Continuous Glucose Monitoring in Low-Income Patients

Broad Street Clinic

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1.0 Summary

This research will examine diabetic patients at the Broad Street Clinics attitudes and perceptions towards continuous glucose monitoring devices. A survey will be distributed to a sample of diabetic patients to measure how they feel about using a continuous glucose monitor, their receptiveness to using the monitor in the future, and any barriers that would prevent them from this type of self-managing technique. Additionally, their satisfaction with their current monitor will be assessed. There is a need to address the management of diabetes to prevent the progression of this disease locally in Carteret County in low-income individuals. This need is due to the disease ranking within the top ten causes of death in the county and achieving higher death rates than the state average.

2.0 Project Description

    2.1 Rationale

Diabetes mellitus is a disease of inadequate control of blood levels of glucose. Continuous glucose monitoring (CGM) uses devices that can measure interstitial glucose concentrations over consistent intervals for several days. Diabetes prevalence is substantially higher in rural populations in comparison to urban populations (Towne et al., 2017). In the rural areas of Carteret County, North Carolina diabetes is the eighth leading cause of death. With 10.4 percent of people living in poverty in the county, residents are faced with challenges that prevent them from managing this disease autonomously (Carteret Health Department, 2019). Although diet quality has improved in the U.S. overall, a cross-sectional analysis reported that adults with both diabetes and low SES and/or food insecurity experience important disparities in diet quality (Orr et al., 2019). As this is one of the major self-management techniques for diabetes it is critical to evaluate the needs of people in Carteret County, especially those receiving free

services at the Broad Street Clinic (located in Morehead City, NC). One study that used the Southern Community Cohort found rates of obesity-associated diabetes were exceptionally high among low-income adults (Conway et al., 2018). To avoid increases in diabetes prevalence in future years, it is important to cease obesity rates as a preventive measure in these populations. Another cross-sectional study found that living in a poor neighborhood increased the odds of having diabetes for poor blacks and whites (Gaskin et al., 2014). For the community to address these needs, policymakers should address the problems that are created by concentrated poverty, for example, the lack of access to reasonable priced fruits and vegetables.

A literature review conducted on CGM displayed the results from using these monitors in relevance to a patient's HbA1c. Following the outcomes of these studies, Ehrhardt et al. concluded that using Real Time-Continuous Glucose Monitoring should be used as a prevention tool for managing diabetes. These devices can be involved with adjusting to lifestyle changes, weight reduction, and potential decrease to insulin and other medications in patients with type 2 diabetes. Other studies have declared CGM as a beneficial use for type 2 patients including the elderly as well (Azhar et al., 2020). Along with CGM use is self-managing this disease, with the help of the provider as well. One study found that participants felt providers were not adequately equipped to deal with the different cultural and social aspects that come along with the self-management of diabetes (Aweko et al.,2018). This is important to acknowledge when administering these devices in a clinical setting, like the Broad Street Clinic, to recognize the existing knowledge related to diabetes and CGM published.

Lastly, CGM devices have been proven effective at lowering patients HbA1c and the incidence of glycemia. However, it is important to note that the benefits from this self-managing technique require adherence to the continuous use of the device which has only been attained in a

small minority of people with type 1 diabetes (Engler, 2018). The advantages from these devices can depend on the patient population, being the need to research this topic specifically at the Broad Street Clinic before determining if it is a feasible treatment method. As many of the patients at the clinic have type two diabetes, it is critical to evaluate the perceptions of individual engagement and adherence to consistent use with continuous glucose monitoring in this setting.

The research conducted at the Broad Street Clinic will be similar to the studies described above by acknowledging the challenges that come with self-managing diabetes in low-income settings. However, this study is innovative by investigating self-management perceptions through CGM in low-income patients. We aim to demonstrate CGM, as an alternative approach to care for patients with diabetes that typically have higher prevalence of the disease due to their income. We hypothesize that patients at the Broad Street Clinic will be receptive to CGM. Following this quality improvement research, it can then be determined if this treatment approach will be feasible and effective in a free clinic setting through futher investigation.

2.2 Objectives

The primary objective of this study is to determine if diabetic patients at the Broad Street Clinic are receptive to using a continuous glucose monitoring device to manage their disease. Aim one will measure the prevalence of satisfaction with current glucose monitor. Through a paper and telephone administered survey, respondents will rate their attitudes toward their current monitor using a selected portion of the Glucose Monitoring Satisfaction Survey (GMSS). The second aim of the study will assess patients' perceptions, barriers, and receptiveness to using CGM's through this survey as well. The proposed study will establish if underinsured or uninsured diabetic patients are willing to consider and self-manage their disease with a continuous glucose monitor. This study intends to provide supporting evidence for CGM

research in free-based clinical settings to determine if further research is needed. If patients are receptive further investigation can be done to explore if devices are feasible and effective for this specific population.

2.3 Methodology

This research is a cross-sectional study design that was done by administering an in-person paper interviewer and telephone questionnaire. Data was collected from self-reported attitudes and perceptions related to CGM. Participants were identified through a medical record report that classified the patient as diabetic by their HbA1c. To be considered in the diabetic range, one's HbA1c test levels will measure above 6.5% at some point in their lifetime (American Diabetes Association, n.d.). HbA1c is a measure of how well blood glucose has been controlled over the last three months. A sample of blood is collected through a finger stick, without fasting and is tested on a DCA Vantage Analyzer at the Broad Street Clinic or from another laboratory result, calculating a participant's HbA1c levels within 6 minutes.

Individuals were enrolled after being asked at a scheduled doctor's visit if they would complete the survey or if they agreed to participate via telephone after being chosen from a report. Those eligible for this study include any adult over the age of 18, and 65 years of age or younger. This age restriction is due to the requirements for being a patient at the clinic. The clinic only permits adults to be treated, however, no individual over the age of 65 can be a patient due to eligibility for Medicare. Participants of any race or gender are to be included in this study. Additionally, only individuals who can read or speak the English language and/or have a translator should participate in this study due to the survey being offered in this language. Type 1 and 2 diabetes patients are qualified to complete the questionnaire as well. Enrollment will occur starting July 12th and end on July 15th. The report of diabetic patients' names along

with their HbA1c were obtained from records at the clinic. From this report participants were called alphabetically down the list. Those who answered on the first call and agreed to participate after hearing about the proposed survey were enrolled into the survey. The sample size was derived from the respondents that chose to engage in participation by completing the survey. The target sample size was between 20 and 40 people.

2.4 Data Collection

The survey questions deployed were determined based off of the variables needed to measure the outcome. Questions related to demographics, current monitor satisfaction, and patients' perceptions, barriers, and receptiveness to using CGM's were included in the survey. Most questions were designed to be closed ended to minimize respondent error and increase consistency among answers. Questions were adapted and revised from existing surveys such as, The Glucose Monitoring Satisfaction Survey (GMSS) and from the Engler et al. study survey.

Attitudes toward current monitor will be measured by questions from the GMSS. This variable will be recoded from the Likert-like scale into either agree or disagree categories, excluding neutral, to create a bivariate variable. This variable will be categorized into two labels indicating openness and behavioral burden to score the correct question. Questions "Helps you feel more satisfied with how things are going with your diabetes" and "Helps you be more open to new experiences in life" will be sorted into openness. Questions "Takes too much time to use," "Is too much of a hassle to use," "Causes too many skin irritations or bruises," and "Is too painful to use" will be in the behavioral burden category. Barriers to prevention of CGM use will be analyzed on an individual basis to report prevalence on if respondents answered yes as a barrier. Perception of the effectiveness of CGM will be assessed if respondents answer 'yes' to both questions "Do you feel that using a CGM would help lower your A1c levels more than what

you're currently using? and "Do you think a CGM has the chance for you to change your current diet and exercise routines." The primary outcome of the study is receptiveness to a glucose monitor. An individual will be considered receptive to using a continuous glucose monitor if they answer 'yes' to the question "Would you agree to wear a CGM in the future if it was provided to you at no cost?"

2.5 Data Management and Analysis

The questionnaire was created in REDCap to be printed off and administered to participants. As respondents complete the questionnaire, data will be entered into an Excel spread sheet to be analyzed. Due to the survey being offered in two different versions, in-person and telephone, manual entry into Excel made the analysis simpler. Manual data entry ensured there were no missing fields, when applicable. Data was then imported into SPSS to compute prevalence and graphing representation. Means, counts and frequencies will be computed.

2.6 Results

Among the 28 respondents who were administered the survey, 26 respondents fully completed the questionnaire. One survey was stopped halfway through the interview due to the inability to understand questions being asked in the English language even with a translator. The other incomplete survey had unanswered perception questions due to the participant already using a continuous glucose monitor previously. Between June 12, 2021 and June 15, 2021 individuals were contacted to ask for voluntary participation to answer survey questions related to their diabetes management. Of the total 28 respondents who answered the first question, "Currently, which type of device do you use to monitor your blood sugar on an everyday basis?" 92.9% of people used a blood glucose meter. Relating to openness to a new monitor, 78.6% agree that their current monitor helps them feel satisfied with how thing are going with their

diabetes. Additionally, 75.0% agree that it helps them understand how food and activity affect them and 64.3% agree that it helps them be more open to new experiences in life. When behavioral burden was measured, 82.1% of respondents disagreed that their monitor took too much time to use. Also, 67.9% disagree that their current monitor is too much of a hassle to use and disagree that it causes too many skin irritations or bruises. Lastly, 71.4% of people disagreed that it was too painful to use. Female respondents consisted of 64.3% of the sample, while males made up 35.7%. Majority of individuals (53.6%) were in the 55-64 age group range.

When assessing respondent's perception of continuous glucose monitoring, 82.1% had heard of a CGM and almost all of participants (96.4%) of people had not used a CGM before. Only 46.4% of people reported they would be very comfortable controlling their sugar levels with a CGM, with 35.7% of people responding they would be somewhat comfortable. Individuals were also asked hypothetical questions relating to how a CGM would affect their diabetes management. Of the 26 complete interviews, 60.7% felt that using a CGM would help lower their A1c levels more than what they currently are, and 63.4% of people felt that a CGM would have the chance for themselves to change their diet and exercise routines. After recoding to quantify perception of effectiveness, 17 individuals (60.7%), were categorized as having a positive opinion.

Following measuring barriers to wearing a CGM, 60.7% of people stated that being uncomfortable and if there was painful application during wear, it would prevent them from wearing a CGM. Also, 64.3% of people indicated that cost would be a barrier to preventing the use of a monitor as well. Conversely, only 32.1% of respondents displayed that being satisfied with their current monitor, the adhesive not holding, and it being too complicated to use would prevent them from using a CGM. Only 28.6% of individuals feel how the sensor looks on the

body would not make them want to use a CGM, and 46.6% of people said the technological requirements would prevent the use. Lastly, a higher prevalence of people 57.1% said being that being the device is attached to their body and skin irritation because of the adhesive would prevent the use of a device. Finally, the main goal to determine if patients are receptive to CGM. When asked if participants would agree to wear one in the future 67.9% of respondents indicated 'yes' they would, while 17.9% said 'no' and 10.7% said 'maybe'.

3.0 Discussion

This study explored the satisfaction of current glucose monitor use and the perceptiveness of, barriers to, and receptiveness of continuous glucose monitoring. Evidence was provided that diabetic patients at the Broad Street Clinic are receptive to continuous glucose monitoring, however, there is a small decreased prevalence of positive perception compared to receptiveness. Additionally, it is important to note that a substantial majority of people are satisfied with their current monitor. The high prevalence of openness/understanding of their current monitor and the high prevalence of disagreement with the behavioral burden can explain this. When considering the barriers and satisfaction among respondents, this study indicates there would still be a need for future research to see if CGM would be feasible and effective in a free clinic setting.

3.1 Strengths and Limitations

This study had some strengths and several limitations as well. One important limitation was the lack of a planned detailed contact protocol and sampling plan. Since the record list was called down in alphabetical order, there was non-probability sampling which could have led to biases among the results, potentially describing the differences among gender representation. Additionally, not having a formal contact protocol could also lead to biases as well if everyone is not given the same and equal opportunity to be contacted. Having a mix of in-person and

telephone survey method is also another limitation to this study. Being there were two different methods, in-person respondents could have gotten the opportunity to understand questions more in person. Due to the literacy level among patients in the clinic, there was a literacy barrier to medical terms observed by the interviewer during the questionnaire. Along with literacy barrier, there was also a language barrier that led to the incompletion of one survey even with a translator. Lastly, it seemed only having closed ended questions was a limitation to this study because many of respondents felt the need to answer the question open-endedly rather than choosing from the answer choices provided. However, by using closed ended questions, data was able to be quantified into simpler variables to be analyzed. Strengths to this study were obtaining a high response rate and incorporating novel research relating to continuous glucose monitoring in a free clinic setting.

3.2 Conclusion

These results suggest that further research to determine if continuous glucose monitoring would be effective at the Broad Street Clinic is still needed. This information displays most diabetic patients are content with their self-management of their disease, and changing their monitor is unnecessary for satisfaction reasons. However, this did not address whether using a CGM would lower their HbA1c more than their current levels after constant monitoring. Although a higher percentage of individuals were interested in wearing a continuous glucose monitor, the evidence provided shows obtaining these devices would not be feasible for the clinic to outweigh the perception and barriers that respondents displayed. If these devices were widely available with minimal cost to the clinic, the feasibility related to effectiveness is not hypothesized to be an obstacle. Knowing this information has the potential to change the results associated with feasibility and effectiveness, after this data showed current monitor satisfaction

and high prevalence barriers. Perception can often be different from the reality, therefore continuing this research to test effectiveness is still necessary.

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