Diabetes Management in Rural Mississippi Before and During the COVID-19 Pandemic: A Program Evaluation

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Abstract

Introduction: Management of type 2 diabetes mellitus (T2DM) in rural Mississippi was impacted by the onset of the COVID-19 pandemic resulting in an increase in telemedicine patient care visits. There is little evidence concerning the long-term quality outcomes of telehealth management of chronic diseases such as T2DM; thus, there is a need for examination of patient outcomes associated with telehealth provided care. *Methods:* To evaluate the efficacy of telehealth in T2DM management, a rural Mississippi clinic was home to a program evaluation to compare A1C measurements of patients with T2DM seen in face-to-face office visits during the year prior to the onset of COVID-19 to those seen during the pandemic which included a mixture of telehealth and face-to-face visits. *Results:* Pre COVID-19 data included 430 male and 531 female patients (face-to-face visits only). Post COVID-19 data included 507 male and 593 female patients (combination of face-to-face and telemedicine visits). Mean A1C levels were not statistically significantly different for patients between the two years compared; however, participants who received a combination of face-to-face and telehealth visits were more likely to have an uncontrolled A1C. There were no gender differences in A1C in the pre or post COVID-19 groups. In the post COVID-19 group, age was not significantly associated with A1C level (controlled vs. uncontrolled); however, in the pre COVID-19 group, age was significantly associated with A1C control (ages 18-45: 12.2% uncontrolled vs. ages 46-75: 6.4% uncontrolled). There was no significant change in follow up compliance. *Discussion:* Because few patients actually participated in telehealth visits, there are insufficient data to determine if telemedicine is an efficacious strategy to provide chronic diabetes management in this rural clinic. More data from telehealth visits are needed to determine telemedicine's impact in rural outpatient diabetes management.

Diabetes Management in Rural Mississippi Before and During the COVID-19 Pandemic: A Program Evaluation

Diabetes in Mississippi is an epidemic. Mississippi leads the nation in type 2 diabetes mellitus (T2DM) prevalence (Mississippi State Department of Health [MDOH], 2018). As a consequence of the COVID-19 pandemic, many traditional office visits for these patients have shifted from face-to-face encounters to telemedicine visits. Thus, it is important for providers to know if use of telemedicine visits provides a way to offer high quality care to patients with T2DM. This program evaluation examines A1C measurements taken during face-to-face visits prior to the COVID-19 pandemic and compares them to those collected when care was provided with a mixture of telemedicine and face to face visits after the onset of COVID-19.

Background

The 13.6% prevalence rate of T2DM among the adult population in Mississippi also means that this state bears a large economic burden due to complications of this disease process (MDOH, 2018). The American Diabetes Association (ADA) estimates that Mississippi's diabetes epidemic costs 3.4 billion dollars annually (ADA, 2020). The COVID-19 pandemic drastically changed outpatient care across the nation, and the care provided to persons with T2DM in rural Mississippi was no exception. To decrease risks of COVID-19 transmission, healthcare providers had to suddenly postpone nonemergent visits and procedures (The Commonwealth Fund, 2020). By mid-2020, in-person office visits dropped by approximately 60% as compared to the previous year (The Commonwealth Fund, 2020). Due to the risk of complications with COVID-19 for the diabetic patient, an immediate risk for these patients was apparent.

At the start of the pandemic, rural areas around the world began to face the same barriers to care as the Centers for Disease Control and Prevention (CDC) encouraged social distancing

and postponing non emergent medical visits (CDC, 2021). This led to an increase in use of telemedicine for chronic disease management. In a cross-sectional study performed in rural Ontario, Canada, the rates of telemedicine visits increased among patients with a variety of chronic diseases including diabetes (Chu et al., 2021). Before the pandemic, patients in this rural area had an average rate of 11 telemedicine visits out of every 1000 visits, and by June 2020 this had increased to 147 visits per 1000 patients (Chu et al., 2021).

Although people have begun to return to traditional visits, providers and patients alike see the value in access to telemedicine and wish to continue access to this type of care (The Commonwealth Fund, 2020; Strazewski, 2020). The American Medical Association (AMA) is supporting legislative proposals to ensure the future of access to telemedicine due to its support of this effort (Strazewski, 2020). The data obtained in this program evaluation of telemedicine use in chronic disease management might be beneficial amidst the ongoing pandemic.

Problem Statement

T2DM is responsible for a large health and economic burden in the state of Mississippi. Its rural populations face this battle with a higher health risk disparity as prevalence rates of T2DM diagnoses is 17 percent higher than those reported in urban areas (Rural Health Information Hub, 2019; Rural Health Research Gateway, 2018). With the onset of the COVID-19 pandemic, face-to-face visits became less utilized by those with T2DM as this group was identified as being at high-risk for complications of COVID-19 (Centers for Disease Control and Prevention [CDC], 2021). This risk swiftly shifted the need for utilization of telemedicine leading to an increase in these visits in chronic disease management in rural areas around the world (Chu et al., 2021). Identification of the need and the impact of COVID-19 on this high-risk population highlighted the need for a program evaluation of telemedicine use for T2DM in

rural Mississippi.

This program evaluation took place in a rural Mississippi primary care clinic where T2DM is one of the top three diagnoses managed at this clinic. This clinic is part of a network of clinics owned by a larger rural hospital system. The clinic home, although considered rural, has a large practice group that includes three physicians and seven family nurse practitioners (NMMC Provider Dashboard, 2021).

As this rural clinic began implementing telehealth visits for patients with T2DM in April 2020, A1C readings of those performed with telehealth versus face-to face were not tracked separately. The A1C data collection continued to be grouped strictly by age, diagnosis, and results. The goal of this program evaluation was to identify the differences in A1C results captured in face-to-face and telemedicine visits, and then to compare them to present to the clinic providers and administration. With the completion of this evaluation, these data can be used for future practice change and promote better outcomes among this clinic's patients with T2DM. As the world continues to go through surges of COVID-19, this information can be used to inform future decisions about what type of visits should be offered to diabetic patients in this rural Mississippi clinic.

Organizational "Gap" Analysis

An A1C is a 90-day average of blood sugar readings and is reported as a percentage finding. It is collected as a serum blood test performed in a medical lab to monitor diabetes management. There are multiple published guidelines that will be further discussed in this project report (American Diabetes Association, 2021; International Diabetes Foundation, 2017; National Committee for Quality Assurance, 2020). Based on the evidence-based guidelines set forth by the National Committee for Quality Assurance (NCQA), the identified clinic caring for

1813 patients with T2DM has a predetermined goal of maintaining an A1C of less than 9 on 90% of adult patients with T2DM under care and maintaining that at least 98% of these patients have A1C measurements done at least every 6 months (NCQA, 2020). The clinic evaluated has two base locations, and as of January 2022, A1C values less than 9 have been met by 90% only 75% of the time, and frequency rates have ranged from 91-97% at an average of 74% of the time. This means that neither of these goals have been met simultaneously in either location, showing a needed area for improvement (NMMC Provider Dashboard, 2022).

Using this NCQA guideline as a criterion for comparison, this program evaluation has compared A1C measurements from face-to-face office visits during the year prior to the onset of the COVID-19 pandemic (April 1, 2019 - March 31, 2020) to those done during the COVID-19 pandemic (April 1, 2020 - March 31, 2021) which includes a combination of telehealth visits and face-to-face visits. Currently, data to distinguish the difference in patient A1C outcomes between these two methods of providing care are not being tracked in the reporting system; therefore, this information cannot be utilized for practice change or future improvements. Identification of the differences in A1C results captured in face-to-face and telemedicine visits can assist providers and administration in future practice change and promote better outcomes among this clinic's patients with T2DM.

Review of the Literature

A thorough review of the literature concerning telemedicine, telehealth, telecare, telemonitoring, telepractice, telenursing, chronic disease management, diabetes management, rural areas, rural communities, and COVID-19 revealed several important studies concerning the benefits of using telemedicine in management of chronic diseases in rural areas. The review

followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines (PRISMA, 2015).

Using the population, intervention, comparison, outcome, and study design (PICOS) framework, the population evaluated includes adult patients ages 18-75 with T2DM living in rural Mississippi. To gather global information on the management of T2DM in other rural areas, this guided review consists of seven studies involving the use of telemedicine and chronic disease management.

In the process of identifying these seven studies, only studies published in the last five years were considered and identified using NCBI/PubMed, Science Direct, and CINAHL databases. The MeSH terms used in each database search included combinations of telemedicine, telehealth, telecare, telemonitoring, telepractice, telenursing, chronic disease management, diabetes management, rural areas, rural communities, and COVID-19. The following search example was done using CINAHL with these MeSH terms. The initial search identified 94 publications. When narrowed down to peer-reviewed journals published in the last five years, 45 sources were identified. These sources, when narrowed again to only include CINAHL plus with full text, revealed 36 studies. When refined further to exclude qualitative studies and include only those that addressed management of diabetes and other chronic disease, 7 articles were identified.

Next, a complete search using the selected databases yielded a total of 1239 studies using the listed MeSH terms. After excluding duplicates, this number was decreased to 1073. The remaining articles were then limited to full text articles published in the last five years and narrowed to 65. Next, these articles were screened for irrelevant titles and studies that did not include management of chronic disease. Once this filter was applied, 24 articles remained. Of

these articles, 13 were excluded due to being qualitative studies, with four speaking only to expert opinions because they did not include any data. This left the 7 studies also identified in the CINAHL search which are included in this literature review (see Appendix A). Collectively, these studies identified equivalent or improved treatment outcomes that will be detailed in this review.

Chan et al. (2021) performed a systematic review of literature concerning the use of telemedicine in which 59 articles were evaluated. Of the 59 identified, 22 published between 2012-2019 mention improved A1C outcomes in diabetes using telemedicine with improvements ranging from 0.1-0.8% improvements in A1C. Likewise, in another systematic review, chronic management of HIV was found to have improved outcomes due to improvements in behavior modification (Kruse, Williams, Bohls, & Shamsi, 2021). This review also identified improvements in diabetes outcomes using telemedicine due to improved efficacy in getting patients to have their annual eye exam. While this study highlights fewer articles that discuss telemedicine use in chronic disease management, there were none identified that showed a decrease in quality outcomes (Kruse, Williams, Bohls, & Shamsi, 2021).

Likewise, articles discussing treatment of opioid dependence and chronic obstructive pulmonary disease (COPD) management in rural populations yielded results supportive of use of telemedicine for effective management (Chow, Gonzalez-Arce, Knight, & Kohler, 2018; Weintraub, Greenblatt, Chang, Himelhoch, & Welsh, 2018). Unlike the systematic reviews, these articles evaluated single studies. A program evaluation of a telemedicine program providing buprenorphine to patients in a rural Maryland community via telemedicine suggests that this treatment can effectively be delivered in this manner. The evaluation showed retention in treatment at 98% in week 1, 91% at one month, 73% at 2 months, and 57% at 3 months. There

was no control group; however, the study highlights that retention rates using telemedicine were similar when compared to retention rates using face-to-face visits. Of those retained in treatment, 86% had negative urine toxicology screens at the end of three months (Weintraub, Greenblatt, Chang, Himelhoch, & Welsh, 2018). Similarly, a COPD study had no comparison group, but provided evidence that telemonitoring of a small group of patients with COPD living in rural Australia showed improvement in monitoring and maintenance of a chronic disease. During the 9-month analysis, home telemonitoring of COPD was found to be a favorable patient management tool which provided an accurate picture of health indicators. More than 50% of these patients showed high clinical risk with 50% being hospitalized during the study (Chow, Gonzalez-Arce, Knight, & Kohler, 2018). Thus, this article's findings support the use of telemedicine and telemonitoring more as a management tool rather than a tool to improve outcomes.

Chan et al. (2021) clarifies that those in rural areas or from low socioeconomic status had equally improved outcomes in their systematic review. In each of the 22 reviewed articles concerning A1C outcomes, those from lower socioeconomic backgrounds and those with limited knowledge of technology also showed the greatest reduction of A1C with an average 0.8% reduction (Chan et al., 2021). Similarly, rural areas benefitting in this manner are also supported in the findings from a retrospective study done in India. A large group of rural residing patients in India were screened for otologic disease using an android otoscopic device capable of transmitting images to providers virtually. Of these 810,746 people screened, 33% were found to have ear problems that required referral for treatment (Gupta et al., 2021). Due to residing in a rural area, the patients screened using this service may not have had access to ENT management

without use of telemedicine. This study provides evidence that telemedicine has potential to help reduce inequalities in health care.

A pilot study conducted in rural Australia evaluated a virtual health coaching program over a 12-week period. This included 62 participants with 63% completing the program. Those who completed the program received more coaching and 43% reported improved attitude and behavior toward exercise for quality-of-life improvement. Weekly exercise in these patients increased by 1 hour after completion of program participation (p=0.02) (Paul et al., 2019).

Review of the identified articles shows that telemedicine management has yielded positive findings; however, there is limited data concerning quality outcome measures for those receiving care via telehealth. Australian researchers have published several studies focused on telemedicine use in rural areas like the ongoing multi-pronged approach to diabetes and cardiovascular disease management that may soon support further conclusive data concerning the benefits of telemedicine use in rural chronic disease management (Brazionis, Jenkins, Keech, Ryan, & Bursell, 2017).

The 7 studies that have been identified support that the use of telemedicine in chronic disease management have equal or superior quality outcomes, showing potential for outcome improvement with use of telemedicine in rural chronic disease management. However, clinical research with measurable clinical outcomes of telemedicine in chronic disease management is limited (Brazionis, Jenkins, Keech, Ryan, & Bursell, 2017; Chan et al., 2021; Kruse, Williams, Bohls, & Shamsi, 2021). This literature review highlights the need for more research in this area and ensures that a program evaluation is needed for the progression of telemedicine use in chronic disease management.

Evidence-based Practice

The International Diabetes Foundation (IDF) and the American Diabetes Association (ADA) both identify an A1C of 7 or less as the standard goal for controlled T2DM (IDF, 2017; ADA, 2021). This goal is different for patients with type 1 diabetes, pregnant females, those considered high-risk for hypoglycemic events, and those with limited life expectancy (ADA, 2021). Because these guidelines vary slightly from one to another, the rural clinic identified in this program evaluation and its associated clinic system, bases its Accountable Care Organization (ACO) A1C goal at less than 9 percent. This goal is in accordance with the NCQA published guidelines which identify an adult patient with T2DM with an A1C of 9 or greater as uncontrolled (NQCA, 2020).

In adopting the NQCA guidelines, the identified clinic has the predetermined goal of maintaining an A1C of less than 9 on 90% of its adult patients with T2DM and maintaining that at least 98% of its these patients have A1C measurements done at least every 6 months. When discussing the "adult" population concerning these goals, the NCQA (2020) identifies ages 18-75. This age rage has been applied to this program evaluation. At this point in the fiscal year, neither of these goals have been met in the local clinic studied showing a needed area of improvement (NMMC Provider Dashboard, 2022). However, patients who were seen face-to-face and those seen via telehealth visits were combined in this report.

Theoretical Framework

The most relevant conceptual framework to support the design of this project is a theory-based evaluation. After obtaining Institutional Review Board (IRB) approval from the University of Alabama and the rural clinic's hospital system, the relevant stakeholders were contacted which included the clinic providers and clinic administration. See Appendices B and C

for IRB letters. Next, a draft of the program evaluation was presented to the stakeholders followed by a discussion about the evaluation, with feedback obtained from the group. The group felt that no changes should be made to the implementation plan, so the program evaluation plan was again reviewed to look for efficacy prior to implementation based on the model concept (Lawless et al., 2017). In this case, no further need for change was identified. Once the clinic provided a letter of support for the project, data collection and review for the program evaluation began on October 22, 2022. A copy of the Letter of Support is included in Appendix D. A1C results and frequency of collection from April 1, 2019-March 31, 2020, and from April 1, 2020-March 31, 2021, were collected. To finalize the steps in this framework, an impact report in the form of a poster presentation of data was presented to the stakeholders on March 10, 2022. The theory-based conceptual framework flow chart is included in Appendix E.

Goals, Objectives, and Expected Outcomes

The goal of this scholarly project was to evaluate the impact of a mixture of telemedicine and face-to-face visits on A1C average, rates of uncontrolled A1C, and follow up testing compliance in patients with T2DM in a rural Mississippi clinic. This program evaluation has compared A1C measurements from face-to-face office visits during the year prior to the onset of the COVID-19 pandemic (April 1, 2019 - March 31, 2020) to those completed during the COVID-19 pandemic (April 1, 2020 - March 31, 2021) which included a mixture of telehealth visits and face-to-face visits. This clinic began offering telemedicine visits to patients with T2DM with use of video and telephone visits in April 2020 to protect its high-risk patient population. This date, therefore, separates the data that were compared. COVID-19 has presented a unique opportunity to evaluate telemedicine use compared to face-to-face visits. Based on the outcomes of the literature review, it was difficult to use the review as a tool to

determine the expected outcome of this program evaluation. It was also difficult to use the review to determine if using telemedicine would be an effective way to provide care during the COVID pandemic, at least in terms of its impact on A1C levels among those with T2DM in rural Mississippi. Many of the identified articles speak more to implementation of telemedicine rather than quality outcomes. However, based on the known literature, prior to implementation of the program evaluation, it was hypothesized that the A1C outcomes and follow up compliance utilizing a mixture of telemedicine and face to face visits would be similar to those found with patients using only traditional face-to-face visits.

Methods

Based on a review of the literature, a need for more research on the efficacy of telemedicine in chronic disease management was identified. A program evaluation was determined to be the best strategy for evaluating the efficacy of telemedicine in T2DM management in rural Mississippi. This project design involved evaluating A1C values and frequency of compliance in seeking follow up care as recommended, in this rural setting with an electronic medical record (EMR) system as the tool for information gathering. After obtaining IRB approval, these data were gathered by generating reports from this EMR. The data were then interpreted using inferential statistics and prepared for presentation to the clinics' providers and administrators by use of spreadsheets, tables, and graphs. These include an average of A1C results, percentage of uncontrolled A1C results (A1C of 9 or greater), and follow up compliance rates from each gender and age group in the year prior to the onset of COVID-19, and in the year following the onset of the pandemic. The A1C values were separated by ages 18-45 and 46-75, by gender, and by year. Once this was done, the A1C results gathered from each of these groups

during the year after the onset of COVID-19 (April 1, 2020 - March 31, 2021) were further separated by visit type (face-to-face or telemedicine) for further analysis.

Project Design

This program evaluation was conducted by collecting A1C values and frequency of compliance with A1C collection from 1342 patients with type 2 diabetes ages 18-75 under care at the identified rural Mississippi clinic and separated into two date ranges. The first year included A1C results completed on 961 of these patients done in face-to-face visits before the onset of COVID-19 from April 1, 2019- March 31, 2020. The second date range was April 1, 2020-March 31, 2021. This second date range occurred after the onset of the COVID-19 pandemic and included A1C results on 1082 patients who had a mixture of face-to-face and telemedicine visits. Many patients had multiple visits over this two-year span. There were a total of 1731 A1C results reviewed on 961 patients in the year prior to the onset of COVID-19 and 1901 A1C results reviewed on 1082 patients in the year after the onset of the pandemic.

Project Site and Population

This program evaluation took place in a rural Mississippi primary care clinic with two base locations within its county. It is part of a network of clinics owned by a large rural hospital system. Diabetes is one of the top three diagnoses managed at this clinic, which is no surprise considering the diabetes epidemic in this state (MDOH, 2018).

The three physicians and seven family nurse practitioners that work at this clinic each work an average of four to five days per week with alternating shifts. One location is open Monday through Saturday, and the other location is open seven days per week to offer access to patients. The clinic is fully staffed with three physicians, seven nurse practitioners, 16 nurses,

two medical assistants, six lab and radiology technicians, nine clerical staff, and two office managers. Each location can get same day A1C readings in the onsite lab.

To collect blood for the A1C to be done on patients planning to have a telemedicine visit, a plan was implemented by this clinic upon the onset of COVID-19. The serum for this lab test was collected by the lab technician prior to the visit. The patient arrived at the clinic a few days prior to the planned visit and called the receptionist upon arrival to do a telephone check in. The receptionist then notified the lab technician that a patient had arrived that needed to have blood work drawn for A1C collection. The patient remained in his or her vehicle while the lab technician donned the appropriate personal protective equipment (PPE) then reported to the patient's vehicle to draw pre visit labs. These pre visit labs were standing protocol orders implemented by the clinic providers based on known diagnoses. For example, when a diabetic patient reports for pre visit labs, the lab technician automatically knows to draw an A1C, CBC, CMP, and lipid profile on the patient. With this done in advance, the provider had the results back when the telemedicine visit took place allowing the patient and provider to discuss results, needs, and medication changes during the visit.

The participant size included all A1C values on these 1342 patients during this two-year period to compare A1C outcomes before and after implementation of telehealth visits at this clinic. For many patients, more than one A1C value was collected, thus A1C values and frequencies have been documented. All providers and managers at this clinic were pleased with the plan to perform this program evaluation. The only constraint identified was not having access to a report within the EMR that separated these A1C values by visit type. Thus, each A1C collected from April 1, 2020- March 31, 2021, was manually reviewed in the EMR to identify what visit type was associated with the result.

Measurement Instruments

Using the electronic medical record (EMR) at the clinical site, reports were generated to obtain A1C values and frequency of A1C testing from each identified patient. These data were placed into a Microsoft Office Excel version 16.0 spreadsheet to provide a way to separate the A1C results by year, patient gender, patient age, and visit type. Using Excel also allowed a way to merge the data into tables and graphs for presentation. More detail on the data inclusion criteria and collection are discussed below.

Data Collection Procedures

First, using the EMR at the clinical site, every A1C value obtained from April 1, 2019 – March 31, 2021, on an adult patient with T2DM at the clinical site was obtained, patient identifiers removed, then placed into a spreadsheet within Excel. After each raw A1C value from the first year (face-to-face visits only) was collected and placed into Excel, the A1C results were then separated by gender, age (18-45 and 46-75), and compliance with follow up (Yes (Y) / No (N)). This method of data collection was then performed for the second year. In addition to collecting these same descriptive findings, the second-year data also included the visit type. These data were placed into a spreadsheet for comparison and used for statistical analysis and to create tables and graphs for visual ease of comparison.

Data analysis

The data collected in this program evaluation are reported as numerical findings from each identified variable except for compliance with follow up which is Y/N based on whether the identified patient kept his or her A1C follow up appointment. Bivariate analyses were conducted to determine the relationship between groups (pre-COVID-19 vs. post-COVID-19), demographic, and clinical characteristics of participants. Welch two sample *t*-tests, Pearson's

Chi-squared test, the Wilcoxon test, and Fisher's Exact test were performed to analyze and compare A1C mean, rate of uncontrolled A1C (≥9), and follow up rates in both groups. Graphs and statistical description have been made available for the clinic's providers and administration. This is identifiable as level 5 research evidence based on the John's Hopkins criteria (Dang & Dearholt, 2018).

Cost-Benefit Analysis/Budget

This program evaluation had no overhead cost as the evaluation of A1C measurements and presentation of the data collected was performed in full by the author. Due to the high economic burden of diabetes in the state of Mississippi, further evaluation of telemedicine's impact in T2DM management could lead to improved outcomes in diabetes management in the future and could be beneficial in a future cost evaluation.

Timeline

The initial project proposal was approved by Dr. Robin Bartlett in August 2021, then IRB applications were started in September 2021. IRB approval from the healthcare facility and University of Alabama were granted October 22, 2021, and data collection began the same day. All data were obtained and documented by November 15, 2021. From this date through February 2, 2022, all identified post COVID-19 office visits were manually reviewed three times to ensure accuracy in reporting visit types. This data collection included A1C findings from April 1, 2019- March 31, 2020, and April 1, 2020- March 31, 2021. The biostatistician, Dr. Glenn assisted with the analyses. The data spreadsheets and tables were reviewed by Dr. Bartlett, and findings were presented to the clinic providers and administration with use of tables and graphs for comparison on March 10, 2022. After review of these results, stakeholders verbalized interest in tracking A1C results for telemedicine visits completed within the clinic

beyond April 1, 2021, to compare them to the pre-COVID-19 results. A timeline example can be found in Appendix F.

Ethical Considerations/Protection of Human Subjects

All participants whose A1C findings were reviewed were protected by the Health Insurance Portability and Accountability Act of 1996 (HIPAA). Only A1C values, A1C frequencies, age, gender and whether the visit was done face-to-face or by telehealth were gathered from the EMRs and reported in the findings. This ensured the protection of patients' private health information (Federal Register: The Daily Journal of the United States Government, 2013). All information collected as part of this program evaluation was aggregated data from patients with T2DM receiving care at this rural Mississippi clinic and did not include any potential patient identifiers. Records were reviewed within the clinic setting and only a summary of the deidentified data were removed from the clinic site. IRB approval was granted by the University of Alabama and by the hospital system that owns the clinic. Because this is a program evaluation, the risk to patients who have participated in this project are no different from the risks of patients receiving standard of care at this clinic under NCQA guidelines (NCQA. 2020).

Participant confidentiality was assured by collecting and reporting data based on A1C values and frequency of collection according to date, age, and visit type only. Furthermore, no patient identifiers were extracted from the reports generated from the clinic's EMR system. This EMR system follows all HIPAA guidelines.

Results

Demographic Summary

On average, the participants seen at the rural Mississippi clinic were 55.6 years old, predominantly female (53.8%), with a median of two clinic visits, and 9.8% had an uncontrolled A1C (≥9). Bivariate analyses were conducted to determine the demographic and clinical characteristic relationships between pre-COVID-19 and post-COVID-19 groups. Age, number of visits, and A1C, were all significantly associated with the intervention group, all $p < 0.01$, see Table 1. On average, participants in the post COVID-19 group were 2.5 years younger than those in the pre COVID-19 group, had one median visit, and 99.3% did not return for recommended follow-up. In this group, 13.1% had uncontrolled A1C in comparison to participants in the pre COVID-19 group who had 7.4% uncontrolled A1C values. A bar graph of these data comparing controlled A1C to uncontrolled A1C can be found in Table 2.

A1C Mean Comparison

A Welch two sample *t*-test was performed to examine whether mean A1C levels differed by group (pre vs post COVID-19) on the first visit. Mean A1C levels were not associated with the pre vs post COVID-19 groups, with participants who received face-to-face only (Mean A1C = 6.7, SD = 1.5), or a combination of face-to-face and telehealth visits (Mean A1C = 6.9, SD = 1.9) having similar mean A1C measures (t (1309) = -1.5, p = .1225).

Controlled vs. Uncontrolled A1C Comparison

A Chi-Square test was conducted to examine the association between rates of controlled vs. uncontrolled A1C values after the introduction of telemedicine in the second year. Among those with uncontrolled A1Cs, a higher percentage (15.5%) of participants received a combination of face-to-face and telehealth visits in comparison to the percentage of participants (9.0%) who received face-to-face visits only.

By Gender

Among participants in the post COVID-19 group, gender was not associated with A1C (controlled vs. uncontrolled), χ^2 (1, N=560) = .25, p = .6206. And, among participants in the pre COVID-19 group, gender was not associated with A1C (controlled vs. uncontrolled), χ^2 (1, N=780) = .202, *p* = .6529. A bar graph with these data can be found in Table 3.

By Age: 18-45 and 46-75 Years

Among participants in the post COVID-19 group, age group (18-45 vs. 46-75 years) was not significantly associated with A1C (controlled vs. uncontrolled), χ^2 (1, N=544) = .49, *p* = .4835. However, among participants in the pre COVID-19 group, age group (18-45 vs.46-75 years) was significantly associated with A1C (controlled vs. uncontrolled), χ^2 (1, N=780) = 10.3, *p* = .0013. A higher percentage of participants (15.9%) with uncontrolled A1C were 18 to 45 years, compared to the percentage of participants (7.4%) who were 46 to 75 years. A bar graph with these data can be found in Table 4.

Follow-Up Compliance

Fisher's Exact test was used to examine the association between the pre-COVID-19 and post-COVID-19 group and follow-up compliance based on the first visit. The post-COVID-19 group was not associated with follow-up compliance, *p* > .999.

Discussion and Study Limitations

This evaluation found that females of both age groups were more likely than males of both age groups to utilize telemedicine visits for diabetes management in the year following the onset of the COVID-19 pandemic. There were no patients identified in this evaluation that used only telemedicine visits after the onset of COVID-19. The patients who took part in telemedicine visits utilized a combination of visit types (face-to-face and telemedicine) after the pandemic onset, removing the option of direct comparison of data related to outcomes for each visit type.

Participants with an A1C > 14 were excluded from the Welch two sample *t*-test analysis because the clinic's lab equipment was not able to report exact values of A1Cs greater than 14. This meant that any A1C result that may have been 14.1 or greater would have been resulted in the EMR as ">14". Uncontrolled A1Cs are defined by NCQA as ≥9, so the lack of access to exact A1C results that were greater than 14 only affected the researcher's ability to calculate the mean A1C in each group and did not limit the ability to analyze controlled vs. uncontrolled or follow up compliance (NCQA, 2020).

Using the Chi-square test to examine the association of controlled versus uncontrolled A1C between the groups revealed that participants who received a combination of face-to-face and telehealth visits were more likely to have an uncontrolled A1C. However, the post COVID data were limited due to the small number of patients that engaged in telemedicine visits. There were only 8 total telemedicine visits in both male age groups combined in the year following the onset of COVID-19. This small number of telemedicine visits accounted for less than 1% of the male population in this study as there were a total of 507 male patients with A1Cs completed in the post COVID-19 year. In the male group ages 18-45, one of the 84 participants utilized telemedicine for T2DM care, and six of the 423 males ages 46-75 utilized telemedicine in the post COVID-19 year. There were 593 female patients with A1Cs analyzed in the post COVID-19 year, and both age groups utilized telemedicine more than the male groups. During this year, 25 of the 118 females ages 18-45, and 49 of the 593 females ages 46-75 utilized telemedicine visits. The number of telemedicine visits that occurred after the onset of COVID-19 could have been affected by provider willingness to engage in telemedicine visits, and patient access to internet or smart phone

Prior to this program evaluation, the efficacy and impact of telemedicine in diabetes management in this rural Mississippi clinic was not tracked in the EMR system of the clinic used for this analysis. Due to the ongoing pandemic, knowledge of the efficacy of this type of visit is important to further determine what type of visit that might be offered to this high-risk population to promote the best T2DM outcomes.

Clinical Implications and Further Recommendations

Based on review of these data, a formative assessment should be ongoing in this area. Utilizing the theory based conceptual framework, after presentation of these findings to the stakeholder, it could be beneficial to discuss adjustments to the timeframe of continued data tracking and apply this to an ongoing evaluation plan. It will be important to continue tracking this information to gain further insight into the clinical significance of the difference in outcomes when using a mixture of telemedicine and face-to-face visits. Finding a sustainable plan for tracking this electronically will be necessary and could be done with a new reporting template built within the EMR. This template should be designed to connect the A1C result with visit type. This would prevent the need for manual chart review, decrease the time that it takes to review this portion of these data, and eliminate human error in manual review. With the capability to run a report in the EMR, administration could have an opportunity to track this information on a larger scale to determine how to guide future clinical practice. Collecting data on a larger scale, perhaps throughout the entire clinic network, could provide additional information to answer the question of whether telehealth is a useful way to provide care for rural Mississippi residents who have T2DM in terms of promoting clinical outcomes as good or better than those achieved with face-to-face visits. With improved evaluation tools, providers could also personalize patient care

plans if the data identifies which subsets of the population have a better chance at maintaining A1C control, or even improvement, with a mixture of visit types.

Conclusion

Published evidence-based data guidelines such as those identified by the ADA, IFC, and NCQA show that a controlled A1C is necessary to maintain good health outcomes for the patient with type 2 diabetes (ADA, 2021; IDF, 2017, NCQA, 2020). With the pressing need for more data and outcome measurements concerning delivery of care using telemedicine, as highlighted by the literature review, this program evaluation was needed to assess the efficacy of telemedicine in management of patients with diabetes in rural Mississippi. With the abrupt onset of the COVID-19 pandemic, the need for telemedicine came without allowing providers and healthcare systems appropriate time to prepare for this change. While this program evaluation was ongoing, Delta and Omicron COVID-19 variants arrived within the United States confirming an ongoing need for telemedicine access. Conclusions of this program evaluation are consistent with the findings discussed in the literature review of studies completed prior to the onset of the data collection reported here. Data reviewed in this evaluation are not sufficient to determine if telemedicine is a viable option for chronic diabetes management in this rural clinic. More data are needed to determine the impact of telemedicine in rural outpatient diabetes management.

References

American Diabetes Association. (2020). *The Burden of Diabetes in Mississippi*. diabetes.org. http://main.diabetes.org/dorg/docs/state-fact-sheets/ADV_2020_State_Fact_sheets_MS.pdf.

American Diabetes Association. (2021). *6. Glycemic Targets: Standards of Medical Care in Diabetes-2021*. Diabetes Care. https://care.diabetesjournals.org/content/44/Supplement_1/S73

Brazionis, L., Jenkins, A., Keech, A., Ryan, C., & Bursell, S. (2017). An evaluation of the telehealth facilitation of diabetes and cardiovascular care in remote Australian indigenous communities: - Protocol for the telehealth eye and associated medical services network [TEAMSnet] project, a pre-post study design. *BMC Health Services Research, 17*, 1-12. https://doi:10.1186/s12913-016-1967-4 ID: 120611358

Centers for Disease Control and Prevention. (2021). *Certain Medical Conditions and Risk for Severe COVID-19 Illness*. Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html

Chan, C. B., Popeski, N., Hassanabad, M. F., Sigal, R. J., O'Connell, P., & Sargious, P. (2021). Use of virtual care for glycemic management in people with types 1 and 2 diabetes and diabetes in pregnancy: A rapid review. *Canadian Journal of Diabetes,* doi:https://doi-org.libdata.lib.ua.edu/10.1016/j.jcjd.2021.02.007

ID: 282131

Chow, J. S. F., Gonzalez-Arce, V., Knight, A., & Kohler, F. (2018). Retrospective analysis of telemonitoring in Wollondilly, Australia. *Journal of Integrated Care, 26*(2), 150-157.

doi:10.1108/JICA-10-2017-0032

ID: 128969265

Chu, C., Cram, P., Pang, A., Stamenova, V., Tadrous, M., Bhatia, R. S., & Bhatia, S. (2021). *Rural Telemedicine Use Before and During the COVID-19 Pandemic: Repeated Cross-sectional Study*. Journal of Medical Internet Research. https://www.jmir.org/2021/4/e26960

Dang, D., & Dearholt, S.L. (2018). Johns Hopkins nursing evidence-based practice: Model & guidelines (3rd ed).

Federal Register: The Daily Journal of the United States Government. (2013, January 25). Modifications to the HIPAA Privacy, Security, Enforcement, and Breach Notification Rules under the Health Information Technology for Economic and Clinical Health Act and the Genetic Information Nondiscrimination Act; other modifications to the HIPAA rules. Federal Register. https://www.federalregister.gov/documents/2013/01/25/2013-01073/modifications-to-the-hipaa-privacy-security-enforcement-and-breach-notification-rules-under-the.

Gupta, N., Baghotia, K. S., Rabha, M., Sachdeva, S., Sahai, G., Bhatnagar, K., & Ahuja, P. (2021). Comprehensive community screening of otological patients by trained technicians using a telemedicine device: An efficient and cost-effective way to triage patients with ear diseases. *ENT: Ear, Nose & Throat Journal, 100*, 263S-268S. doi:10.1177/0145561320950992

ID: 150577976

International Diabetes Federation. (2017). *IDF Clinical Practice Recommendations for Managing Type 2 Diabetes in Primary Care*. International Diabetes Federation.

https://www.idf.org/e-library/guidelines/128-idf-clinical-practice-recommendations-for-managing-type-2-diabetes-in-primary-care.html.

Kruse, C. S., Williams, K., Bohls, J., & Shamsi, W. (2021). Telemedicine and health policy: A systematic review. *Health Policy and Technology, 10*(1), 209-229. doi:https://doi-org.libdata.lib.ua.edu/10.1016/j.hlpt.2020.10.006

ID: 280958

Lawless, A., Baum, F., Delany-Crowe, T., MacDougall, C., Williams, C., McDermott, D., & Eyk, H. van. (2017). Developing a Framework for a Program Theory-Based Approach to Evaluating Policy Processes and Outcomes: Health in All Policies in South Australia. *International Journal of Health Policy and Management*, *7*(6), 510–521. https://doi.org/10.15171/ijhpm.2017.121

Mississippi State Department of Health. (2018). *Diabetes Prevention and Control*. Diabetes - Mississippi State Department of Health. https://msdh.ms.gov/msdhsite/_static/43,0,296.html.

National Committee for Quality Assurance. (2020, December 22). *Comprehensive Diabetes Care*. NCQA. https://www.ncqa.org/hedis/measures/comprehensive-diabetes-care/.

North Mississippi Medical Clinics Provider Dashboard (2022, January). *Provider Quality Data*. Iuka Medical Clinic and Belmont Family Medical Clinic: North Mississippi Medical Clinics.

Paul, S. S., Gardner, T., Hubbard, A., Johnson, J., Canning, C. G., Leaver, A., . . . Dennis, S. M. (2019). Feasibility of the PHYZ X 2U program: A mobile and cloud-based outreach service to improve chronic disease outcomes in underserviced rural communities. *Australian Journal of Primary Health, 25*(6), 539-546.

doi:10.1071/PY19090

ID: 140296458

PRISMA: Transparent reporting of systematic reviews and meta-analysis. (2015). Retrieved from http://www.prisma-statement.org/.

Rural Health Information Hub. (2019). *Rural Health Disparities*. Rural Health Disparities Overview. https://www.ruralhealthinfo.org/topics/rural-health-disparities.

Rural Health Research Gateway. (2018). The Burden of Diabetes in Rural America: Rural Health Research Project. https://www.ruralhealthresearch.org/projects/100002380.

Strazewski, L. (2020). *Telehealth's post-pandemic future: Where do we go from here?* American Medical Association. https://www.ama-assn.org/practice-management/digital/telehealth-s-post-pandemic-future-where-do-we-go-here.

The Commonwealth Fund. (2020). *What Impact Has COVID-19 Had on Outpatient Visits?* Commonwealth Fund. https://www.commonwealthfund.org/publications/2020/apr/impact-covid-19-outpatient-visits.

Weintraub, E., Greenblatt, A. D., Chang, J., Himelhoch, S., & Welsh, C. (2018). Expanding access to buprenorphine treatment in rural areas with the use of telemedicine. *American Journal on Addictions, 27*(8), 612-617. doi:10.1111/ajad.12805

ID: 133427106

Table 1

Summary statistics of the study cohort by COVID-19 Group (pre vs. post)

		COVID-19		
Characteristic	**Overall** N = 1340	**PRE** N = 780	**POST** N = 560	***p*-value**
Demographic				
Age, years, mean (SD)	55.6 (13.5)	56.7 (13.7)	54.2 (13.2)	**<0.001**[1]
Age group, years, N (%)				**.006**[2]
18-45	284 (21.2)	145 (18.6)	139 (24.8)	
46-75	1,056 (78.8)	635 (81.4)	421 (75.2)	
Gender, N (%)				.054[2]
Female	721 (53.8)	437 (56.0)	284 (50.7)	
Male	619 (46.2)	343 (44.0)	276 (49.3)	
Clinical				
Number of visits, median (IQR)	2 (1, 2)	2 (1, 2)	1 (1, 2)	**.0034**[3]
Follow up, N (%)				>.9994[4]
Yes	3 (0.5)	1 (0.4)	2 (0.7)	
No	566 (99.5)	283 (99.6)	283 (99.3)	
HbA1c, %, N (%)				**<0.001**[2]
Controlled	1,183 (90.2)	710 (92.6)	473 (86.9)	
Uncontrolled	128 (9.8)	57 (7.4)	71 (13.1)	
HbA1c, mean (SD)	6.8 (1.6)	6.7 (1.5)	6.9 (1.9)	.139[1]

[1] Welch two sample *t*-test. [2] Pearson's Chi-squared test. [3] Wilcoxon test. [4] Fisher's Exact test.
Bold = statistically significant at the $p < 0.05$ level.

Table 2

A1C by COVID-19 Group (pre COVID-19 vs. post COVID-19)

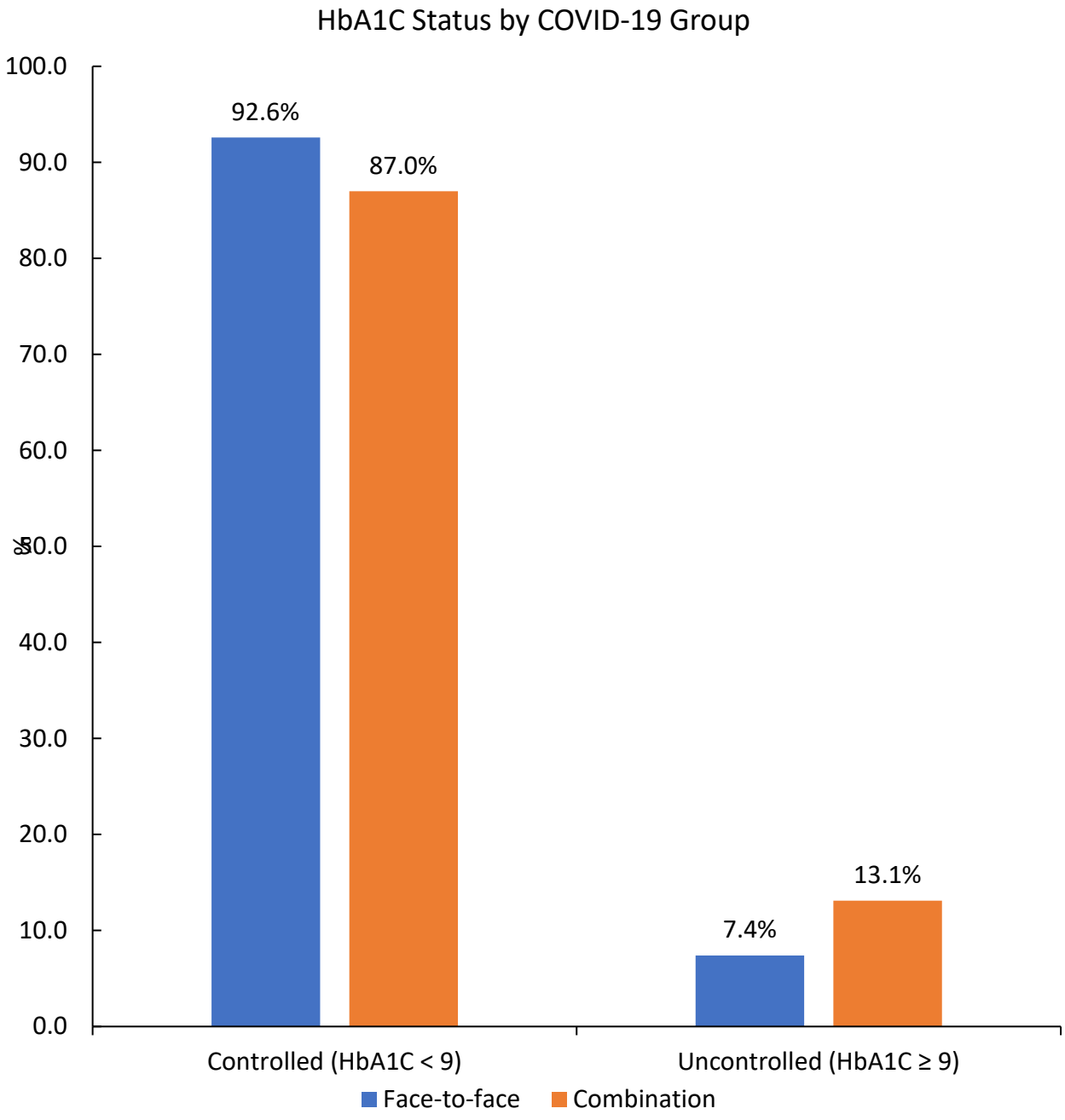


Table 3

A1C by Age and COVID-19 Group (pre COVID-19 vs. post COVID-19)

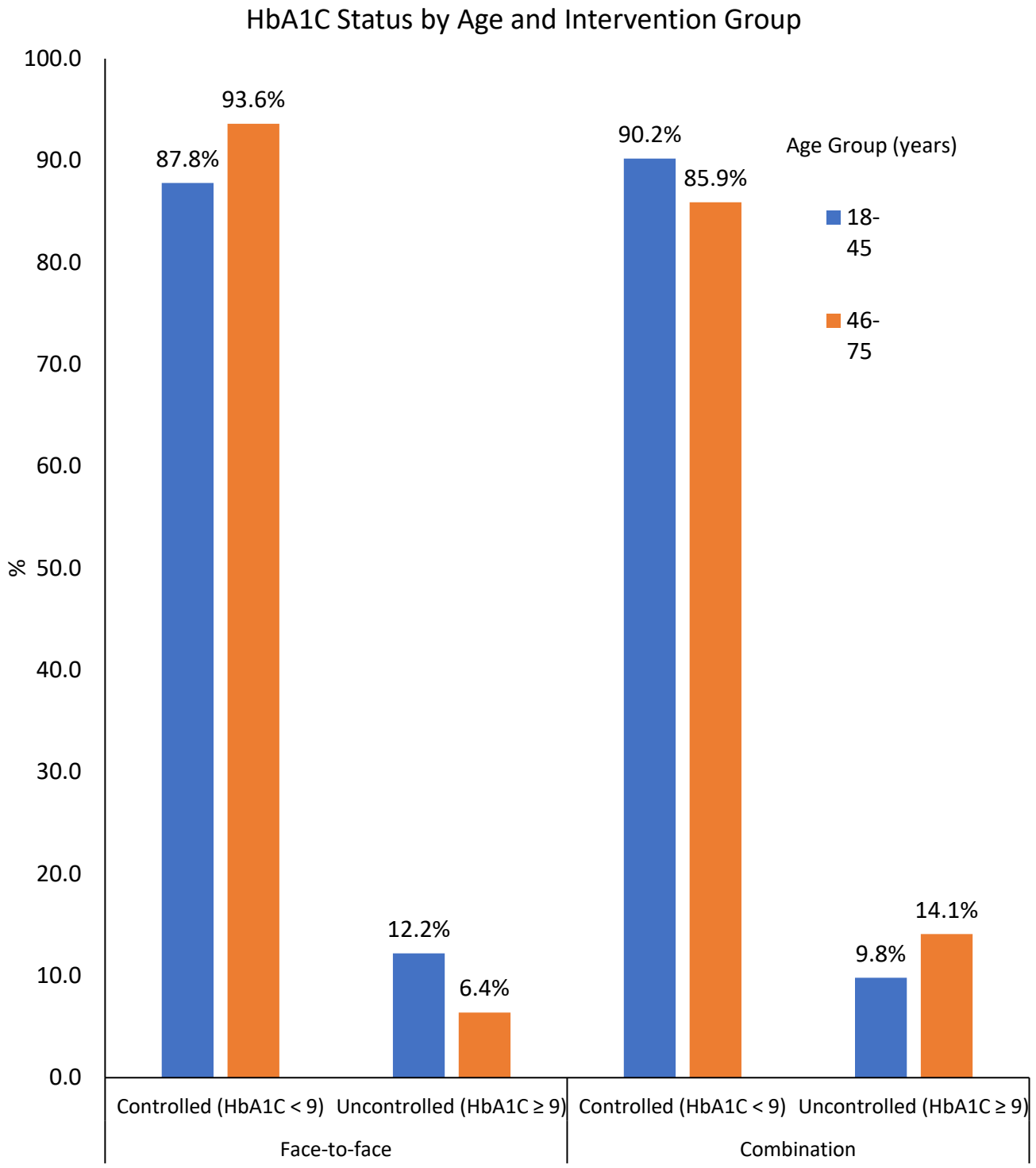
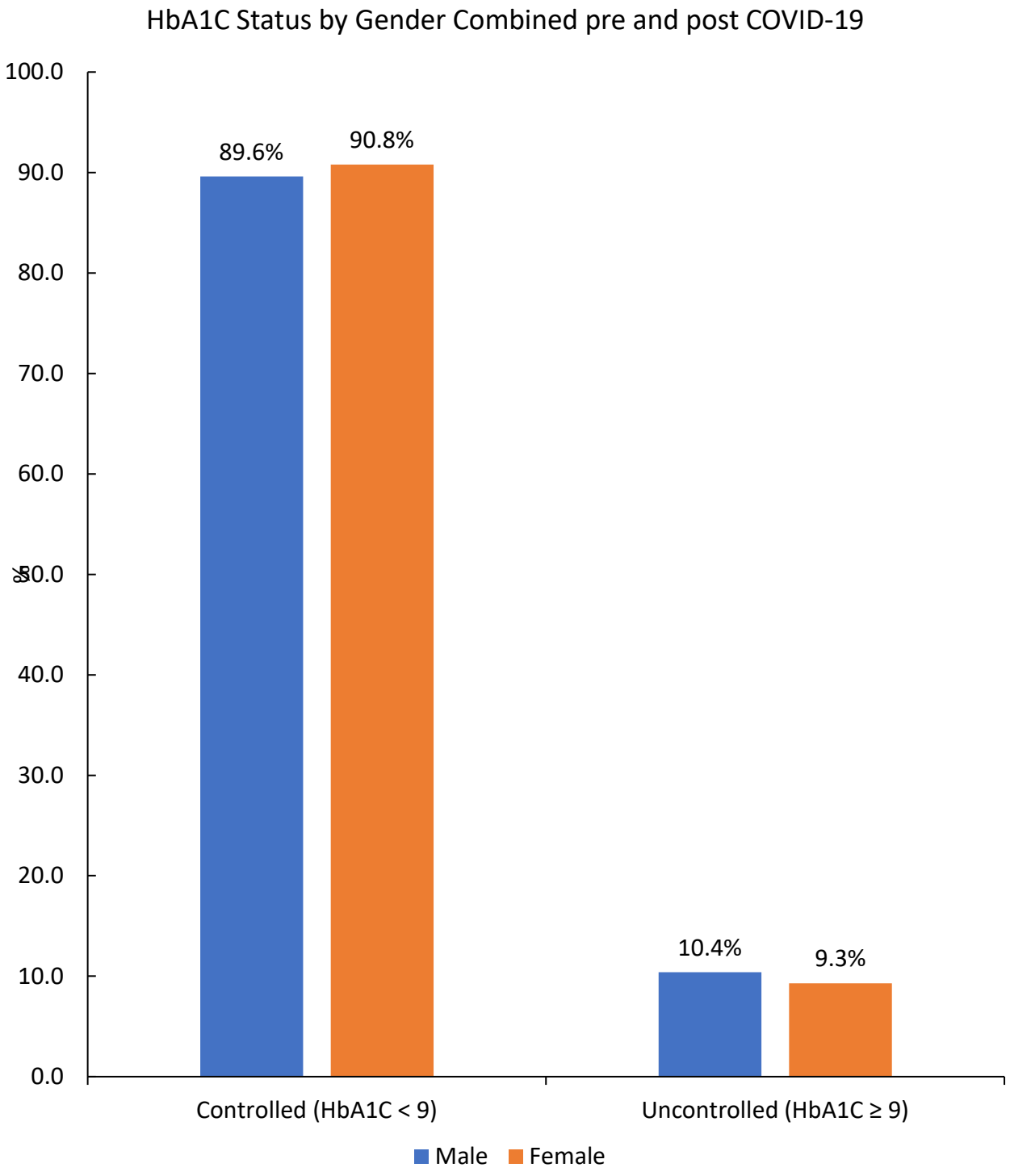


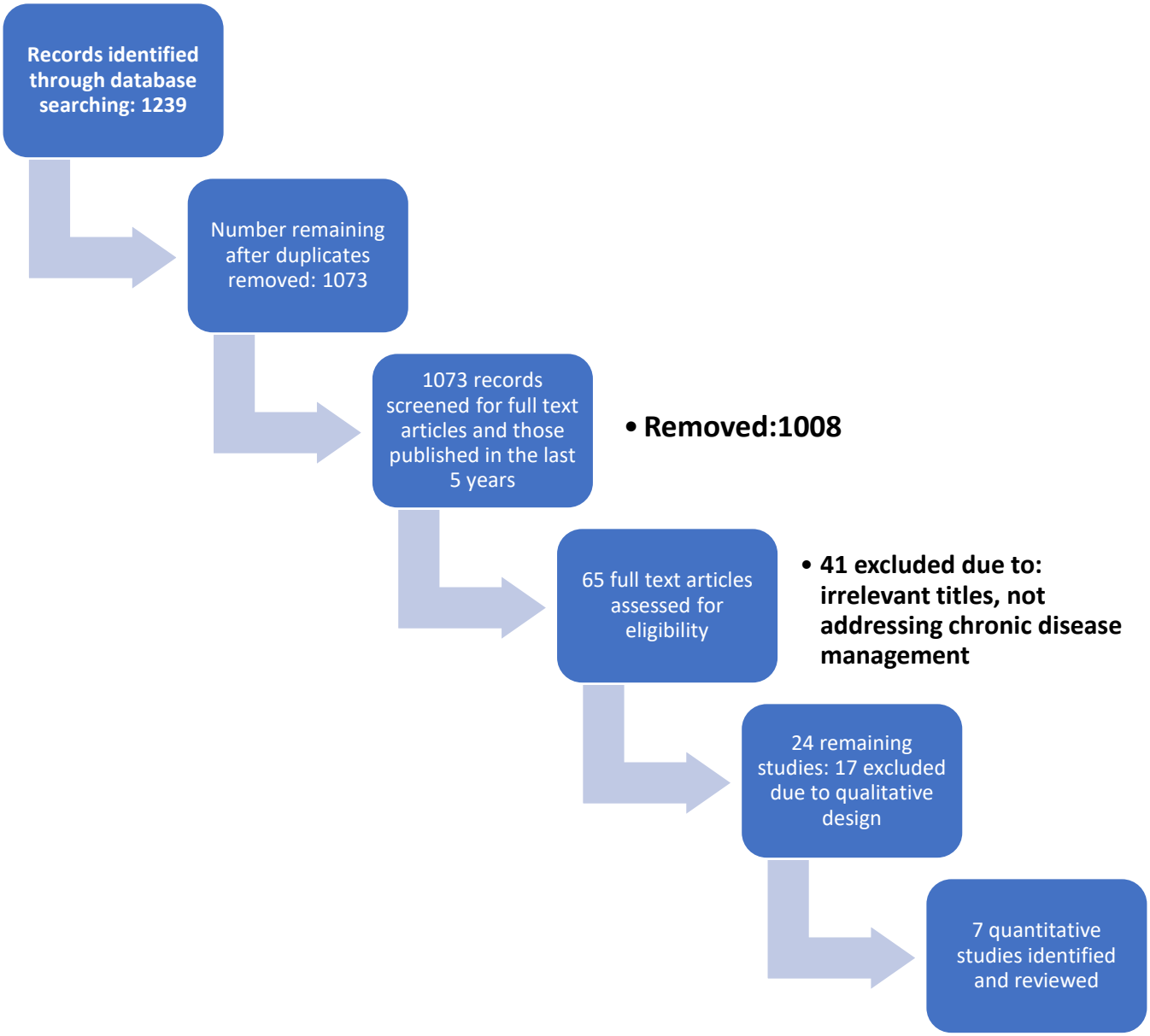
Table 4

A1C by Gender



Appendix A

PRISMA Flow of Information Through Phases of Review



Appendix B

IRB Approval North Mississippi Health Services

NORTH MISSISSIPPI
HEALTH SERVICES

INSTITUTIONAL REVIEW BOARD

September 20, 2021

Whitney Sparks, NP-C
27 Main Street
Belmont, MS 38827

Dear Ms. Sparks:

The North Mississippi Health Services Institutional Review Board (NMHS IRB) received the following:

- IRB submission form
- Study description
- Data collection form

These items were received for the following project:

Title: Diabetes Management in Rural Mississippi Before and During the COVID 19 Pandemic: A Program Evaluation

As your project is, the NMHS IRB has determined the following:

- The project is not a systematic investigation, including research development testing and evaluation, designed to develop or contribute to generalizable knowledge
- The project does not involve any intervention or interaction with a living individual

With these determinations, your project does not meet the criteria for human subjects research. Therefore, IRB oversight is not required. All of the information associated with this project will be kept in the appropriate NMHS IRB file.

Sincerely,

Jeannine Peters

Jeannine Peters, PharmD
IRB Manager

JP/at

cc. Dr. Robin Bartlett (University of Alabama Capstone College of Nursing)

835 South Gloster Street
Tupelo, Mississippi 38801

Appendix C

IRB Approval from The University of Alabama

THE UNIVERSITY OF ALABAMA | Office of the Vice President for Research & Economic Development
Office for Research Compliance

October 21, 2021

Whitney Bonner
Capstone College of Nursing
The University of Alabama
Box 870358

Re: IRB # 21-10-5051: "Diabetes Management in Rural Mississippi Before and During the COVID 19 Pandemic: A Program Evaluation"

Dear Whitney Bonner,

The University of Alabama Institutional Review Board has granted approval for your proposed research. Your application has been given exempt approval according to 45 CFR part 46. Approval has been given under exempt review category 4(ii) as outlined below:

(4) Secondary research for which consent is not required: Secondary research uses of identifiable private information or identifiable biospecimens, if: (ii) Information, which may include information about biospecimens, is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained directly or through identifiers linked to the subjects, the investigator does not contact the subjects, and the investigator will not re-identify subjects.

The approval for your application will lapse on October 20, 2022. If your research will continue beyond this date, please submit the annual report to the IRB as required by the University policy before the lapse. Please note, any modifications made in research design, methodology, or procedures must be submitted to and approved by the IRB before implementation. Please submit a final report form when the study is complete.

Sincerely,

Carpantato T. Myles, MSM, CIM, CIP
Director & Research Compliance Officer

Jossup Building | Box 870127 | Tuscaloosa, AL 35487-0127
205-348-8461 | Fax 205-348-7189 | Toll Free 1-877-820-3066

Appendix D

Letter of Support

NORTH MISSISSIPPI
MEDICAL CENTER
BELMONT FAMILY MEDICAL CLINIC
A Division of Tishomingo Health Services

To Whom it May Concern,

Belmont Family Medical Clinic fully supports Whitney Bonner Sparks, DNP student as she performs a retrospective review of A1C findings to evaluate the impact of telemedicine in the management of type 2 diabetes in our clinic. We agree that this program evaluation could yield beneficial information for the future care of our patients with type 2 diabetes.

Sincerely,

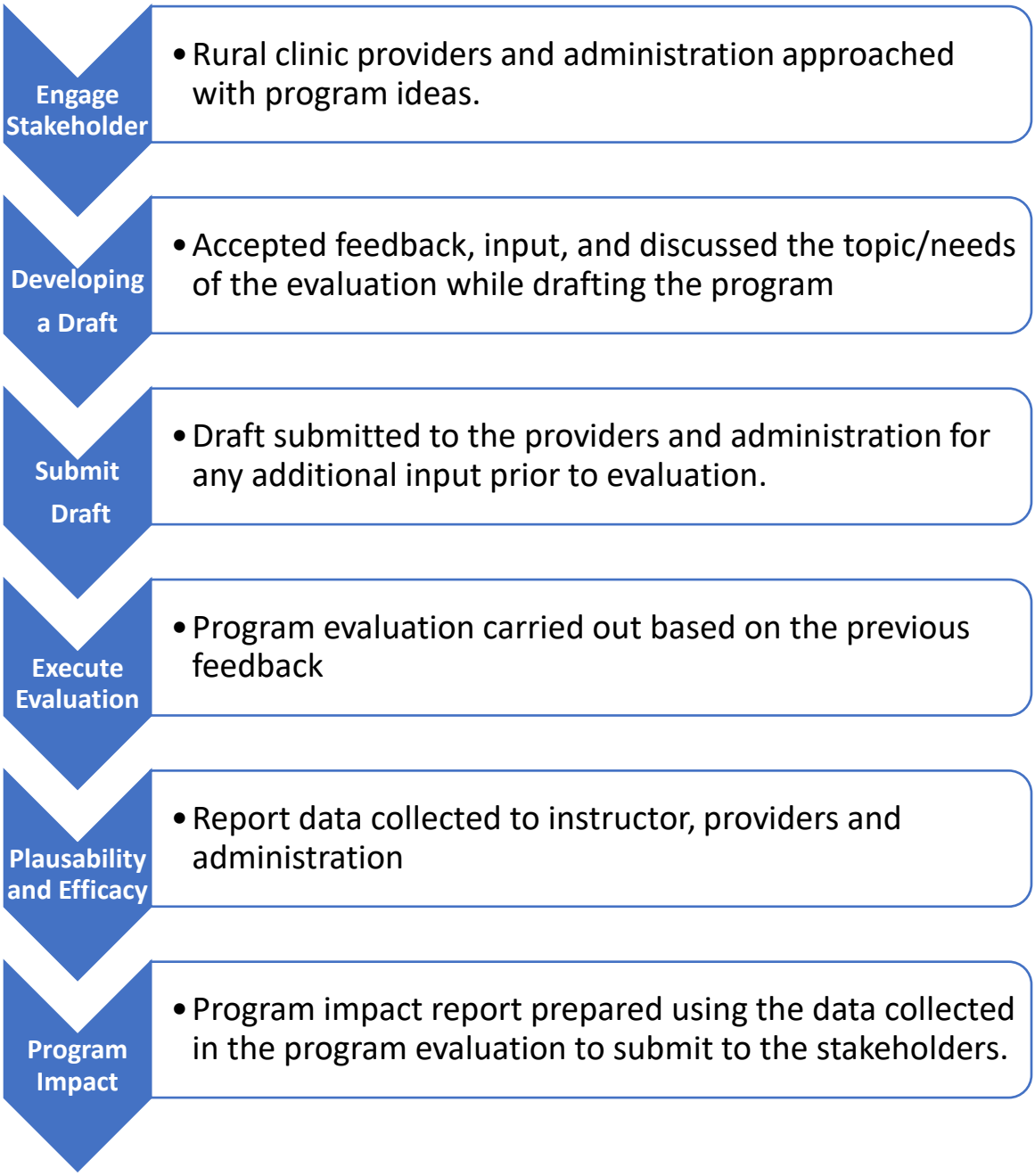
Hannah Hamm

Hannah Hamm,
Office Manager

26 Third Street • Belmont, Mississippi 38827
(662) 454-4520 • (662) 454-4521

Appendix E

Theory-Based Conceptual Framework



Appendix F

Timeline for program evaluation