12-17-2022

Improving glycemic control during the COVID-19 pandemic: A quality improvement project

Megan Henderson
James Madison University

Improving Glycemic Control During the COVID-19 Pandemic: A Quality Improvement Project

Megan L. Henderson, MSN, FNP-C

A clinical research project submitted to the Graduate Faculty of

JAMES MADISON UNIVERSITY

In

Partial Fulfillment of the Requirements

for the degree of

Doctor of Nursing Practice

School of Nursing

December 2022

FACULTY COMMITTEE:

Committee Chair: Holly Buchanan, DNP, MS, ANP-BC

Committee Members/Readers: Deidra Pennington, DNP, RN

Dedication

I dedicate this project to my husband, Brandon. Thank you for always supporting me and encouraging me to follow all my dreams. Thank you to my Mom and Dad. Thank you for instilling a love of learning, the want to always better myself, and always telling me you are proud of me.

Acknowledgments

I would like to thank Dr. Holly Buchanan, project chair. Thank you so much for all the time spent teaching me and walking through each step of this journey with me. To Dr. Pennington, our journey together has been long, but the time has been so sweet. Thank you for inspiring me to become a cardiac nurse. Thank you for instilling in me the value of lifelong learning, being a team player, and always seeking to better myself. To the other faculty I have had the honor of learning under, thank you. To my nurse, Kathy-- you inspire me daily to be a better nurse and a better person. To my family at the office, thank you for always being so supportive.

Table of Contents

List of Tables

Abstract

Diabetes is a costly, chronic health condition. The COVID-19 pandemic has significantly impacted the delivery of health care and exacerbated chronic health conditions, such as diabetes. Diabetes is one of the most significant comorbid conditions associated with poor COVID-19 outcomes (Cariou et al., 2020). Control of blood glucose levels during the COVID-19 pandemic has proved challenging to maintain. The purpose of this quality improvement project is to identify gaps in diabetic self-care and then implement a diabetic toolkit to improve self-efficacy of diabetes self-management. According to the American Diabetes Association (2022), self-management of diabetes, education, and support from providers is crucial to prevent both acute and long-term complications. Close monitoring of blood glucose levels with improved glycemic control can help to decrease the risk of complications associated with COVID-19 and progressive diabetes.

Keywords: type two diabetes, COVID-19, diabetic self-management, diabetic toolkit

Introduction

Diabetes is a costly, chronic health condition affecting a significant percentage of the United States population. According to the Centers for Disease Control (CDC) (2020), one in ten Americans has diabetes while one in three Americans has prediabetes, or impaired fasting glucose (IFG). The number of adults diagnosed with prediabetes nearly doubled between 2005 and 2016; yet, despite this increase in disease prevalence, most Americans remain unaware of the diagnosis (American Diabetes Association [ADA], 2018).

In Virginia, diabetes is occurring similarly to the national average. According to the ADA (2022), more than 10% of adults in Virginia have diabetes. More than 33% of the adult population have elevated blood glucose levels consistent with IFG or prediabetes. It is estimated that each year nearly 51,000 people will be diagnosed with diabetes (ADA, 2022).

Diabetes rates continue to rise in Smyth County, Virginia. In 2019, 3000 residents were diagnosed with diabetes (CDC, 2021). This trend echoes state and national averages. According to the National Kidney Foundation (2022), if current trends continue, it is estimated that one in three adults in the United States will develop diabetes.

Problem Description

Diabetes is a chronic disease characterized by hyperglycemia due to insufficient insulin secretion, poor insulin action, or a combination of both (ADA, 2022). long-term complications, with or without the diagnosis of diabetes. Diabetes damages nearly every organ system including the eyes, heart, kidneys, nerves, and skin. Diabetes is also costly to treat. According to the ADA (2018), the United States spends an estimated $237 billion in direct medical costs and $90 billion in reduced productivity. Individuals spend just under $10,000 annually on diabetic care. Care of the diabetic patient accounts for one in four health care dollars spent. It is estimated that a large portion of medical costs associated with diabetes is spent on care of comorbid conditions (ADA, 2018).

COVID-19 is a new respiratory illness that originated in Wuhan, China, in December 2019. It has now been declared a pandemic by the World Health Organization (Kumar et al., 2020). COVID-19 is a respiratory virus causing upper respiratory infections. SARS-CoV2, or COVID-19, symptoms can vary dramatically from asymptomatic to respiratory distress or even death (Muniyappa & Gubbi, 2020). The case fatality rate for COVID-19 is thought to be less than five percent; however, between 15 to 18 percent may become severely symptomatic (Kumar et al., 2020).

There is an overlap between COVID-19 and diabetes. Nachimuthu (2020) states that the COVID-19 burden, social distancing guidelines, lockdown protocols, and anxiety related to COVID-19 and its disease processes increase susceptibility to COVID-19 infection and poor glycemic control.

Available Knowledge

Literature Search Methods

A literature search was conducted regarding type-two diabetic patients to better understand the relationship between COVID-19 and diabetes. Information was gathered utilizing the PubMed database. An initial search of PubMed using the search terms "COVID-19" and "diabetes" yielded greater than 7,700 articles between the years 2000 and 2020. Additional searches were completed using the terms "COVID-19" and "type two diabetes". This decreased search results to 270 articles. The years available for this search were between 2020 and 2021. Articles selected were those written in English, peer reviewed, and having a patient population of type two diabetes. Selected articles once reviewed were organized into the evidence table according to the matrix method (Garrard, 2017).

Literature Review Findings

Diabetes and Compliance

In 1979, Powell et al. conducted a study to ascertain compliance following a diabetic education program. The researchers compared two groups of type two diabetic patients in relation to education and medication compliance. Group one was considered the “control” group that was studied with no additional education other than basic diabetic education. Group two was educated with printed and audiovisual materials. After one month, compliance was assessed. Group one showed no notable change. Group two was found to have a significant increase in both general disease knowledge and compliance.

Nachimuthu et al. (2020) interviewed patients to assess compliance with their diabetic regimen and identify the impact of the COVID-19 lockdown in India. Ninety-two percent of respondents in this study had type two diabetes. The study also considered medication modalities, glucose monitoring, and compliance. Nearly half of the participants were only using oral medications. Forty-three percent of participants used a combination of oral and insulin modalities, while eight percent only used insulin. Of the eight percent solely on insulin therapy, 87 percent monitored their blood glucose at least once daily. Eighty percent of respondents also noted continued compliance with diet and exercise. Forty percent of respondents cited anxiety related to the COVID-19 pandemic.

During the COVID-19 pandemic lockdown in Saudi Arabia, researchers discovered that medication compliance and lifestyle habits were significantly reduced. Alshareef et al. (2020) discovered that the longer lockdown was implemented, the worse compliance was. The opposite was found to be true in type one diabetics in Italy. Per Bonora et al. (2020), glycemic control was improved during the COVID-19 pandemic due to decreased work, stress reduction, and greater compliance with healthy lifestyle habits.

Comorbid Conditions

Prior to the COVID-19 pandemic, diabetes was the leading cause of kidney failure, lower-limb amputations, and blindness in the United States (Virginia Department of Health, 2018). According to the National Kidney Foundation (2022), diabetes is the leading cause of kidney failure accounting for 44 percent of new cases in the United States. In the United States, diabetic patients are twice as likely to die from cardiovascular disease and cerebrovascular disease at a younger age than their non-diabetic counterparts (Virginia Department of Health, 2018).

Across the globe, researchers participating in the CORONADO study (Cariou et al., 2020) worked to identify the impact of comorbid conditions. In their research, they discovered patients with macro- and microvascular complications and other comorbid conditions like sleep apnea, age, congestive heart failure, and hypertension may have poorer clinical outcomes associated with COVID-19 infections. Hussain et al. (2020) found that Chinese patients with cardiovascular disease, including hypertension, cerebrovascular disease, and diabetes, had a two-fold increased risk for severe COVID-

19 infection. Patients with diabetes and hypertension alone were twice as likely to require admission to the intensive care unit or invasive ventilation (Hussain et al., 2020).

COVID-19 Severity

Patients with new onset hyperglycemia have been observed in patients admitted with COVID-19 with no history of diabetes, poor glycemic control, or recent use of corticosteroids. Kumar et al. (2020) noted the prevalence of diabetes in COVID-19 patients at around ten percent. According to Hussain et al. (2020), diabetes and uncontrolled hyperglycemia have been reported as significant predictors of COVID-19 severity and death. This is important because mortality associated with COVID-19 significantly increased during this phenomenon (Singh & Singh, 2020).

Initially, the CORONADO Study (2020) found data published from China that stated patients with diabetes had more severe COVID-19 infections than their non-diabetic counterparts. These findings were validated after being replicated in the United States (Feldman et al., 2020). Within the United States, patients with diabetes in New York City were more likely to require admission to the intensive care unit and require invasive ventilation. Similar research was gathered in Detroit, Michigan revealing higher rates of hospitalizations and lower discharge rates in patients admitted to the intensive care units.

In an update to the CORONADO Study (Cariou et al., 2020), 31 percent of COVID-19 positive patients in France were diabetic and admitted to the intensive care unit. Furthermore, greater than 20 percent of those patients required invasive mechanical ventilation. Unfortunately, approximately ten percent of those patients died by day seven.

Patients with diabetes are twice as likely to develop acute respiratory distress syndrome, require admittance to the intensive care unit, and need invasive mechanical ventilation. Kumar et al. (2020) discovered that diabetic patients are twice as likely to develop severe COVID-19 infections, twice as likely to die from these infections, more likely to develop ARDS, require intensive care monitoring and treatment, and require invasive mechanical ventilation. These patients are at higher risk of succumbing to their infections. Aggarwal et al. (2020) replicated this data and verified that patients with diabetes could have a significantly worsened clinical course of COVID-19. Their pooled analysis shows a two-fold increase in the risk of severe COVID-19 infection and a two-fold increase in mortality risk.

Independent from other comorbidities, diabetes has been shown to increase the risk of severe pneumonia, an uncontrolled inflammatory response, high levels of tissue injury, and a hypercoagulable state (Kumar et al., 2020). It is thought that the severity of COVID-19 infection is due to "a pro-inflammatory milieu" (Aggarwal et al., 2020). To make a comparison, type two diabetic mice were exposed to MERS-CoV (Middle East Respiratory Syndrome Coronavirus). It was discovered that the diabetic mice also had a prolonged period of severe disease, delayed recovery, prolonged systemic inflammation, and an overall dysregulated immune system.

Mortality

Kumar et al. (2020) revealed diabetes was found to be "significantly associated with mortality risks of COVID-19". Furthermore, when combined, the development of severe COVID-19 infection and death was still "statistically significantly high" after adjustment for bias and avoidance of duplication (2.49, 95% CI: 1.98-3.14; $p<0.01$). Per

Kumar et al. (2020), diabetic patients are twice as likely to develop a severe COVID-19 infection and then twice as likely to die from it.

Women were more likely to be discharged than men regarding hospital discharge. Those with advanced age were less likely to be discharged (Wargny et al., 2020). Patients with hypertension, microvascular/macrovascular complications, heart failure, or chronic obstructive pulmonary disease were also associated with lower chances of hospital discharge. Wargny et al. (2020) also discovered that higher hemoglobin A1c (HbA1c) readings were also associated with more significant risks of death.

Standard variables associated with favorable outcomes include younger age, extended time between symptom onset and presentation to hospital, and routine, compliant use of metformin therapy (Wargny et al., 2020). Metformin therapy has been shown to have favorable outcomes. Statin therapy and anticoagulation therapy conversely showed increased risks of death and reduction in hospital discharges. Higher plasma glucose concentrations are associated with lower chances of hospital discharge and higher risks of death (Wargny et al., 2020).

According to Wargny et al. (2020), during the initial CORONADO study, mortality was reported to be 11.2 percent. This was only discovered after following the patient for seven days. In the continuation of the CORONADO study, mortality increased to 20.6 percent near day 28. However, in the United States, New York City had a mortality rate of 33.1 percent. England reported that 29.9 percent of patients with in-hospital deaths were due to complicated diabetes.

Rationale

Theoretical Framework

To measure quality of care, the Donabedian Model was used to guide the intervention (Donabedian, 1966). This model assesses structure, process and outcome measures to evaluate the quality of healthcare (Agency for Healthcare Research and Quality [AHRQ], 2015). The Donabedian conceptual framework was used to conceptualize, plan, and evaluate the impact of the intervention on patient outcomes.

Structural measurements were obtained through both chart review of HbA1c measurements and patient reported self-efficacy surveys. These were chosen as structural measures because they provide information on the patient's ability to self-manage their diabetes. Process measures were obtained through patient satisfaction scores from patient satisfaction surveys. These were chosen as process measures as evidence of how satisfied patients were with their diabetes self-management education. Outcome measurements were obtained from chart review of participants' HbA1c measurements. These were chosen as outcome measures in order to demonstrate how efficiently patients and providers manage the participants' diabetes.

Specific Aims

The purpose of this quality improvement DNP project is to improve glycemic control, specifically during the COVID-19 pandemic. Literature demonstrates that patients with diabetes were more likely to develop severe COVID-19 infections. However, little data is available to guide outpatient management of patients with diabetes and COVID-19 infections, as evidenced by literature review. It is crucial to improve glycemic control regardless of whether patients have COVID-19 infections. Diabetes is costly to treat and leads to progressive comorbid conditions, which are also costly. Thus, the aims of this quality improvement project were:

1. The primary aim of this DNP project was to improve HbA1c values for patents who experienced the most dramatic increases in HbA1c during the COVID-19 pandemic by at least 25% (outcome measure).
2. The secondary aim of this project was to improve patient-reported self-efficacy of managing their diabetes by at least 25% (structure measure).
3. The tertiary aim of this project was to improve patient satisfaction scores regarding their diabetes self-management by at least 25% (process measure).

Applying Donabedian's model for measuring quality care, these three measures allowed for a determination of whether the improvement project had the desired impact.

Methods

Context

This project was implemented in a rural health clinic (RHC) located in the Southeastern United States. Within this clinic there is one physician and two advanced practice providers. The population served by this clinic is primarily English-speaking Caucasians. The ages served at this clinic cover the lifespan. Patients observed in this quality improvement project were adult type two diabetic patients between the ages of 18 and 64 with commercial insurance.

Ethical Considerations

The purpose of this project was to implement an evidence-based diabetes self-management toolkit to improve patients' self-efficacy and satisfaction when it comes to managing their own diabetes and subsequently improve outcomes through reduced HbA1c values. The implementation of a patient self-management toolkit was based on longstanding evidence of the ability for diabetes self-management education initiatives to improve patient outcomes. This project was classified as quality improvement and did not meet the criteria for original research.

Institutional Review Board (IRB) approval was obtained at James Madison University (JMU). This quality improvement project posed no risks greater than those of standard of care to individuals involved and participation was entirely voluntary. Participants could terminate their involvement in the project at any time without penalty or delay in standard of care. Only the primary investigator (PI) had access to the data, and it was not used for any other purposes than this quality improvement project. This data was considered highly sensitive because it included the patient's medical record number for tracking of HbA1c values over time via periodic chart review. Data was stored on a password protected Excel spreadsheet on the PI's personal computer that only the PI had access to. De-identified data was shared with the PI's DNP Project chair. This sharing of de-identified data occurred using a Duo-protected encrypted server approved by the James Madison University IRB and managed by JMU (where the PI is a student). Paper surveys were scanned onto an encrypted flash drive and then destroyed. When information needed to be transported off the health system's premises, an encrypted flash drive was used. The researcher reported no potential conflicts of interest.

Baseline Measures

To determine the impact of the lockdown period during the COVID-19 pandemic, baseline HbA1c measures were collected via chart review to compare average HbA1c values for the clinic population prior to the lock-down and after. Baseline HbA1c data was obtained and assessed at the onset of the COVID-19 pandemic (March-May 2020) and then again one year later (March-May 2021) through chart review. This data was used to better understand the evolving needs of patients experiencing type two diabetes during the pandemic and lockdown periods. The initial HbA1c measurements served to reflect the time period in the United States prior to the COVID-19 lockdown. Pre-pandemic HbA1c measurements were then compared to 2021 measurements. This served to display changes in glycemic control during one year of the COVID-19 pandemic and lockdown period.

Intervention

Patients were recruited for participation in the project at an in-office visit during May 2022. Informed consent was obtained during this visit. After obtaining informed consent, a diabetes self-efficacy survey was distributed to the patient to determine baseline comfort of self-management of diabetes. Following dissemination of the survey, a diabetes self-management toolkit was given to patients. The toolkit utilized in this project was based on a similar quality improvement project implemented by Margo Sutton (2015). The toolkit was reviewed by a local endocrinology nurse practitioner who manages patients in the same geographical location.

This toolkit had information regarding elevated blood glucose levels, low blood glucose levels, a blood glucose logbook, and other information for patient specific education on self-management such as the importance of eye exams, foot exams, and what to do when sick. The patient was educated on proper blood glucose testing and the importance of tracking meals. At the three month follow up appointment, HbA1c was reassessed. The self-efficacy survey and patient satisfaction surveys were also repeated at this time. These values were compared to HbA1c values from May 2022 to determine if a change had occurred.

Outcome Measures

The participants of this quality improvement project were recruited from a Rural Health Clinic in the Southeastern United States. There were four participating patients in this project. The ages for the participants ranged from 44-66 years. All patients identified as Caucasian. All patients in the project had type two diabetes. Pre-intervention HbA1c measurements ranged from 6.3% to 12.1%. Post-intervention HbA1c measurements ranged from 6.8% to 9.2%. Data measured during this study included HbA1c both "pre-" and "post-" COVID-19 lock down (2021 and 2022), self-efficacy surveys collected pre- and post-intervention, patient satisfaction surveys collected pre- and post-intervention, and HbA1c levels pre- and post-implementation of the diabetic tool kit.

Data Collection

Comparison of HbA1c measurements during the COVID-19 pandemic were obtained through chart review. Patients were identified by searching the EMR with the ICD-10 code 11.9 "type 2 diabetes mellitus without complications". Patients were included if they were between the ages of 18 and 64, commercially insured, and had HbA1c obtained between March and May 2020 and then repeated in March through May 2021. This information was collected and stored on a password protected Excel spreadsheet on the PI's personal computer.

Patients were offered participation in this quality improvement project if they had an office visit scheduled in May 2022. Inclusion criteria for participation in the intervention was the same as that of the chart review and included patients type 2 diabetes, aged 18-64, and commercially insured. Participation was completely voluntary, and the patient could withdraw at any time without penalty. Informed consent was obtained during the initial office visit in May 2022. HbA1c measurements from participating patients were obtained from the May 2022 office visit. HbA1c measurements were stored on the same password protected Excel spreadsheet underneath a different tab denoted “participants”. During this visit, the patient also completed a self-efficacy survey detailing their comfort in managing their diabetes, as well as a patient satisfaction survey. Once collected, these surveys were scanned onto an encrypted flash drive and the paper copies were destroyed.

Patients were then scheduled for a routine follow up appointment in three months. At this time, HbA1c were repeated in preparation for their office visit. These measurements were then transcribed to the password protected Excel spreadsheet in preparation for analysis. Post-intervention self-efficacy and satisfaction surveys were then obtained and scanned onto the encrypted flash drive. Paper copies were destroyed immediately.

Analysis

In comparison of pre- and post-COVID-19 HbA1c levels, paired *t*-tests (or the non-parametric equivalent) were used. *T*-tests are also used to compare survey scores from the self-efficacy tool and the patient satisfaction survey. At the conclusion of the project, HbA1c measurements were collected and compared to earlier pre-intervention levels to determine efficacy of diabetic education and toolkit.

Results

Baseline Findings

HbA1c measurements were compared to determine if a change had occurred during the COVID-19 pandemic. 78 patients fitting inclusion criteria were identified and selected for review. In 2020, or the “pre-COVID-19 lockdown” timeframe, the average HbA1c was 7.5%. The lowest HbA1c was 5.3%, while the highest was 13.6%. In 2021, or the “post-COVID-19 lockdown” timeframe, the average HbA1c was 7.6%. The lowest HbA1c was 5.0%, while the highest HbA1c was 13.2%. HbA1c measurements reviewed prior to and one year during the COVID-19 did not have a statically significant change.

Table 1

Comparison of HbA1c values pre- and post-lockdown

Year	HbA1c Average	Lowest A1c	Highest A1c
2020	7.5%	5.3%	13.6%
2021	7.6%	5.0%	13.2%

Demographic Information

The participants of this quality improvement project were recruited from a Rural Health Clinic (RHC) in the Southeastern United States. There were four participants in this study, three males and one female. All participants identified as Caucasian. The ages for the participants ranged from 44 to 66 years. All patients in the project had type two diabetes and were commercially insured. Pre-intervention HbA1c measurements for these participants ranged from 6.3% to 12.1%, with an average HbA1c of 7.5%. Post-intervention HbA1c measurements ranged from 6.8% to 9.2%, with an average HbA1c of 7.6%.

Self-Efficacy

The Self-Efficacy Survey for Diabetes is made up of eight questions. The survey utilizes the Likert scale in which respondents rate their self-efficacy on a scale of 1-10.

One on the scale denoted “not at all confident” and ten denoted “totally confident”. The survey asked the participants questions regarding diet, exercise, management of hypoglycemia, management of hyperglycemia, sick day management, and quality of life.

The average self-efficacy score for all participants pre-intervention was 8.4. The average self-efficacy score for all participants post-intervention was 7.9. Two of the four participants did not experience a change in self-efficacy when comparing survey scores pre- and post-intervention; both participants scored the same score before and after the intervention. The remaining two participants demonstrated a decrease in self-efficacy after the intervention. When comparing these two individuals’ pre- and post-intervention self-efficacy scores using a paired *t*-test to determine if the decrease was significant, one individual did in fact demonstrate a statistically significant decrease in self-efficacy post-intervention ($t = 4.25$, $df = 7$, $p < .01$).

Table 2

Comparison of self-efficacy survey scores pre- and post-intervention for all participants

Question	**Average Score Pre-Intervention**	**Average Score Post-Intervention**	**Change in Score**
How confident do you feel that you can eat your meals every 4 to 5 hours every day, including breakfast every day?	8.5	8.25	-0.25
How confident do you feel that you can follow your diet when you have to prepare or share food with other people who do not have diabetes?	8	8	0
How confident do you feel that you can choose the appropriate foods to	8.75	8.75	0

eat when you are hungry (for example, snacks)?			
How confident do you feel that you can exercise 15 to 30 minutes, 4 to 5 times a week?	6.75	6.75	0
How confident do you feel that you can do something to prevent your blood sugar level from dropping when you exercise?	8.25	8.25	0
How confident do you feel that you know what to do when your blood sugar level goes higher or lower than it should be?	9	9	0
How confident do you feel that you can judge when the changes in your illness mean you should visit the doctor?	7	9.5	+2.5
How confident do you feel that you can control your diabetes so that it does not interfere with the things you want to do?	9	9	0

Table 3

Paired Sample Statistics Pre- and Post-Intervention Self-Efficacy

Pairs	Mean	N	Standard Deviation	Standard Error Mean
Participant 1 Pre-Intervention	8.6250	8	.91613	.32390
Participant 1 Post-Intervention	8.6250	8	.91613	.32390
Participant 2 Pre-Intervention	8.5	8	1.69031	.59761
Participant 2	8.5	8	1.69031	.59761

Post-Intervention				
Participant 3 Pre-Intervention	9.125	8	.64087	.22658
Participant 3 Post-Intervention	7.3750	8	.91613	.32390
Participant 4 Pre-Intervention	7.5	8	.75593	.26726
Participant 4 Post-Intervention	7.12	8	1.80772	.63913

Patient Satisfaction

The patient satisfaction survey was made up of five questions. The first three questions utilized the Likert Scale for rating satisfaction or dissatisfaction with education of diabetes, ease of use of the toolkit, and meeting the patient's specific needs. Questions four and five were "free-response" questions that allowed the patient the give the PI feedback regarding the Diabetic Toolkit. There was also a space provided for additional comments.

Patient satisfaction surveys were distributed following initial education of the Diabetic Toolkit. Patient satisfaction surveys were then again distributed at the three month follow up visit. For the first three questions, utilizing the Likert Scale (1 - very dissatisfied to 5 - extremely satisfied). All participants rated their satisfaction as 5 – extremely satisfied for all three Likert-type questions for both pre- and post-intervention. There was no change in score when comparing pre- and post-intervention scores.

Table 4

Open-Ended Responses from Patient Satisfaction Surveys

Participant	The feature I liked best about the diabetic toolkit was:	The feature I liked least or could be improved was:
1	“Helped me know what was going on”	No response
2	“Medication list” “Appointment reminders and blood sugar log”	None
3	No response	None
4	“Being able to record my blood sugar levels. It made me pay more attention to it.” “I really liked the whole thing. It made me pay more attention to my diabetes and better maintain them.”	“I liked it all, but maybe put a food selection for meals and in between meals. What’s good for you to eat, more of a selection.”

Pre-/Post-Intervention HbA1c Scores

HbA1c measurements prior to the intervention ranged from 6.3% to 12.1%. Post intervention, HbA1c measurements ranged from 6.8 to 9.2%. Analysis of the average of pre- and post-intervention HbA1c values for all four participants did not reveal any statistical significance (t = -.88, df = 3, p = .44). Three out of four participants did see an improvement in their HbA1c values after receiving the intervention; however, one participant did experience an increase in HbA1c after the intervention.

Table 5

Pre- and Post-Intervention HbA1c Measurements

Participant	Pre-Intervention HbA1c	Post-Intervention HbA1c
1	12.1%	9.2%
2	6.3%	7.2%
3	7.1%	6.8%
4	7.5%	7.0%

Table 6

Paired Sample Statistics Pre- and Post-Intervention HbA1c

Month HbA1c Measured	Mean	N	Standard Deviation	Standard Error Mean
May	8.25	4	2.61470	1.30735
August	7.55	4	1.11206	.55603

Discussion

Measurement of HbA1c prior to and one year into the COVID-19 pandemic did not have a statistically significant change. Three out of the four participants did experience an improvement in HbA1c measurements. However, one patient experienced an increase in HbA1c following the intervention. Implementation of the diabetic toolkit did not have a statistically significant impact on HbA1c measurements.

When comparing self-efficacy scores pre- and post-intervention, two participants did not experience any change. The other two participants experienced a decrease in self-efficacy. One participant experienced a statistically significant decrease in self-efficacy. Patient satisfaction remained extremely satisfied during both the pre- and post-intervention implementation.

A strength of the toolkit was the ability to be individualized to the patient's specific needs. Each participant was able to utilize different portions of the toolkit in order to better manage their diabetes. Feedback from a participant noted the individual was more accountable when writing blood glucose readings down and could look back at previous trends. Other participants utilized the medication list which included a section to write what the medication is used for. Other feedback from non-participating patients included making the toolkit electronic and including diabetic diet recommendations.

Limitations of this project included the small sample size and self-enrolled patients. Patients may have been more inclined to be more compliant with medications and diabetic diet while participating in this project. Time spent during an office visit is also a limitation. Much of the visit is dedicated to routine follow-up assessments, review of laboratory data, medication review, and discussion with the patient.

It should be noted that the changes experienced by participants during and after the intervention may not be a direct reflection of the intervention. The changes demonstrated could have been observed due to the participants being more aware of dietary habits, medication compliance or lack thereof, and ability to monitor blood glucose levels and follow trends.

The diabetic toolkit that was implemented in this quality improvement project was reviewed by an endocrinology nurse practitioner prior to implementation. This provider manages patients in the same geographical region and could therefore offer population-specific recommendations. The toolkit was found to be relevant. Changes that were suggested included editing the goal of LDL cholesterol to less than 70mg/dL.

Conclusion

Research shows that COVID-19 infections, social distancing guidelines, and anxiety related to the pandemic can lead to worsening glycemic control. Compliance was found to be decreased the longer than lockdown protocols were implemented. This project was created to identify gaps in adult patients' self-management of type two diabetes and then implement an intervention to correct these gaps.

Powell et al., (1979) demonstrated improvement in disease knowledge and management with implementation of both written and visual materials. Baseline HbA1c measurements were obtained to identify if a change had occurred during the first year of the COVID-19 pandemic within this patient population. These baseline measures did not show a statistically significant change. Following implementation of the diabetic toolkit utilized in this project, 75 percent of participants experienced an improvement in HbA1c measurements. One participant did experience an increase in HbA1c measurement that was statistically significant. With relation to self-efficacy, two participants did not experience a change. Two participants experienced a decrease in self-efficacy. Further investigation is needed to identify why this change occurred.

According to Cho and Kim (2021), focus should be on helping the patient to manage their chronic illness rather than the intervention itself. Good self-management techniques may include a variety of interventions. In their research, it was found that patients had improvements in HbA1c with any intervention with nursing. All interventions studied included diabetic education with nursing staff. Other improvements demonstrated include improvements in fasting blood sugar levels, cholesterol levels, blood pressure, and weight reduction. Diabetes related psychological distress also decreased following these interventions.

For future studies, this project could include further discussions of disease education, lifestyle modifications, and medication education. Timing of implementation could also be factored into the intervention, such as new onset diabetes, worsening of laboratory data, or medication changes. The toolkit does not have to be a singular use item. Time could be spent during each office visit going over sections that are useful to the patient. Education could be tailored to what the patient requires based upon laboratory data, lifestyle modifications, or medications.

References

Agency for Healthcare Research and Quality. (2015). *Types of health care quality measures*. Retrieved from https://www.ahrq.gov/talkingquality/measures/types.html

Alshareef, R., Al Zahrani, A., Alzahrani, A., & Ghandoura, L. (2020). Impact of the COVID-19 lockdown on diabetes patient in Jeddah, Saudi Arabia. *Diabetes & metabolic syndrome: Clinical research & reviews, 14*. 1583-1587

American Diabetes Association. (2022). The Burden of Diabetes in Virginia. Retrieved from https://diabetes.org/sites/default/files/2022-04/ADV_2022_State_Fact_sheets_all_rev_VA-4-4-22.pdf

American Diabetes Association. (2018). Economic costs of diabetes in the U.S. in 2017. *Diabetes care, 41*. 917-928.

American Diabetes Association. (2022). Introduction: Standards of medical care in diabetes—2022. *Diabetes care, 45* (1). 51-52. https://doi.org/10.2337//dc22-SINT

Aggarwal, G., Lippi, G., Lavie, C. J., Henry, B. M., & Sanchis-Gomar, F. (2020). Diabetes mellitus association with coronavirus disease 2019 (COVID-19) severity and mortality: A pooled analysis. *Journal of diabetes, 12 (*11). 851-855. doi: 10.1111/1753-0407.13091

Cariou, B., Hadjadj, S., Wargny, M., Pichelin, M., Al-Salameh, A., Allix, I., Amadou, C., Arnault, G., Baudoux, F., Bauduceau, B., Borot, S., Bourgeon-Ghittori, M., Bourron, O., Boutoille, D., Cazenave-Roblot, F., Chaumeil, C., Cosson, E., Coudol, S., Darmon, P., … Gourdy, P. (2020). Phenotypic characteristics and prognosis of inpatients with COVID-19 and diabetes: the CORONADO study. *Diabetologia*, *63*. 1500-1515. https://doi.org/10.1007/s00125-020-05180-x

Centers for Disease Control and Prevention. (2021). Morbidity and mortality weekly report: Provisional mortality data. Retrieved from https://www.cdc.gov/mmwr/volumes/70/wr/mm7014e1.htm

Centers for Disease Control and Prevention. (2020). National diabetes statistic report. Retrieved from https://www.cdc.gov/diabetes/library/features/diabetes-stat-report.html

Centers of Disease Control and Prevention. (2021). U. S. Diabetes surveillance system. Retrieved from https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html

Cho, M. and Kim, M. Y. (2021). Self-Management nursing interventions for controlling glucose among diabetes: A systematic review and meta-analysis. *International journal of environmental research and public health, 18(23)*. Doi: 10.3390/ijerph182312750

Cleveland Clinic. (2021). Diabetes: An overview. Retrieved from https://my.clevelandclinic.org/health/diseases/7104-diabetes-mellitus-an-overview

Donabedian A. (1966). Evaluating the quality of medical care. *The Milbank Memorial Fund quarterly*, *44*(3), 166–206.

Garrard, J. (2017). *Health sciences literature review made easy*. (5th Ed.). Jones Bartlett Learning.

Feldman, E. L., Savelieff, M. G., Hayek, S. S., Pennathur, S., Kretzler, M., & Pop-Busui, R. (2020). COVID-19 and diabetes: A collision and collusion of two diseases. *Diabetes journal, 69*. 2549-2565.

Hussain, A., Bhowmik, B., & do Vale Moreira, N. C. (2020). COVID-19 and diabetes: Knowledge in progress. *Diabetes research and clinical practice*, *162*. 1-9.

Kumar, A., Anora, A., Sharma, P., Anikhindi, S. A., Bansal, N., Singla, V., Khare, S., & Srivastava, A. (2020). Is diabetes mellitus associated with mortality and severity of COVID-19? A meta-analysis. *Diabetes & metabolic syndrome: Clinical research*, *14*. 535-545.

Muniyappa, R. & Gubbi, S. (2020). COVID-19 pandemic, coronaviruses, and diabetes mellitus. *American journal of physiological endocrinology metabolism. 318*. E736-E741. DOI: 10.1152/ajpendo/00124/2020

Nachimuthu, S., Sudha, R. V., & Viswanathan, V. (2020). Coping with diabetes during the COVID-19 lockdown in India: Results of an online pilot survey. *Diabetes & metabolic syndrome: Clinical research & reviews, 14*. 579-582.

Naitional Kidney Foundation. (2022). Diabetes and chronic kidney disease. Retrieved from https://www.kidney.org/news/newsroom/factsheets/Diabetes-And-CKD

Powell, M. F., Burkhart, V. P., and Lamy, P. P. (2006). Diabetic patient compliance as a function of patient counseling. *Annals of pharmacotherapy, 40*. 747-752.

Singh, A. K. & Singh R. (2020). Hyperglycemia without diabetes and new-onset diabetes are associated with poorer outcomes in COVID-19. *Diabetes research and clinical practice, 167*. 1-6. doi: 10.1016/j.diabres.2020.108382

Sutton, M. (2015). A Quality Improvement Project to Increase Diabetes Self-Efficacy in a Rural Primary Care Clinic Through Patient Utilization of a Diabetic Logbook.

Virginia Department of Health. (2018). Diabetes burden in Virginia. 1-26.

Virginia Department of Health. (2018). Smyth County Health Assessment. Retrieved from https://www.vdh.virginia.gov/content/uploads/sites/90/2018/08/Smyth-CHA.pdf

Virginia Department of Health. (2022). COVID-19 in Virginia. Retrieved from https://www.vdh.virginia.gov/coronavirus/

Wargny, M., Potier, L., Gourdy, P., Pichelin, M., Amadou, C., Benhamou, Y., Bonnet, B., Bordier, L., Bourron, O., Chaumeil, C., Chevalier, N., Darmon, P., Delenne, B., Demarsy, D., Dumas, M., Dupuy, O., Flaus-Furmaniuk, A., Gautier, F., Guedj, M., …Hadjadj, S. (2020). Predictors of hospital discharge and mortality in patients with diabetes and COVID-19: Updated results from the nationwide CORONADO study. *Diabetologica, 64* (4). 778-794. doi: 10.1007/s00125-020-05351-w