaccinations. Additional data collected were client reported barriers to receiving care. Results of the program evaluation assisted in determining if there is an impact of the care coordination intervention on individual client's disease management, and if there are identifiable trends in client reported barriers.

The following question guided this project:

In uninsured adults, ages 18 and older enrolled in the DCC program, what trends were observed based on the following indicators and documented data? Indicators evaluated included HgA1c, BMI, total cholesterol, LDL, blood pressure, biannual primary care exams, annual dilated eye exam, foot exam, and dental exam, annual urine microalbumin check, and completed influenza and pneumonia vaccinations. Qualitative data were gathered regarding client reported barriers to care.

Review of the Literature

T2DM is a chronic disease, causing disability and premature death disproportionately affecting populations of lower socioeconomic status (Levengood et al., 2019; Terens et al., 2018). Correspondingly, there is limited evidence-based literature regarding T2DM care programs for uninsured lower socioeconomic populations in the U.S. and barriers to care (Ahn et al., 2018).

A comprehensive review of the current literature was conducted using the databases CINAHL, EBSCO, Google Scholar, and PubMed returning 225 scientific articles. Keywords used included diabetes type 2, community, uninsured, evaluating quality improvement projects, chronic disease management, and nurse interventions. Articles chosen focused on T2DM team-based care coordination programs with participants being 18 years and older. Exclusion criteria included studies published prior to 2015, articles not written in the English language, and studies that included participants under the age of 18 years old. A total of 12 peer-reviewed articles were included in the final review published between 2015 and 2020. Included were one systematic review, six experimental and quasi-experimental designs, one random effect meta-analysis, and two retrospective cohort studies.

There are racial and ethnic disparities in populations with T2DM including access to medical care, quality of care, and diabetes related complications (Terens et al., 2018). African Americans are disproportionately affected by T2DM with 16.8% African Americans diagnosed with diabetes compared to 10.0% diagnosed Caucasians (CDC, 2020). In addition, low socioeconomic status and residential deprivation often are associated with lower quality of care for clients with T2DM (Terens et al., 2018).

Diabetes care coordination programs can improve access to quality diabetes-related care for populations experiencing health disparities. Ahn et al. (2018), Hassabella et al. (2015), Robinson, Lang, and Clippinger (2019), and Solorio et al. (2015) conducted quasi-experimental studies involving communities living in low socio-economic situations with predominately uninsured populations. Results of these studies showed significant improvements in reduction of BMI, weight, blood pressure, and HgA1c. In

addition, these care coordination programs improved client T2DM education and increased recommended health screenings. Terens et al. (2018) used a different focus in review of 58 randomized trials, noting that key social determinants of health, including physical address, education, religion, insurance, and employment needed to be considered when determining the most effective interventions to reduce health disparities in diabetes care.

There is significant research suggesting that use of multi-disciplinary teams as an organizational intervention leads to effective management of chronic illnesses (Hernandez-Jimenez et al., 2019; Levengood et al., 2019; Terens et al., 2018). Team member composition is important to successful client outcomes, which incorporates the client, primary care provider, and other health care professionals to ensure clients receive appropriate tests, manage risk factors and provide education (Levengood et al., 2019). In a quality improvement assessment using the team-based approach, Hernandez-Jimenez et al. (2019) demonstrated similar results in managing clients' diabetes care using interventions including adherence to client-centered medical treatment plans, completion of recommended exams, and participation in diabetes education. Self-management, group sessions, and programs that monitored HgA1c, BMI, blood pressure, and cholesterol showed statistically significant improvements in these client indicators, particularly related to HgA1c when nurses and community health workers provided culturally appropriate care to clients (Terens et al., 2018). Both Hernandez-Jimenez et al. (2019) and Levengood et al. (2019) concluded this type of multidisciplinary team-based care not only resulted in clients becoming empowered to participate in their own care but also

demonstrated sustained improvements in disease management, quality of care, and client's quality of life.

Limitations of the literature review include limited number of non-randomized controlled trials, short time frames, and limitations to the samples including size, location, insurance status, and race/ethnic groups. Consensus from several research and QI studies suggested research over longer time frames (over 1 year), is indicated for diabetic care coordination programs (Hernandez-Jimenez, 2019; Solorio, 2015; Terens et al., 2018). Regardless, the literature was able to demonstrate that diabetic care coordination programs led by multidisciplinary teams statistically improved health outcomes in clients with T2DM who have financial, social, and environmental barriers.

The Plan Do Study Act (PDSA) framework was used to test change in this DCC program. The PDSA framework provides guidance in understanding the pathway of the project, when to review and how to apply guidelines to make changes in the project (Hickey & Brosnan, 2017).

Method

Design

This quality improvement project used a descriptive retrospective chart review for the time period June 1, 2018 (inception of the program) through December 31, 2019 (19 months). Data were collected on HgA1c, total cholesterol, LDL, BMI, blood pressure, primary care exams, dilated eye exams, annual foot and dental exams, annual urine microalbumin test, and completed influenza and pneumococcal vaccinations. Additional data collected were client reported barriers to care.

Setting

This project took place in an urban Midwest clinic for clients with no insurance located in an underserved predominately African-American neighborhood where the social, economic and environmental determinants negatively affect the health of community members. In the zip code where the clinic is located, 54% of the population are living below the federal poverty level, 24% are unemployed, and the median household income is $15,000 (Washington University in St. Louis, 2018). According to the United States Census Bureau (2018), 14.8% of the population under 65 years old do not have health insurance. African Americans in this area report that healthy foods are very difficult to buy due to the lack of nutritious foods available in the city (Washington University, 2018).

Sample

A sample of all medical records of clients who participated in the 2019 DCC program analysis (n=24) were included in the chart review. All clients were 18 years and older, with no insurance, and had the diagnosis of type 2 diabetes mellitus. Exclusions were clients who were not enrolled in the 2019 DCC program quality improvement evaluation and clients with active health insurance. Client data were coded with a unique alphanumeric identifier made up of the last two letters of the client's first name, and two digit month of birth. A master code list of identifiers and client names was stored on a password protected file on the clinic's computer system.

Approval Processes

Formal, written approval was obtained from executives at the clinic to access client data documented in medical records. Institutional Review Board (IRB) approval was obtained from the University of Missouri-St. Louis (UMSL) on December 29, 2019. Client data were de-identified to assure confidentiality. There were no known ethical concerns.

Data Collection and Analysis

The 24 clients in the first PDSA cycle of the DCC program evaluation were identified from the DCC electronical database. Data were collected via retrospective chart review. Demographic variables collected included age, gender, race/ethnicity, zip code, annual income, and months enrolled in the program. Client medical data collected included HgA1c, total cholesterol, LDL, urine microalbumin, BMI, blood pressure, biannual primary care exams, annual dilated eye exam, annual foot exam, and completed influenza and pneumonia vaccinations. In addition, data related to client reported barriers to care were recorded verbatim as written in the medical record.

Data were analyzed using Intellectus Statistics and Microsoft Excel using a repeated measures design over the 19- month period. To assess the effect of the DCC program over time, a paired *t* test was used to evaluate HgA1c, total cholesterol, LDL, BMI, and blood pressure. Repeated measures Ancova, Pearson, and Spearman were used to determine correlations. Aggregated data including influenza and pneumococcal vaccinations received, bi-annual evaluations by a primary care provider, annual ophthalmologic, foot, and dental exams, and annual urine microalbumin checks were

summarized and reported as percentages. Client reported barriers to care were displayed in a pareto chart (Appendix B).

This program evaluation is the second PDSA cycle of the DCC program. The first PDSA cycle occurred between June, 2018 to June, 2019, when the DCC program was developed and piloted to provide support to uninsured clients with T2DM experiencing barriers to care. Following the CDC's National Diabetic Education Program Action Plan, the nurse coordinator of the newly established DCC program provided support and management of the clients' diabetic care (CDC, 2016). At conclusion of the first PDSA cycle, it was recommended for the DCC program to be evaluated over a longer period of time.

The second PDSA cycle began when a team of key stakeholders was formed in September, 2019 and proposed to evaluate the DCC program and determine if changes were needed based on first cycle results. After IRB approval, chart review for this second cycle was completed. Results from data analysis were shared with the clinic to discuss effectiveness of the program and need for additional PDSA cycles.

Results

Of the 24 clients in the study, 67% were females (n=16) and 33% were males (n=8). Age of clients ranged from 29- to 79- years with a mean *(m)* of 52.58 years (sd=10.656). All clients were African American with no health insurance and the mean *(m)* annual income was $10,133 ($sd$=$9,750). Length of time clients were in the DCC program ranged from 4- to 19- months with a mean (m) 2.46 months (sd=4.64) (Appendix A). Of the 24 clients, 91.7%, (n=22) completed bi-annual PCP visits, 66.7%

(*n*=16) completed annual dilated eye exams, 37.5% (*n*=9) received annual foot exams, and 8.3% (*n*=2) received dental exams.

A two-tailed paired samples *t*-test was conducted to examine whether the mean difference of HgA1c pre- (at enrollment) and post- (end of program) was significantly different from zero. Results showed significance with mean HgA1c pre- being significantly higher than mean of HgA1c post- based on an alpha value of 0.05, $t(23)= 2.15$, $p=.042$. Additionally, a two-tailed paired samples *t*-test was done to evaluate the difference in mean of the BMI pre- and post. Results were not significant based on an alpha value of 0.05, $t(18) = -0.31$, $p=.759$.

Annual total cholesterol and LDL labs were evaluated in 95.8% (*n*=23) of clients and urine microalbumin labs evaluated in 83.3% (*n*=20). BMIs were evaluated yearly in 87.5% of the clients in the study (*n*=21). Mean pre-blood pressure for all clients was *m*=143/89 and mean post- was *m*=144/86. No client received a pneumococcal vaccination and one client received an annual influenza vaccination (*n*=0, *n*=1).

There were a total of 138 client reported barriers. All 24 clients communicated barriers with a mean *(m)* of 6.13 barriers reported per client (*sd*=5.37). Females reported barriers to care during visits, average 41% (*n*=76), while males reported barriers 38.1% (*n*=62). The most frequently reported barrier was 'unable to take medications' (*n*=49, 35%) (Appendix B). Of the category 'unable to take medications,' the most frequent reason given was 'out of medications' (*n*=32, 65%). The second and third most frequently reported barriers were 'pain' (*n*=20, 14.5%) and 'injury/illness' (*n*=20, 14.5%). A Spearman correlation analysis was conducted among number of barriers reported, age, months in program, HgA1c pre- and post- difference, and annual income. Correlations

were examined using Holm corrections to adjust for multiple comparisons based on an alpha value of 0.05. There were no significant correlations between any pairs of variables (Appendix C).

Discussion

This quality improvement project was the second PDSA cycle evaluating the Diabetes Care Coordination (DCC) program at an urban underserved clinic in the Midwest from June 2018 to December 2019. A two-tailed paired *t* test determined that being enrolled in the DCC program resulted in statistically significant improvements in HgA1c. There were not statistically significant differences found in two-tailed paired *t* tests evaluating BMI, total cholesterol, LDL, nor blood pressure. It was clinically significant that the majority of the clients met the recommended bi-annual PCP visits and annual dilated eye exams. A Spearman correlation analysis was conducted among number of barriers reported, age, months in program, HgA1c pre- and post- difference, and annual income resulting in no significant relationship related to reported barriers to care. However, it is clinically significant that all 24 clients reported barriers throughout the program with the most frequent barrier being 'unable to take medications.'

Small sample size (n=24) may limit results of this improvement project, namely statistical significance reported for BMI, total cholesterol, and LDL outcomes. There were instances of missing data in paper charts, i.e. heights of two clients, excluding their data from BMI analysis. Limited volunteer staff may have affected complete documentation, resulting in data being not reported. Not having vaccinations available at the clinic possibly affected the low number of vaccination adherence.

Recommendations for further study include studying a larger sample size for a longer period of time. The most prevalent finding that clients reported 'running out of medications' can guide future PDSA cycles to address this barrier. In order to improve BP, it is recommended to further evaluate prescribed blood pressure medications, adherence to taking medications, client reported stress, and diet. Increased monitoring of recommended annual exams, specifically podiatry and dental exams, is advised to ensure clients are completing the yearly CDC recommendations. In addition, it is recommended for a nutritionist to be added to the DCC team to provide effective and consistent dietary support to clients.

Conclusion

This Diabetes Care Coordination program demonstrated positive results from time of inception (cycle 1) to this present cycle (cycle 2). The DCC significantly reduced HgA1c, improved adherence to recommended bi-annual PCP visits, annual dilated eye exams, and annual total cholesterol, LDL, and urine microalbumin checks. One strength of this two-cycle project is long-term tracking and evaluation of this high risk cohort can direct the DCC team to offer customized client care and important feedback to the clinic on services provided. The implementation of nurse-led care coordination programs for high risk, uninsured and underserved populations is recommended as care coordination programs can lead to significant impacts on health outcomes and improve quality of life.

References

Ahn, S., Lee, J., Bartlett-Prescott, J., Carson, L., Post, L., & Ward, K. D. (2018). Evaluation of a behavioral intervention with multiple components among low-income and uninsured adults with obesity and diabetes. *American Journal of Health Promotion, 32*(2), 409-422. doi: 0.1177/0890117117696250

Centers for Disease Control and Prevention (CDC). (2020). *National diabetes statistics report 2020: Estimates of diabetes and its burden in the United States.* Retrieved from https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf

Centers for Disease Control and Prevention. (2016). *Tips to help you stay healthy with diabetes.* Retrieved from https://www.cdc.gov/diabetes/ndep/pdfs/tips-to-help-you-stay-healthy.pdf

Hassaballa, I., Ebekozien, O., Ogungbadero, A., Williams, F., Schultz, J., Hunter-Skidmore, J., . . . Watson-Thompson, J. (2015). Evaluation of a diabetes care coordination program for African-American women living in public housing. *Journal of Clinical Outcomes Management, 22*(8), 365-372. Retrieved from https://pdfs.semanticscholar.org/7817/129f24e0f0e4b4a6905b7675 4c372d 58db80.pdf

Hernández-Jiménez, S., García-Ulloa, A. C., Bello-Chavolla, O. Y., Aguilar-Salinas, C. A., Kershenobich-Stalnikowitz, D., & Group of Study CAIPaDi. (2019). Long-term effectiveness of a type 2 diabetes comprehensive care program. The CAIPaDi model. *Diabetes Research and Clinical Practice*, 151, 128-137. doi: 10.1016/j.diabres.2019.04.009

Hickey, J. V., & Brosnan, C. A. (2012). *Evaluation of health care quality in advanced practice nursing*. New York, NY: Springer Publishing Company.

Levengood, T. W., Peng, Y., Xiong, K. Z., Song, Z., Elder, R., Ali, M. K., . . . Becenti, A. (2019). Team-based care to improve diabetes management: A community guide meta-analysis. *American Journal of Preventive Medicine, 57*(1), e17-e26. doi: 10.1016/j.amepre.2019.02.005

Office of Disease Prevention and Health Promotion. (2019). *Healthy Diabetes*. Retrieved from https://www.healthypeople.gov/2020/topics-objectives/topic/diabetes

Robinson, J., Lang, B., & Clippinger, D. (2019). Impact of the alphabet strategy on improving diabetes care at a free health clinic. *Journal of Community Health Nursing*, *36*(4), 157-164.

Solorio, R., Bansal, A., Comstock, B., Ulatowski, K., & Barker, S. (2015). Impact of a chronic care coordinator intervention on diabetes quality of care in a community health center. *Health Services Research, 50*(3), 730-749. doi: 10.1111/1475-6773.12253

Spencer, Emma. (2019). *Management and support of uninsured patients with diabetes type II within a nurse managed clinic.* Unpublished doctoral capstone project, University of Missouri-St. Louis. Retrieved from https://irl.umsl.edu/dissertation/858/

Terens, N., Vecchi, S., Bargagli, A. M., Agabiti, N., Mitrova, Z., Amato, L., & Davoli, M. (2018). Quality improvement strategies at primary care level to reduce inequalities in diabetes care: An equity-oriented systematic review. *BMC Endocrine Disorders, 18*(1), 31-31. doi: 10.1186/s12902-018-0260-4

United States Census Bureau. (2018). *Quick facts. St. Louis City, Missouri*. Retrieved September 23, 2019 from https://www.census.gov/quickfacts/fact/table/stlouiscitymissouri,U S/PST045218

Washington University in St. Louis. (2018). *Segregation in St. Louis: Dismantling the divide.* Retrieved from https://cpb-us-w2.wpmucdn.com/sites.wustl.edu/dist/3/1454/files/2018/06/Segregation-in-St.-Louis-Dismantling-the-Divide-22ih4vw.pdf

Appendix A

Table 1

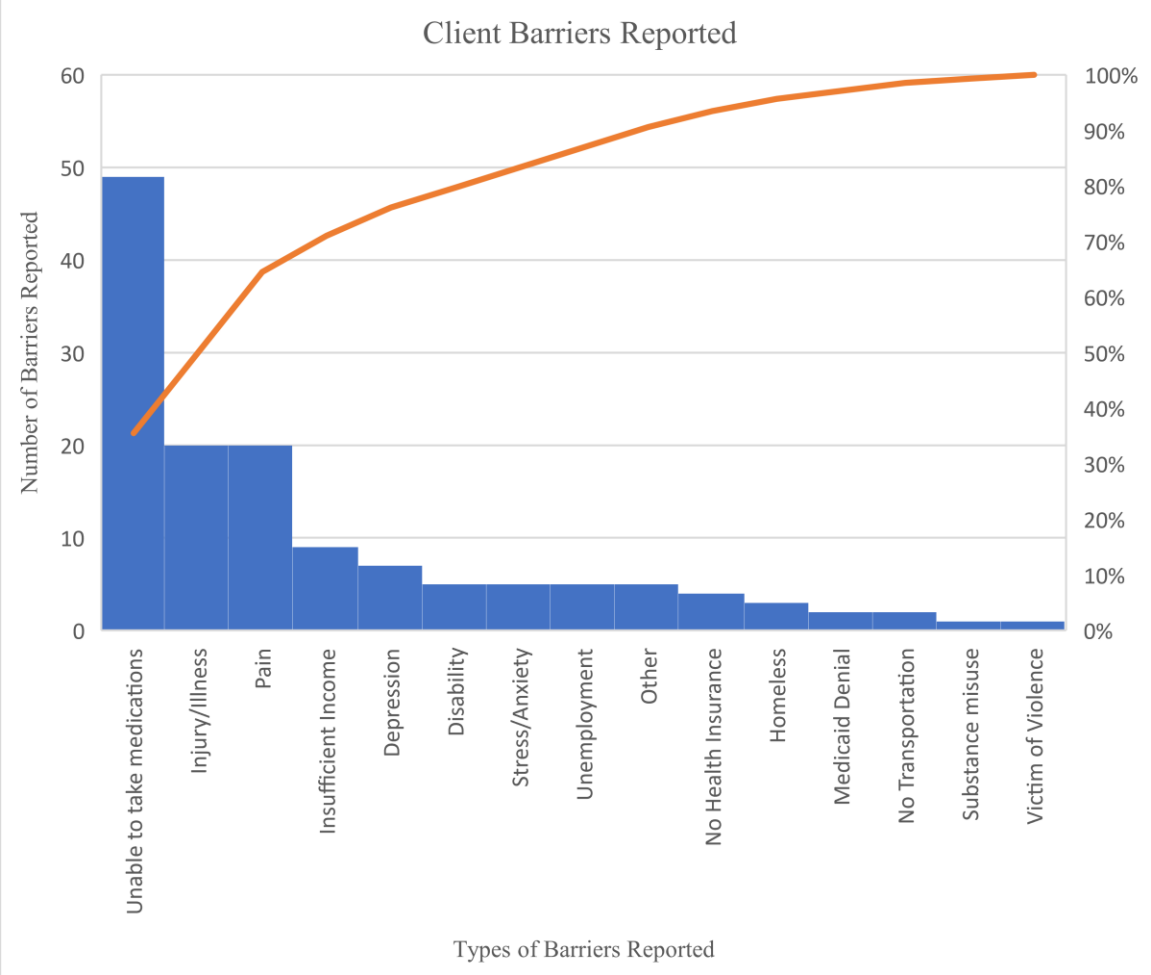
Demographic Characteristics of Clients

Variable		n	%	Mean	SD	min	max
Age		24	100	52.58	10.656	29	79
Gender	Male	8	33.3				
	Female	16	66.6				
Race	African American	24	100				
Annual Income		23	95.8	10,132	9749.83	0	30,000
Months in Program		24	100	13.21	4.64	4	19

Appendix B

Figure 1

Pareto Chart of Client Reported Barriers from June, 2018 to December, 2019



Appendix C

Table 2

Spearman Correlation Results Among Number of barriers reported, Client age, Months enrolled in program, Client HgA1c pre-post difference, and Client annual income

Combination Correlated	r_s	Lower	Upper	*p*
Number of barriers reported-Age	-0.02	-0.43	0.39	.917
Number of barriers reported-Months in program	0.41	-0.00	0.70	.052
Number of barriers reported-HgA1C difference	0.04	-0.38	0.44	.861
Number of barriers reported-Annual income	-0.37	-0.68	0.05	.086
Age-Months in program	0.10	-0.32	0.50	.636
Age-HgA1C difference	0.08	-0.35	0.47	.726
Age-Annual income	0.04	-0.38	0.45	.845
Months in program-HgA1C difference	0.14	-0.29	0.52	.527
Months in program-Annual income	-0.04	-0.44	0.38	.864
HgA1C difference-Annual income	-0.17	-0.54	0.26	.441

Note. Confidence intervals$\alpha = 0.05$; $n = 23$; Holm corrections adjusted *p*-values.