ORIGINAL PAPER

Diabetes Control in a Student-Run Free Clinic During the COVID-19 Pandemic

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Abstract

Student run free health clinics (SRFCs) provide medical care to vulnerable populations in communities throughout the United States. The COVID-19 pandemic had a significant impact on the delivery of healthcare services and demanded a rapid adjustment in care delivery methods in both resource-rich and resource-poor settings. The aim of this study is to evaluate the impact of the pandemic on the management of chronic disease, specifically diabetes. Patients with diabetes who received care continuously throughout the pre-pandemic (face-to-face) and pandemic (telehealth) study periods at MedZou Community Health Center, a SRFC located in central Missouri, were evaluated. This sample of patients (n = 29) was evaluated on six quality measures including annual eye exams, blood pressure, hemoglobin A1c, chronic kidney disease monitoring, flu vaccination, and statin therapy. Overall diabetes care, as measured by the number of quality measures met per patient, decreased by 0.37 after the onset of the pandemic. The median COVID-era ranks were not statistically significantly different than the pre-pandemic ranks (z = 1.65, P = 0.099). Fewer patients received an influenza vaccination the year following the onset of the pandemic (10.3%) compared to the year before the pandemic (37.9%; difference in proportions 0.276, 95% CI 0.079, 0.473; p = 0.005). No other individual measures of diabetes care statistically differed significantly in the year after the pandemic began. Twenty-six (90%) patients received diabetes care using telehealth after the onset of the pandemic. Diabetes care using telehealth in a SRFC may be an acceptable alternative model when face-to-face visits are not feasible. Observed decreases in diabetes-related clinical quality measure performance warrant further study.

Keywords Diabetes management · Student Run Free Clinic (SFRC) · COVID-19 · HbA1c

Introduction

Student-run free clinics (SRFCs) are a form of healthcare delivery driven by medical students which provide free clinical services to uninsured patients. [1] According to the most recent estimate, more than 75% of all allopathic medical schools in the United States have an associated SRFC. [2] In total, there are more than 1,400 free clinics, including those unaffiliated with university systems, in the U.S. These clinics fill a gap in healthcare access which plagues communities across the country, exacerbated by limited access

to federally qualified health systems (FQHCs) and lack of Medicaid expansion in some states. [3] SRFCs provide care to millions of Americans, most of whom are primarily seeking chronic disease management and affordable medications. [4]

An estimated 37.3 million individuals in the U.S. have been diagnosed with diabetes, and several million more are at considerable risk of developing the disease. [5] Diabetes is linked to a 1.8-fold increase in all-cause mortality and surpasses all other diagnoses as the leading cause of renal failure, lower limb amputations, and adult-onset blindness. [6] Along with its many health implications, diabetes also confers a hefty financial burden. In 2016, diabetes accounted for 17.2% of total costs associated with chronic disease management, second only to cardiovascular conditions. [7]

Effective management of diabetes is essential in preventing long-term complications of the disease and in lowering the risk for adverse outcomes from other, concurrent

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illnesses. Nothing in recent years has highlighted this quite like the coronavirus disease 2019 (COVID-19) pandemic. Diabetic patients are at increased risk of severe infection with coronavirus when compared to their non-diabetic counterparts. [8] The pandemic not only increased the risk of adverse health outcomes for these patients via direct infection but also impacted chronic disease management. [9, 10] Some studies have demonstrated that patients living with diabetes during the COVID-19 pandemic had higher fasting blood glucose levels on average as compared with pre-pandemic levels. [11, 12] Hypothesized explanations for this finding include limited physical activity due to social distancing requirements, restrictions on food supply, difficulty in obtaining necessary medications and testing supplies, and difficulty accessing physicians for routine care appointments. [13] Furthermore, exacerbation of mental disorders and, as a result, worsening glycemic control, was also noted during this time in a population that already caries a higher risk for the development of depression and anxiety. [14–17] However, other studies have demonstrated glycemic control after the lockdown equivalent to before the pandemic. [18–20] The cause for conflicting evidence is unclear but may be related to differences in patient populations studied and downstream socioeconomic effects during a national pandemic. Most authors agree that changes in chronic care management may have resulted in an even greater impact on diabetes outcomes than infection with the coronavirus itself. [9, 21]

MedZou Community Health Clinic is a SRFC associated with the University of Missouri School of Medicine.

Table 1 Diabetes-related clinical quality measures

Quality Measures	Defined measure
Eye Exam	Patient received eye exam during time period
CKD Monitoring	Patient received CKD monitoring during time period (includes any of the following: urine microalbumin, urine microalbumin/creatinine ratio, 24-hour urine total protein, urine protein/creatinine ratio)
A1C < 9%	HbA1c was measured during time period and was < 9 in most recent measure
Blood Pressure < 140/90 mmHg	Blood Pressure < 140/90 in most recent clinic or home blood pressure recording
Influenza Vaccination	Patient received influenza vaccination during time period
Statin Therapy	Patient was prescribed a statin cholesterol lowering agent during time period if meeting any of the following indications: (1) Adults aged ≥ 21 years with diagnosis of clinical atherosclerotic cardiovascular disease (ASCVD), or (2) Adults aged ≥ 21 years who have ever had a fasting or direct low-density lipoprotein cholesterol (LDL-C) level ≥ 190 mg/dL, or (3) Adults aged 40–75 years with a diagnosis of diabetes with a fasting or direct LDL-C level of 70–189 mg/dL

MedZou serves uninsured patients in mid-Missouri free of charge. At the onset of the pandemic in March 2020, the Association of American Medical Colleges (AAMC) issued a joint statement pausing all direct medical student involvement in patient care. [22] As a result, many SRFCs closed entirely. [23–25] In contrast, MedZou shifted to telehealth as the sole method for patient visits until April 1, 2021. The demographic impact of this change in care delivery as a result of the pandemic has been documented for MedZou. [26] However, given the rapid implementation of telehealth, vulnerable patient population, and volatility at the time of pandemic onset, it is of interest to determine the impact of the pandemic on the care for chronic conditions in a SRFC, including diabetes. Chronic disease management can be difficult for providers and patients in resource-rich settings, and health systems including SRFCs such as ours face even greater difficulties in effectively managing these conditions. This study sought to evaluate if and how the management of diabetes changed by assessing predetermined clinical quality care measures in our patient population before and after the onset of the pandemic. We sought to determine if unanticipated shifts in care delivery associated with the COVID-19 pandemic altered outcomes for diabetic patients.

Methods

A retrospective analysis was performed using data from a single-center, SRFC in the USA (University of Missouri Health System, MedZou Community Health Clinic). MedZou visits were first recorded in the University of Missouri Health System EHR on 3/17/2018. Patients were candidates for inclusion in the study if seen as patients at MedZou between 3/17/2018 and 10/31/2021 with a diagnosis of diabetes and a recorded hemoglobin A1c at any time. The study cohort was defined as the subset of patients receiving care at MedZou during the one-year pre-pandemic period (March 17, 2019 – March 16, 2020) and with both (1) evidence for ongoing residence in the region based on other encounters (such as emergency room visits) within the healthcare system and (2) no evidence for transfer of care outside of the MedZou system through the end of the one-year post-pandemic study period which concluded on March 1, 2021. The MedZou population is highly transient. These definitions were chosen to best capture those patients who remained in the MedZou service area throughout the entire pre- and post-pandemic study periods without accessing other sources of primary care for their diabetes. Through manual chart review of the MU Health Care electronic health record (EHR), health information regarding patient diabetes management was obtained from March 17, 2019 through March 16, 2021.

To determine the adequacy of diabetes management during each time period, six quality measures used in the assessment of care of diabetic patients were utilized. [27–29] The quality measures chosen for this study included annual eye exam, chronic kidney disease monitoring, HbA1c value, blood pressure control, influenza vaccination, and prescribed statin therapy. Quality measure definitions used are shown in Table 1. For direct comparison of patient care, matched data for each patient was collected during the one-year pre-pandemic period, during which all visits were face-to-face, and during the first one-year period of the COVID-19 pandemic, during which all visits were conducted using telehealth.

The primary outcome was the total count of all quality measures satisfied. The primary outcome was analyzed using the Wilcoxon signed-rank test, with patients serving as their own controls, comparing the matched pairs of clinical quality measures met in the one-year pre-pandemic study period to the year after the onset of the pandemic. Secondary outcomes included the performance of individual quality measures, assessed using McNemar's test for binary matched pairs. Statistical analysis was performed via the Stata/IC v16.0 (College Station, TX) software, with a p-value of 0.05 determined to be statistically significant. This study was reviewed and approved as exempt by the University of Missouri Institutional Review Board (IRB). The requirement to obtain informed consent was waived.

Results

Fifty-two clinic patients were candidates for the study and 29 with type II diabetes met the inclusion criteria and were included in the study cohort. Socio-demographic data describing the included patient population is provided in Table 2. The mean age of participants was 53.0 years old. The majority of patients were ≥45 years old (86.2%), were male (55.2%), were White (62.1%), identified as non-Hispanic (89.7%), and lived in an urban setting (72.4%). All 29 patients had face-to-face visits in the pre-pandemic period. Twenty-six patients in the cohort had telehealth visits after the onset of the pandemic. Three patients remained in the cohort given evidence of ongoing residence in the service area and no evidence of transfer of care elsewhere, yet they did not record a telehealth encounter in the one year after the onset of the pandemic.

On average, patients met 2.40 of the 6 quality measures during the year prior to the onset of the COVID-19 pandemic and met 2.03 of the 6 quality measures during the year after pandemic onset. There was an average change of -0.37 quality measures met per SRFC patient. The median

Table 2 Socio-demographic characteristics of 29 patients included in this study

Demographic		N (%)
Age	<45	4 (13.8)
	≥45	25 (86.2)
Sex	Female	13 (44.8)
	Male	16 (55.2)
Race	Black or AA	8 (27.6)
	White	18 (62.1)
	Other	3 (10.3)
Ethnicity	Hispanic	1 (3.4)
	Non-Hispanic	26 (89.7)
	Other	2 (6.9)
Residence	Urban	21 (72.4)
	Rural	8 (27.6)
AA = African American		

COVID-era ranks were not significantly different than the pre-pandemic ranks ($z = 1.65$, $P = 0.099$, Table 3).

Regarding individual quality measures, we did not detect statistically significant differences for the following quality measures: annual eye exam, annual kidney disease monitoring, an HbA1c < 9%, recorded blood pressure measuring < 140/90 mmHg, and the prescription of statin therapy (Table 3). Among patients with at least one HbA1c measured during both study periods, there was an increase in the HbA1c of 0.59%. The number of patients meeting the HbA1c quality metric declined from 16 (55.2%) to 12 (41.4%) (difference in proportions − 0.138, 95% CI -0.359, 0.152; p = 0.103). The pandemic was associated with a decrease in administration of the annual influenza vaccination; the percentage of patients receiving a flu vaccine dropped from 37.9 to 10.3% in the year after pandemic onset (difference in proportions 0.276, 95% CI 0.079, 0.473; p = 0.005).

Table 3 Type II diabetes quality measures met during the year before and after the onset of the COVID-19 pandemic (N = 29). HbA1c: hemoglobin A1c; BP: blood pressure

Quality Measures	Pre-pandemic N (%)	Pandemic N (%)	Difference in proportions (95% CI)	p-value
Total Combined	72 (41.4)	61 (35.1)		0.099
Annual Eye Exam	9 (31.0)	8 (27.6)	0.034 (-0.202, 0.271)	0.739
Annual Kidney Disease Monitoring	7 (24.1)	6 (20.7)	0.034 (-0.151, 0.220)	0.655
HbA1c < 9.0%	16 (55.2)	12 (41.4)	0.138 (-0.054, 0.330)	0.103
BP < 140/90 mmHg	8 (27.6)	11 (37.9)	-0.103 (-0.359, 0.152)	0.366
Annual Influenza Vaccine	11 (37.9)	3 (10.3)	0.276 (0.079, 0.473)	**0.005**
Statin Therapy	21 (72.4)	21 (72.4)	0 (-0.215, 0.215)	1.000

Discussion

Our study is one of the first to examine the effect of the COVID-19 pandemic on the management of diabetes mellitus in patients at a SRFC. We failed to detect a statistically significant difference between the total number of quality measures met for each patient before and after the start of the pandemic. A number of other studies of broader populations have compared diabetes care before and after the onset of the COVID-19 pandemic and found no significant differences in glycemic control or other measures of diabetes care. [18–20] However, the smaller number of patients in our cohort may mean that our study lacked the statistical power to detect a significant change in both the composite primary outcome of numbers of quality measures met and in the secondary outcomes of individual clinical quality measures. We observed numerical decreases in some of the outcomes, which while not statistically significant may be clinically significant. The average number of quality measures met per SRFC patient decreased by 0.37. Perhaps the most important individual metric, certainly the most commonly reported, is HbA1c control. Among patients with a recorded HbA1c in both study periods, there was an average worsening in the HbA1c of 0.59%. This change is higher than many other studies of glycemic control with the COVID-19 pandemic and may reflect the unique challenges in caring for SRFC populations. [18–20, 30, 31] An increase of 0.59 in the HbA1c is potentially clinically significant given that for every 1% increase in HbA1c, the risk of cardiovascular events or death increases by around 25%. [32] Larger, adequately powered studies might better address the differences in diabetes care among populations of SRFC patients, but this will likely require multicenter studies, as cohorts of patients at single SRFCs are likely to have the same sample size problems encountered in this study.

Drops in performance on diabetes-related clinical quality measures during the pandemic must be framed in the context of the SRFC and the special population of patients they serve. The COVID-19 pandemic had a tremendous impact on access to and utilization of healthcare services in the United States and worldwide, and adverse health outcomes that resulted from the pandemic and its' downstream effects were multiplied in the uninsured population. [33–35] Many SRFCs were forced to close temporarily as a result of nationwide efforts to maintain social distancing guidelines. [23–25] The use of telehealth expanded dramatically at the onset of the pandemic, but in most care settings, patients generally still had options for face-to-face visits. In contrast, patients receiving care at many SRFCs did not have options for face-to-face visits during the pandemic; the alternative to telehealth care may have been no care at all. Med-Zou Community Health Clinic was able to transition from solely in-person visits to solely telehealth visits quickly and effectively to avoid shutdown and continue providing care to the uninsured population served. Twenty-six of the 29 patients in our diabetes cohort (90%) received diabetes care using telehealth during the first year after the onset of the pandemic. We have attempted to characterize the value of chronic disease care via telehealth at SRFCs in this report; that value may be further characterized by future work comparing SRFC populations with telehealth access to those whose SRFC access was ended entirely.

More diabetic patients receiving care through MedZou Community Health Clinic received an influenza vaccination during the year prior to the onset of the COVID-19 pandemic than during the following year. Interestingly, influenza vaccination was the sole outcome measured that is not specific to the diabetic population. In nearly all children and adults, yearly influenza vaccinations are essential in preventing the acquisition and spread of disease and have been shown to limit disease severity. This finding within the MedZou diabetic population is consistent with growing data suggesting a decrease in routine vaccination during the pandemic. [36] Low vaccine uptake during the pandemic has resulted in the resurgence of vaccine-preventable infections. [37, 38] Overall vaccine hesitancy has increased alongside and secondary to COVID-19 vaccine hesitancy. [39–41] In diabetic patients, who are high-risk patients with regards to influenza and other infections, the flu vaccine is an important component of disease prevention. [42] The significant decline in flu vaccine administration at our student-run free clinic during the year following the onset of the pandemic may be, in part, due to the transition from solely in-person visits to solely telehealth visits. While the shift in visit type allowed MedZou to continue providing care in a safe, socially distanced manner, it also made routine vaccinations less accessible to patients and created more barriers for those who would have otherwise been vaccinated. Widespread administration of influenza vaccinations should remain a priority, even and especially during global health crises.

Overall performance on the clinical quality measures assessed in this study were low in our SRFC. When compared with the Merit-based Incentive Payment System (MIPS) quality benchmarks, fewer patients receiving care through MedZou received an eye exam before and after the onset of the pandemic than the national average (89.7%). [43] Fewer MedZou patients were screened for diabetic nephropathy during either time period than the national average (84.4%), as well. MedZou patients had an HbA1c value greater than 9.0% more often than the national average (37.3%), according to the MIPS benchmark data. Further work could and should be done to shed light on these gaps in care and to implement changes that will improve the

number of quality care measures that are assessed in each diabetic patient.

This study has several limitations. Most importantly, the small sample size may result in lack of the power needed to detect not only clinical but statistical differences in quality measures before and after the onset of the pandemic. A larger sample might better detect existing differences in primary and secondary outcomes. Further, data was not collected from outside health systems, and it is possible that quality measures were met outside of MU Health Care and not included in the study. The MedZou population is highly transient. Inclusion criteria used in our study were carefully selected with the aim of including all of the patients who remained in the region and for whom there was no evidence for transfer of care outside the MedZou system throughout the study period. Nevertheless, these inclusion criteria may have introduced selection bias. If MedZou was the only source of care for some patients after the onset of the pandemic, and they did not receive care in the post-onset period, and thus were excluded from the study, our results would underestimate the effect of the COVID-19 pandemic on the care of diabetes in the MedZou SRFC population.

The results of this study have implications for the future management of chronic conditions such as diabetes mellitus at safety-net health systems. Perhaps most importantly, it suggests that when face-to-face visits are not feasible, telehealth care for chronic conditions like diabetes may be provided at some potential cost in the quality of care as measured by common clinical quality measures. This study also highlights the challenges faced in administering routine vaccinations to vulnerable populations amidst a public health crisis. Furthermore, this study highlights gaps in the care in the SRFC population. While our SRFC was able to continue providing care to a vulnerable population during the COVID-19 pandemic, diabetic patients both before and after the onset of the pandemic did not receive diabetic care across a number of measures equivalent with national averages. Future work should be done to analyze the underlying factors that led to fewer measurable outcomes in this patient population and to address changes that could result in increased screening and improved overall care of diabetic patients receiving care through safety-net health systems.

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