A Produce-Based Type 2 Diabetes Curriculum Intervention

THESIS

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By

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Abstract

Purpose: The goal of this study is to determine the feasibility and acceptability of an adapted Type 2 diabetes mellitus (T2DM) self-management (DSME) curriculum with a produce provisioning component in an urban, underserved population.

Methods: A mixed methods approach consisted of a one group, pretest-posttest, 3-month follow-up design with a post-intervention focus group. Adults residing in the Near East side of Columbus, with poor glycemic control (HbA1c >7.0%), enrolled in Medicare and Medicaid, and patients of the Ohio State University CarePoint East Clinic were recruited by phone. Participants received the evidence-based DSME weekly for four consecutive weeks led by a Medical Dietetics graduate student. Sessions included information on diabetes management; the ABC's of diabetes, nutrition for diabetes, and getting routine care. Opportunities for tasting vegetables were included as well as recipes. Outcome measures included diabetes knowledge, blood glucose self-management, vegetable intakes, and food insecurity.

Results: Participants (n=6) were mostly female, aged 60 or older, and African American. Diabetes related knowledge increased in six out of eleven survey categories, including goal setting, mental health, and problem solving. HbA1c decreased (mean 8.2 to 7.8). Focus group participants (n=4) enjoyed and utilized the fresh produce provided with the intervention and continued to use them post intervention.

Conclusions: DSME is an important component of diabetes care. Combining fresh produce with DSME interventions can improve access and intake of vegetables, diet quality, food insecurity, and potentially glycemic control. DSME with a fresh produce component is feasible with low-

income populations. Future studies should focus on evaluating the efficacy of similar

interventions.

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Chapter 1: Introduction

Background of the Problem

Diabetes, the 7th leading cause of death in the US, is characterized by the progressive

worsening of glycemic control related to insulin resistance in type 2 diabetes mellitus (T2DM).[1]

More than 30 million Americans currently have diabetes mellitus, with at least 90 percent of

those cases classified as T2DM.[2,3] Disparate populations may be at an increased risk of

developing T2DM; ethnic minorities in the United States have increased risk from two to six

times greater than white, non-Hispanics. African Americans are at 77 percent greater risk, and

Hispanic/Latino individuals 66 percent greater risk than white, non-Hispanic individuals.[4]

According to the 2017 National Diabetes Statistics Report, from 1994 to 2015 diabetes

incidence rates nearly doubled from 5.5 percent to 9.4 percent of the adult US population. By

2050, the CDC estimates that one out of every three adults may have diabetes.[3,5] Ohioans face a

similar diabetes burden as the rest of the country. Recent estimates indicate that 9.5 percent, or

over 1 million individuals in Ohio have been diagnosed with diabetes.[6] Franklin county adult

diabetes prevalence is 9.9 percent.[7]

A diabetes diagnosis is associated with increased morbidity and mortality. Individuals

with diabetes tend to live fewer years. The life expectancy of an individual with diabetes has

increased, with better management practices and tighter glycemic targets decreasing the risk

for complications. Mortality rates due to diabetes have decreased, though they are still elevated

relative to healthy individuals.[8] Individuals with diabetes were found to live 4.6-5.7 fewer years

than those without, based on a cohort of people who were 50 years and older. Years spent without disability were also decreased in those with diabetes versus those without.[9]

Increased mortality rates in those with diabetes is largely due to increased risk for cardiovascular disease, stroke, kidney disease and cancer.[10] Individuals with diabetes develop cardiovascular disease as a result of atherosclerosis and metabolic syndrome.[11]

As diabetes progresses the likelihood of complications increases. Most complications resulting from diabetes can be classified as microvascular and macrovascular. Microvascular complications involve the nerves, kidneys, and eyes, while macrovascular complications impact the heart and arteries.[11] Approximately 10,000 individuals per year lose their vision due to diabetic retinopathy; individuals with uncontrolled diabetes or persistent hyperglycemia and high blood pressure have a greater risk than those who have normal blood pressure.[11] Renal complications are an additional burden on those with diabetes, from abnormal kidney function to end stage renal disease.[12] Renal failure in the United States is largely caused by degenerative changes to the kidneys as a result of diabetes.[11] Finally, neuropathy involves the improper function of nerves due to the effects of hyperglycemia over time. Neuropathy itself can cause pain or tingling in the affected regions, and wounds that remain untreated due to the lack of sensation may lead to ulceration or amputation.[11]

Diabetes and the complications of the disease pose an economic burden on the nation and the individual. The estimated total yearly costs of diabetes in 2017 amounted to $327 billion, a result of $237 billion in medical costs and $90 billion due to decreased work output.[13] Individuals with diabetes spend 2.3 times more on medical care than those without the disease. The cost of diabetes yearly in Ohio is estimated to be $12 billion; including direct medical costs and indirect productivity loss.[7]

Socioeconomic factors such as education, income and age increase a person's risk for diabetes. Approximately 12.6 percent of adults in the U.S. who did not graduate from high school have diabetes versus 7.2 percent of those with greater than high school education. Income levels of $50,000 yearly and above were associated with a 6.8 percent risk for diabetes compared to a 10 to 15 percent risk for annual income levels below $50,000.[6] Age is an additional risk factor for diabetes,[14] with rates as high as 25 percent of the population above 65 years old.[3] As the population ages it is predicted that the incidence of diabetes will continue to rapidly increase. In Franklin County, an estimated 8.2 percent of individuals lived below the poverty income level and over 14 percent of residents 25 years and older had less than a high school education. An estimated 13.5-15.5 percent of Ohioans have been diagnosed with diabetes in the income range below $50,000 annually, versus 6.7-8.1 percent of individuals with incomes greater than $50,000.[6]

Low income urban dwellers experience unique challenges in diabetes self-management. Low income individuals report a lower degree of health than those individuals who make more money; fair or poor health was reported by 22.8 percent of people who earned less than $35,000 yearly versus just 7 percent in individuals who made $75,000-99,999 and 5.6 percent in those who earned $100,000 or greater. Low income individuals are less likely to have a primary care provider than their wealthier counterparts.[15] The wealthiest one percent of individuals in the US will like 10-15 years longer than the poorest one percent.[16]

Low income was found to predict increased risk for developing T2DM in a Canadian study; low income individuals had a four-time greater risk of diabetes than the top income group in Canada. More frequent periods of low income, versus fewer or a single instance, resulted in increased risk for developing diabetes.[17] Low income is also linked with a higher

degree of physical inactivity, an important consideration in general as well as diabetes-related health.[18]

The United States Department of Agriculture (USDA) has identified food security as a continuum on which individuals exist, and can move from one end of the spectrum to the other. Food security is officially defined as "access by all people at all times to enough food for an active, healthy life."[19] High food security exists for those who do not have problems getting the types and amount of food needed to live a healthy life, while very low food security indicates that eating patterns have become disrupted and consumption of food has decreased to a significant degree. Those who are food insecure are more likely to reduce the size of or frequency of meals, worry about food, and/or have difficulty making food last long enough.[19] In the United States, 12.3 percent or 15.6 million households were food insecure during 2016. Black, non-Hispanic households were more likely to be food insecure at a rate of 22.5 percent, Hispanic households at a rate of 18.5 percent, and households under 185 percent of the Federal Poverty Line at a rate of 31.6 percent. Non-Hispanic white households experience food insecurity at a rate of 9 percent.[20] Food insecurity was independently associated in U.S. adults over the age of 55 with being part of a minority and diabetes diagnosis.[21] Very low food security was most prevalent in Black, non-Hispanic, Hispanic, urban cities and rural regions, and impoverished households than in most other subgroups.[19] Ohioans experience above-average rates of food insecurity compared to national averages.[22]

Diabetes prevalence increases with the degree of food insecurity; mildly food insecure households had a 10.2 percent diabetes prevalence, versus 16.1 percent in severely food insecure households, although factors that influence both food insecurity and T2DM including income were not included in this study as the focus was on levels of food security.[23] A long scale study revealed that food insecure households face a 50 percent increased risk for diabetes than

households that have adequate food.[23] Food insecure individuals tend to have higher glycated

hemoglobin (HbA1c) levels than individuals who have a greater degree of food security.[24,25] Food

insecure individuals tend to face difficulties in purchasing foods appropriate for diabetes.[25,26] An

additional stressor for the food insecure individual with diabetes is the cost of purchasing the

food appropriate for their chronic disease while juggling other costs such as medication and

other costs required for daily life.[23]

Low household income is linked to an increased prevalence of mental health

problems.[27,28] Poverty is associated with higher levels of stress, anxiety, and depression, while

existing psychological issues can also predict for lower income. Neighborhoods in which low

income individuals reside tend also to have fewer resources and further contribute to the strain

on mental health. Individuals who are low income are also less likely to receive the care needed

to improve mental health.[27] Decreased mental health status may result in poorer diabetes

management and increase risk for diabetes-related complications.[29] Individual with diabetes

have a two times greater risk for diagnosis with major depressive disorder compared to

individuals who do not have diabetes (Type I or II). Furthermore, depression results in poorer

self-care with diabetes, increasing the rate of complications, worsening glycemic control,

quality of life,[29] glucose monitoring, exercise,[30] and dietary guideline adherence.[31] Individuals

who were food insecure also were more likely to report higher levels of depression and diabetes

distress than those who were food secure. [24] Individuals in one study reported that stress

increased their likelihood of over-eating and making poor dietary decisions.[26]

Problem Statement

Diabetes prevalence is higher among low-income, urban individuals (<$50,000 annually)

and/or those with low educational attainment (less than high school education). Individuals who

are low income and live in the urban setting may find it difficult to access healthy foods due to

geographic and economic barriers, and concern for long-term health effects may come

secondary to the need to feed themselves. Minority populations tend to consume more fat and

fewer fruits and vegetables than other population groups in addition to having higher rates of

food insecurity.[22] In a cross-sectional study on low income individuals with diabetes, the degree

of education and health literacy impacted the rates at which HbA1c targets were met.[32] Target

levels for those with diabetes, as set forth by the American Diabetes Association (ADA) include

pre-meal blood glucose from 80-130 mg/dL, peak post-meal blood glucose of <180mg/dL, and

HbA1c of <7.0 percent.[33] Socioeconomic status is widely considered to be a barrier to diabetes

management, which has led to an increased number of interventions focusing on improving

health literacy and critical thinking skills particularly in underserved populations.[13]

Food insecurity is likely to be linked to poorer glycemic control due in part to decreased

ability to choose healthy foods that adhere to diabetic diet guidelines. While nearly half of low

income adults were found to be unable to bring their HbA1c ≤7 percent, the National Health and

Nutrition Examination Survey revealed that this percentage may even be higher. Researchers

found that 69 percent of those who reported food insecurity were unable to bring their HbA1c

below the 7 percent target.[23] A 2013 prospective cohort study over 37 months revealed that

food insecurity and increased HbA1c levels were positively correlated, with an HbA1c increase of

approximately 0.6 percent in the food insecure.[34]

Additionally, low income individuals living in urban neighborhoods tend to have poorer

access to fresh fruits and vegetables than individuals who live in higher income areas or those

with a lower density of ethnic minority individuals.[35] Lower proximity of grocery stores

combined with the decreased buying power associated with low income results in decreased

intake of produce and increased intake of processed or other foods with low nutrient but high

caloric density. Additionally, fewer stores were found in proximity to where individuals with

diabetes lived, however, proximity of grocery stores was less likely to predict poor glycemic control than was food insecurity.[34]

Although diabetes is a serious, costly, and common, it is a manageable disease.[36] Diabetes management involves daily self-care activities, as well as regular follow-ups with medical professional team to ensure that long-term glycemic targets are met and other health indicators continue to remain within normal limits. The National Institute of Diabetes and Digestive and Kidney Diseases has simplified the tenets of diabetes care into the ABCS; HbA1c testing, Blood pressure, Cholesterol, and Stop smoking.[36] This simple mnemonic indicates the important factors of diabetes management and may enable participants to begin to understand the core components of keeping their disease under control.

Behavior change may slow the disease progress of T2DM, however food insecure individuals are unlikely to experience the full benefit of an intervention if they do not have ready access to fresh fruits and vegetables. Increasing the availability of produce for low income individuals can be accomplished through various means. One strategy successfully employed in low income individuals was a program that increased the value of Supplemental Nutrition Assistance Program vouchers when spent at farmers markets; over five months participants increased average vegetable intake during and after the intervention, with almost 70 percent of participants using the benefit at least once.[37] A small-scale intervention in the Bronx, New York provided one hour of nutrition education and a $6 farmers market voucher; a small increase in daily fruit intake was seen in the intervention group as a result.[38] In Detroit, Michigan up to $40 in vouchers to a farmers market was provided to low income individuals with uncontrolled diabetes; HbA1c showed a statistically significant decrease post-intervention due in part to increased produce intake.[39] These HbA1c changes work in the reverse as well; increased prices of produce and low-fat dairy resulted in higher HbA1c levels after three months in individuals

with diabetes than in periods where those items were more affordable.[40] Decreasing cost of produce and healthy food items, or increasing availability such as through vouchers, could therefore be an effective means of improving glycemic control in low income individuals with diabetes.

Evidence for the efficacy of diabetes education on HbA1c exists, but an integrated diabetes education program combined with produce provisioning has not been documented in low income, urban populations.[36,41,42] While there has been increased interest in the creation of "Diabetes Gardens" to enable individuals to have greater access to fresh produce, there is little research specifically investigating the impact, if any, that this produce may have on the people who choose to utilize the provided produce. Furthermore, combining a diabetes curriculum with easy, healthy snacks and meals using the produce provided, is a novel approach. This feasibility study may serve to fill the gap in information regarding the acceptability and outcomes of a modified diabetes curriculum combined with the provision of diabetes-friendly produce items from a local garden.

Objectives:

The goal of this study is to determine the feasibility of an existing T2DM self-management curriculum with an added produce provisioning component and the acceptability of a Type 2 diabetes intervention in an urban, underserved population.

The objectives were to:

1. Determine the feasibility of existing type 2 diabetes curriculum with the added produce provisioning component related to:

    a. Acceptability, how participants reacted to the intervention

    b. Implementation, the likelihood, and manner to which the intervention can be fully implemented as planned and proposed.

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c. Practicality, and the resources, time, and commitment needed to effectively implement the intervention.

d. Adaptation, the aspects of the curriculum, that is, contents or procedures that need to be changed, altered, added, or updated in the new environment

2. To determine if a shortened version of the existing diabetes curriculum helped individuals with T2DM manage their diabetes, that is, improved:

a. Knowledge related to diabetes self-management

b. Diabetes self-care behaviors related to meal management, physical activity, monitoring

c. Goal setting and problem solving

d. Quality of life

e. Food insecurity

f. Access to vegetables

Chapter 2: Literature Review

Introduction to Diabetes Incidence

The vast majority of diagnosed cases of diabetes are classified as Type 2 diabetes mellitus (T2DM). By 2050, the Center for Disease Control (CDC) estimates that one out of every three adults may have diabetes.[5] An estimated 30 percent of individuals in the U.S. with diabetes are likely to be undiagnosed due to lack of healthcare access. Certain ethnic groups tend to have higher rates of diabetes in the United States. Alaskan Natives, American Indians, non-Hispanic blacks, and Hispanic individuals are diagnosed with diabetes more frequently than non-Hispanic whites and Asians.[43] Individuals with lower levels of education tend to also be diagnosed with diabetes more frequently than their more educated counterparts; those with less than a high school education have a 12.6 percent prevalence of diabetes, while those who completed high school have a prevalence of 9.5 percent. Furthermore, greater than a high school education indicated reduced risk of diabetes, with 7.2 percent of diabetes cases attributed to those with higher education.[43]

Rates of diabetes increase with age; in 2015 approximately 1.5 million individuals were diagnosed with diabetes, more than half of which were individuals between the ages of 45-64.[43] The age group of 65 and older has a high prevalence of poor glycemic control; individuals within this age range may account for 55 percent of all diagnosed diabetes cases by 2050. Diagnosed and estimated undiagnosed diabetes rates increase with age; the 18-44 age group is estimated to have diabetes at a rate of 4.6 percent. The estimated rate of diabetes increases approximately 10 percent in the 45-64 age group to 14.3 percent. The 65 and older age group

has slightly decreased rates of diabetes compared to previous group, at around 12 percent of that subgroup.[43]

T2DM occurs when an individual's body loses the ability to efficiently use insulin, which often results in elevated blood glucose levels, or hyperglycemia. Hyperglycemia is characterized by blood glucose above 130 mg/dl before a meal, or greater than 180 mg/dl 2 hours after a meal.[10] Diagnosis of T2DM is according to the following American Diabetes Association guidelines: HbA1c ≥6.5 percent; fasting plasma glucose ≥ 126 mg/dL; oral glucose tolerance test ≥ 200 mg/dL; or random plasma glucose ≥ 200 mg/dL.[33] Most individuals with a diagnosis of diabetes are encouraged to meet the HbA1c target of 7.0 percent, which is associated with decreased risk for complications. Goals above or below 7.0 percent may be set according to factors such as life expectancy, comorbidities, risk for hypoglycemia, and disease duration.[33] Other target levels include pre-meal blood glucose from 80-130 mg/dL, and peak post-meal blood glucose of <180mg/dL.[44]

Pancreatic β (beta) cell insulin output decreases as diabetes severity worsens, though the rate of decline is not fully understood. As insulin sensitivity decreases, individuals with diabetes or prediabetes were more likely to have a decreased insulin output versus those individuals with normal glucose tolerance.[45] Elevated blood glucose levels can cause damage to tissues and organ systems over time. Complications from diabetes include increased risk of cardiovascular disease and stroke, loss of vision, impaired kidney function, and amputations due to damage to the vascular system.[11]

Individuals who have lower levels of education or income tend to receive poorer care than those with greater means.[46] Adults without insurance who had diabetes may not seek the care they need to manage their disease due to financial and access barriers, versus low-income individuals who are covered under Medicaid. Annual health care costs related to diabetes

management may surpass yearly income for low-income individuals, underscoring the importance of programs like Medicaid which enable access to care for those who would otherwise not seek or have the means to get care.[47] Those low-income individuals who are not insured tend to not receive the care they need for a variety of reasons. Having a primary care provider and getting needed prescriptions are difficult when not insured, leading to poorer outcomes than comparably low-income individuals insured through Medicaid.[47] The economic burden of diabetes continues to rise, both in terms of personal losses and federal expenditures. Individuals with diabetes spend 2.3 times more on medical care than those without the disease.[48]

Diabetes-related Socioeconomic factors

While T2DM can be controlled with lifestyle changes such as moderate carbohydrate intake of 45-55 percent of daily caloric needs split between meals and snacks,[49] and physical activity, the determinants of health have a substantial impact on an individual's ability to manage their chronic diseases. The key social determinants of health are defined in Health People 2020 documentation as economic stability, health and healthcare, education, neighborhood and built environment, and social and community context.[50] Economic stability encompasses poverty, employment status, food insecurity, and stability of housing. Health and healthcare includes access to both health and primary care and health literacy. Education includes language and literacy, as well as levels of education and development. The neighborhood and built environment includes access to foods for health, environmental conditions, housing quality, crime, and violence. Finally, social and community context encompasses discrimination, incarceration, civic engagement, and social cohesion.[50]

The built environment includes how safe a neighborhood is, access to transportation, and healthy food options. Safety not only impacts property but also the ability a person has to

exercise outdoors or walk throughout the neighborhood either for recreation or transportation. High crime rates in neighborhoods may drive businesses elsewhere, decreasing nearby employment opportunities. Likewise, access to public transportation itself is a component that could impact ability to procure food, employment, and medical care.[51]

The degree of education and health literacy impacted the rates at which HbA1c targets were met in a cross-sectional study on low income individuals with diabetes.[52] Socioeconomic status is widely considered to be a barrier to diabetes management, as is being female which has led to an increased number of interventions focusing on improving health literacy and critical thinking skills particularly in these underserved populations.[51,53,54] A focus group conducted in minority individuals with diabetes revealed that eating in a healthy manner did not produce immediate results and was thus not prioritized by those individuals due to the difficulties of obtaining said healthy food in the environment as well as the limited understanding of how diabetes is impacted by dietary choices.[55]

Food Insecurity and Diabetes

Food insecurity is defined as the "limited or uncertain availability of nutritionally adequate and safe foods."[56] Over 14 percent of the US population has some degree of food insecurity; and individuals who are food insecure tend to have higher rates of chronic disease than those who have adequate food.[57] Individuals who are food insecure tend to have worse measures of self-care. Physical activity, dietary intakes, and taking medications are negatively impacted when an individual with diabetes is also food insecure.[58]

Laboratory measures are similarly impacted by food insecurity in those with diabetes. Individuals with diabetes were found to be more likely to have higher HbA1c levels if they were food insecure than those who lived in food secure households. Researchers found that 69 percent of those who reported food insecurity were unable to bring their HbA1c below the 7

percent target,[33] and one study found that the food insecure were more likely to have an HbA1c >9.0 percent than those who had adequate food.[59] Food insecurity is also linked to higher BMI in addition to poor glycemic control, which may exacerbate diabetes and related complications.[24,60,61] In turn, individuals who are overweight or obese are more likely to have HbA1c between 7-9 percent than lower weight individuals.[62] An intervention involving diabetes self-management revealed that food insecure individuals entered the study with greater HbA1c values than their food secure peers. Self-efficacy and produce intake were lower than the food secure. After the intervention, however, the food insecure individuals had HbA1c levels decrease by 0.38 percent versus 0.01 percent in the food secure.[63]

According to 2011-2014 NHANES analyses, 8.5 percent of people with prediabetes were food insecure and 10 percent of people with diabetes were food insecure in the previous year.[64] The costs of diabetes medications can be prohibitive, especially among the food insecure. Those households that reported food insecurity on the 2011 National Health Interview Survey had increased rates of cutting back on medication compliance; moderately food insecure individuals scrimped at a rate of 27.7 percent, while 45.6 percent of food insecure individuals indicated that they had cut back on the medications they needed to control diabetes.[65] These findings highlight several problems; namely the inability to afford the types or amounts of foods required for a healthy life, as well as the inability to afford the medications prescribed to manage diabetes.

Food insecure individuals with diabetes may benefit from programs such as the Supplemental Nutrition Assistance Program (SNAP); while food insecurity has a detrimental impact on glycemic control, SNAP recipients were found to have better control despite their food insecure status.[61] Food pantries exist to serve these individuals who cannot guarantee diet adequacy without assistance, however even those resources are limited. A systematic review indicated that the types and amounts of foods available from food pantries are unlikely to

provide adequate amounts of micronutrients such as calcium, and vitamins A and C.[66] Likewise, food intakes of those who utilize food pantry resources were unlikely to meet dietary guidelines due to low amounts of fruits, vegetables, and energy overall.[67] These reviews, however, were unable to find a nationally-representative sample and specific regions may lack certain micronutrients more than others.

Income levels are associated with levels of food security, in that lower income has been linked to a lack of food. Approximately 15 percent of households in the United States were classified as food insecure as of the 2011 Current Population Survey Food Security Model. Households including those with children, single individuals, African Americans, and Hispanic individuals were more likely to be food insecure than other portions of the population. Geographically, food security rates are lowest in metropolitan city core and rural regions.[22]

Individuals who have knowledge of healthy eating patterns may struggle with the burden of the costs of the healthy foods that they would prefer to purchase. Low income groups reported adequate knowledge of healthy foods, however barriers to implementing knowledge included higher costs, poor proximity of stores stocking healthy foods, as well as poorer produce quality.[68] Diabetes self-care tends to decrease with increasing levels of food insecurity. People who are concerned with how they might obtain their next meal are less likely to comply with the guidelines for healthy, balanced diets. Not taking medications as prescribed and restricting energy intake were also found to decrease as food security increased.[58]

An unpublished study conducted from 2015-2017 sought to determine the effects on HbA1c of an intervention conducted with food pantries on individuals with diabetes and food insecurity.[69] Results from this study could be used to drive other research utilizing similar interventions if statistically significant positive results are found.

Quality of Life and Diabetes

Health status, along with mental, physical, social, and emotional functioning impact the quality of an individual's life. With chronic disease as a context for this measure of life quality, health related quality of life provides a useful measure of less tangible aspects of health and well-being.[70] The currently-employed categories encompassed by quality of life are: material and physical well-being, interpersonal relationships; civic, community, and social activities; personal development and fulfillment, and recreation.[71] Mental health is an important component of the 'physical well-being' category, as is health in general.

Diagnosis and treatment of T2DM is intended to increase health-related quality of life, as this measure tends to decrease as comorbidities arise or symptoms worsen.[72,73] Blood sugar control may not directly correlate with quality of life scores, however.[74] The frequency with which individuals with T2DM also report a mental health concern underscores the importance of determining each patient's individual needs beyond diabetes treatments. In fact, quality of life was seen to decrease as diabetes control intensity increases.[75]

People with diabetes who reported mild or severe food insecurity were also at greater risk for depression, [64] diabetes distress, poor compliance with prescriptions, and poorer control of blood sugar.[24] Mental health diagnoses alongside T2DM are common; in one study of over 3000 patients over 20 percent had anxiety, depression, schizophrenic, bipolar, or substance abuse disorders,[76] this number is consistent worldwide with an average of 20 percent of individuals with diabetes suffering from an additional mental health diagnosis.[77] Individuals who were food insecure and had a diagnosis of T2DM were more likely to have high levels of emotional suffering than those who were food secure in safety net clinics in San Francisco and Chicago.[25]

Depression and T2DM may create a positive feedback loop – the risk of developing major depression increases with a diabetes diagnosis, and a diabetes diagnosis likewise increases the risk of depression. Individuals with diabetes (type 1 or 2) have a 2 times greater risk for depression than individuals without a diabetes diagnosis. Depression, likewise, has been linked to reduced compliance with various aspects of diabetes management, resulting in poorer blood sugar control and an increase in diabetes-related complications[29] and medical costs.[78] These findings underscore the need for mental health screening along with diabetes care in order to improve the dimensions of care a patient receives so that health outcomes may improve.

Diabetes Self-Management

Individuals with T2DM face many barriers to successfully managing their disease. The key components of diabetes self-management have been identified as diet, physical activity, and blood glucose control. Many methods exist to educate and empower individuals with type 2 diabetes to manage their health, however the complexity and duration of the disease necessitates a comprehensive approach. The American Diabetes Association and Academy of Nutrition and Dietetics report that Diabetes Self-Management Education and Support (DSME/S) should be given to all individuals diagnosed with diabetes upon diagnosis as well as afterwards to reinforce and support patient efficacy. DSME/S also decreases the burden on the healthcare system of recurrent hospitalizations related to diabetes, which is a concern when one third of the US population is expected to develop diabetes by 2050.[79]

As identified by the American Association of Diabetes Educators, diabetes management involves seven behaviors to properly manage diabetes; healthy eating, being active, monitoring, taking medications, problem solving, healthy coping, and reducing risks.[80] Shifting diabetes self-management from focusing on content to outcomes allows education to better suit the needs of those living with T2DM.

Several approaches to DSME exist, though the overall benefit to those with diabetes is that group educational program attendance improves glycemic control.[81,82] Tailoring methods to specific populations increases acceptability and thus should improve health outcomes in individuals who receive education. Participation is encouraged when sessions were scheduled during regular appointment times as opposed to less convenient times. Compliance and patient follow up are two traditionally difficult study barriers especially in low socioeconomic status

populations. Despite improved health outcomes and lower costs, a low percentage of people with diabetes attend DSME.[83,84]

Management of diabetes involves a multifactorial approach, with changes to diet and lifestyle considered to be the first line of therapy for some individuals with T2DM. Patients with diabetes also tend to have a range of comorbidities; often but certainly not limited to cardiovascular disease and obesity. This, along with the various socioeconomic factors is known as patient complexity; effective interventions are evidence-based and enable patients to become active participants in their own health.[85] Interventions also acknowledge that complex situations require multifaceted approaches.

Patients who receive intensive, pharmaceutical-based, treatment of diabetes tend to have decreased risk of complications.[33,86] A review of T2DM interventions revealed that risk for cardiovascular disease (but not events in the long term) was decreased with diet and exercise interventions.[87] The 10-year LOOK AHEAD study followed more than 5000 overweight or obese individuals with T2DM during the study duration to identify the effects of a lifestyle intervention. The intervention group demonstrated weight loss greater than that of the control (6 percent versus 3.5 percent), though cardiovascular event rate differences were not statistically significant.[88] A smaller study of individuals with T2DM and microalbuminuria compared intensive medication-based management versus the conventional therapy on cardiovascular death risk versus all-cause mortality. Fewer patients in the intensive group died due to cardiovascular disease or events, progressed to renal failure, or needed treatment for diabetic retinopathy, compared to the control group.[89]

Long-term diabetes complications can be prevented when early and intensive interventions are implemented in individuals with T2DM duration less than 10 years, reducing risk of mortality as well as CVD-related deaths.[90] A review of 19 randomized controlled trials

revealed that mortality was decreased as a result of intensive interventions in non-fatal strokes and myocardial infarctions; suggesting that groups with higher risk for mortality from cardiovascular disease may benefit more from these intensive interventions than those groups with lower CVD risk.[91]

Two tenets of the conventional therapy for diabetes include physical activity and dietary changes. Diabetes care is unique among chronic diseases in that the person with a diabetes diagnosis performs most of their own health and self-care.[92] As such, proper education and being empowered with the tools for success were affect overall quality of life and health outcomes for those with diabetes. A systematic review of interventions in diabetes (types 1 or 2) in individuals of low socioeconomic status revealed that those interventions that had the most success had a number of features; they were tailored to the individual's culture, relied less on professionals for teaching, and had more contact points over a longer period of time.[93]

Diabetes care and resulting health outcomes may be improved by changing the way that diabetes education is approached. Participation in four to five group sessions resulted in greater involvement in self-care when the individual felt empowered versus merely instructed on properly managing their diabetes. Additionally, group sessions enabled participants to develop a community that consisted of the other participants with diabetes and the facilitators.[94] A four-year, two-arm, multicenter study indicated that group care delivered in a clinical setting increased health outcomes in terms of better blood lipid profiles, improved blood pressures, BMI, and lower HbA1c than those participants who received one-on-one care.[31]

African Americans in particular have been found to struggle with managing diabetes. A qualitative study investigated the reasons why African Americans were minimally compliant with diabetes prescriptions; results indicated that there were negative emotions around the medication or side effects, they viewed the illness in a dismissive manner, and had poor access

to information and the pharmaceuticals they needed to manage diabetes. Participants spoke to the need for support networks to improve self-efficacy and -advocacy and improve access to information and relevant resources.[96]

Previous interventions in low income and minority groups have demonstrated that curriculum-based interventions increase participant understanding of factors that impact blood glucose control as well as a statistically significant degree of adoption of healthy eating patterns. The Detroit REACH Study, a program tailored to meet the needs of African Americans and Latinos with diabetes living in Detroit, had a 98 percent participation rate in at least one meeting, while 41 percent attended five out of five meetings. Blood sugar monitoring compliance also improved in all participants as did HbA1c values, by 0.8 percent, for participants receiving the intervention. Despite residing in an urban setting, minority group participants in the study had statistically significant improvements over the baseline after the intervention.[97]

To increase the efficacy of diabetes educational practices, the population receiving the intervention, as well as the various environmental factors impacting them, must be properly understood. The National Standards for Diabetes Self-Management and Support, which are revised every five years, identified several research goals including the impact of structured curriculum use in DSME.[41] This study were utilize a mixed methods approach to deliver diabetes management education to a population and gather feedback from focus groups to enhance education delivery and efficacy.

Curricula that encourage physical activity to help manage blood glucose levels may need to be tailored specifically to the environments in which the underserved populations reside. Physical activity may not be a reasonable goal for individuals who face higher rates of crime and lack of spaces in which to be physically active.[97] Inner city adults often face a myriad of barriers to managing chronic diseases, among them food insecurity related to cost or availability of

healthy foods in their neighborhoods. Decreasing food security likely predicts poorer diabetes management and compliance with treatment regimen.[98,99]

Behavior change may slow the progression of T2DM, however food insecure individuals are unlikely to experience the full benefit of an intervention if they do not have ready access to fresh fruits and vegetables. Individuals in communities with access to communal gardens may experience greater fresh fruit and vegetable intake, higher rates of physical activity, decreased blood pressure and BMI.[100]

Produce-Provisioning Interventions

Currently, Americans do not consume the recommended amounts of dietary fiber. The average American adult eats just 16 of the recommended 25 grams of fiber for women, or 38 grams for men, per day.[101] Inadequate fiber intake may increase the risk of cardiovascular and metabolic diseases, including diabetes and obesity. Fruits, vegetables, and whole grains contain high amounts of fiber yet tend to be under consumed by low income individuals. Highly refined or processed grains, meats and foods with added sugars or fats tend to be a large portion of dietary intakes in this population.[102]

From 1970-2009 the per capita energy availability rose nearly 500 calories to 2594 calories per day, with most additional available calories attributed to processed grain foods and fat. Conversely, less than 70 percent of the recommended amounts of fruits, vegetables, and dairy are available to US residents for consumption. Various analyses of low income food procurement indicate that the lowest income individuals purchase fewer produce items, while spending a high proportion of money on various processed foods and meat than higher income individuals.[103]

Interventions involving produce provisioning and various health outcomes have revealed that there is a desire and need for these approaches. Low income, overweight individuals with T2DM in the Bronx, New York demonstrated that an educational intervention combined with coupons totaling $6 would increase purchasing of foods from farmers markets as well as intake of fruits daily.[38] The link between low-income, food insecurity, fruit and vegetable consumption, and diabetes incidence and severity is well-established. Interventions targeting these diabetes modifiers have the potential to improve health outcomes in low-income and minority populations who have the highest risks for diabetes related problems.

Chapter 3: Methods

Design:

A mixed methods approach was used to measure the feasibility and adaptation of an existing T2DM self-management curriculum with an added produce-provisioning component in an urban, underserved population, and determined the extent to which a shortened version of the curriculum helped individuals manage their diabetes. A one group pre-test/post-test design was used to determine the limited efficacy of the shortened version of an existing T2DM self-management curriculum.

The post-test survey was administered in order to assess diabetes self-management behavioral changes as well as how fresh produce intake was impacted by the intervention. A focus group was conducted at the end of the intervention in order to determine the feasibility of the curriculum. Feasibility of the intervention was determined by assessing acceptability, implementation, practicality, and adaption.

Sample Population

Low income individuals of all ethnic groups with T2DM who were current patients of Care Point East at the time of study recruitment were recruited to take part in the study. Focus group participants were recruited from the pool of individuals who attended at least one curriculum session. These individuals were informed at initial recruitment of the chance to participate in a focus group upon the conclusion of the study curriculum, and contacted by phone seven days prior to the focus group date. Care Point East is located in the near east side of Columbus where the average income for residents is $25,000, about 55 percent of all residents live in poverty and 60 percent of the residents receive food stamps.[20] Individuals from

specific area codes identified around the CarePoint East Hospital were selected for inclusion in this study. ZIP codes included in the search were 43203, 43219, 43205, 43207, 43209, 43229. The zip code 43219 covers areas of Columbus, Gahanna, and Whitehall and as such covers a wide income range; the average household income was $44,854 according to 2016 US Census Bureau information. The median household income for the Gahanna subset of 43219 was $73,535 versus $37,671 in Whitehall.[104] The other included zip codes demonstrated a similar degree of income variability, therefore enrollment in either Medicare or Medicaid (or similar) publicly funded insurances was used as a selection criteria. For a household of one, the maximum annual before-tax income an individual could have in order to qualify for Medicaid in Ohio is $15,800. Each additional member of the household increases the maximum income allowed to qualify for Medicaid by approximately $5,500.[105]

Procedure

The clinician associated with the study screened a list of eligible individuals based on inclusion criteria. Individuals were included in the study if they were verified by clinic records to have T2DM, 19 to 85 years old, had an HbA1c >7.0 percent, and were a patient of CarePoint East. The clinician associated with this study and dietetic student contacted potential participants using phone numbers found in the electronic medical records. Of the potential participants contacted, 77 were found in the medical record and one referred by an endocrinologist involved with the study. Phone calls to each potential participant followed a script with a brief description of the study, the time commitment, as well as any potential risks and benefits. The clinician and dietetic intern attempted to leave voicemails with a brief study description and contact information for those individuals who did not answer but were potentially interested in participating. Attempts at contact for recruitment were made once with each individual; 37 were reached at first contact, 34 calls went to voicemail and messages were

25

left, 1 email was sent, and 6 calls were to numbers with full voicemail boxes, or no voicemail was available. The individuals who expressed interested in participation were reminded the day before each curriculum session regardless of their attendance at any of the previous sessions. All participants gave their informed consent to participate in the study. The Ohio State University Institutional Review Board approved the study.

A conference room at CarePoint East was the location of the educational intervention. A series of four T2DM training sessions were provided, free of charge, to all participants enrolled in the study; the first session was taught twice several weeks apart in an attempt to increase participation. Sessions were offered once weekly at the same time and location. The sessions began at 1:00 PM and were ninety minutes long. The curriculum was taught by the medical dietetics student involved with the study. Each participant was given an information packet containing an overview of the session and diabetes-friendly recipes.

During each session, diabetes-friendly recipes were provided along with a diabetes-friendly snack, and a bag of fresh produce that was harvested from the Garden of Hope at the OSU Waterman Farm. Items included tomatoes, zucchini, bell peppers, eggplant, kale, and/or chard, as available due to the seasonality of each produce item. Attempts were made to split allotments equally among participants, which averaged approximately 5-10 pounds per person. During several of the sessions participants were given incentives; Regent Products Corp two section microwave portion plates (Session 2), Nakosite simple pedometer (Session 3), or Dynapro Power resistance bands (Session 4) as incentives for participation, in addition to the weekly produce bag each person received.

Measurements/Instrumentation

All instruments used are available for reference in Appendix A.

Stages of Change Questionnaire

A brief "Stages of Change" questionnaire was administered at each participant's first visit to assess levels of motivation and current behaviors as they relate to readiness to change. This questionnaire was created by La Clinica de La Raza as part of the Advancing Diabetes Self-Management Project, supported by the Robert Wood Johnson Foundation.[106]

The stages of change questionnaire used in this study was formulated with the Transtheoretical Model (TTM) for behavior change.[107] The TTM lays out the six potential regions in which an individual might reside as they advance towards changing their health behaviors. The domains are: precontemplation, contemplation, preparation, action, maintenance, and termination. Populations categorized as "at risk" have been shown to be divided 40 percent into the precontemplation stage, 40 percent in contemplation, and 20 percent in preparation. Interventions aimed at improving participant standing in their particular stage of change tend to have fewer issues with recruitment, keeping participants engaged for the duration of the intervention, and improving the stages themselves.[108]

Low levels of health literacy may result in poor glycemic control, however diet-related knowledge helped move participants into later stages of change as well as improving blood sugar control.[109] Further links were found between empowerment, impacting health literacy, which corresponded to increased self-efficacy. In a primarily African-American, low income population, the concept of health status and knowledge related to diabetes were found to be the best predictors of glycemic control, whereas health literacy related more to diabetes knowledge than control of blood sugar.[32] The links between empowerment, self-efficacy, and health literacy may lead to improved HbA1c levels in individuals with T2DM when interventions seek to improve those specific dimensions.

Physical Activity: The questionnaire began with a question regarding the degree to which a participant was active on a weekly basis. After a brief description of the types of activities that would be included, the questionnaire prompts the participant "Exercising five times a week for about 30 minutes each time is very important to your health and diabetes control. Do you usually get this much exercise?"

Medication: Next the questionnaire assessed adherence to medication regimen to control diabetes by looking at past behaviors. The benefit described for managing medication properly was a reduced risk of complications related to diabetes. The query provided was "Do you intend to start taking all your medications correctly every day?"

Meals: The next section involved frequency and amounts of food intakes. These factors were linked to glycemic control when food is consumed every 3-5 hours in reasonable amounts. Participants were asked to respond to "Do you have something to eat every 3-5 hours?"

Counting carbohydrate Servings: Further assessment of meal intakes was provided by this question, which asked participants to consider their meals and snacks eaten the day before. Managing carbohydrate intakes was linked in this section to glycemic control; namely the higher carbohydrate foods being more likely to cause higher blood sugar. Participants then responded to "Do you limit the amount of high carbohydrate foods you eat in any one meal during the day, in order to keep your blood sugar under control?"

Five a Day: The final section of the questionnaire examined the types and amounts of produce eaten daily. A brief description of serving sizes was provided as a point of reference. Participants were then asked, "Do you eat 5 or more servings of fruits and vegetables a day?"

Diabetes Knowledge and Behaviors Assessment

The Diabetes Knowledge and Behaviors questionnaire administered at the beginning

and end of the intervention was created using a variety of validated tools aimed at assessing

participant demographics, behaviors, knowledge, and diabetes management-related

socioeconomic factors. The survey consisted of eight sections: Demographics, Medical concerns,

Diabetes knowledge, Diabetes self-management, Goal setting and problem solving, Quality of

life, Food security, and Vegetable intake.

The Demographic section contained information on sex, age, marital status, ethnicity,

living arrangement, education, employment, occupation and height and weight. Demographic

categories were derived from the Centers for Disease Control and Prevention (CDC) Behavioral

Risk Factor Surveillance System (BRFSS) 2017 questionnaire.[74]

Medical Concerns

The presence of complications related to T2DM was assessed by gathering information

from the electronic medical records. Chart reviews included problem lists, past medical history,

and health care provider documentation. Each participant's medical record was assessed for the

following conditions; hypertension, cardiovascular disease, hyperlipidemia, neuropathy, diabetic

retinopathy, and nephropathy.

Diabetic nephropathy was defined as those individuals who had a glomerular filtration

rate <60 mL/min/1.73m^2, microalbuminuria 30-300 mcg/mg creatinine, or macroalbuminuria

with >300 mcg/mg creatinine. Cardiovascular disease was defined as a history of

cerebrovascular accident, myocardial infarction, coronary revascularization, or peripheral

arterial disease. Hyperlipidemia was defined as a diagnosis of hyperlipidemia, abnormal blood

lipid levels (total cholesterol ≥ 240 mg/dL, low density lipoprotein [LDL] cholesterol ≥ 160

mg/dL, triglycerides ≥ 200 mg/dL)[110], or use of medications to lower cholesterol such as statins.

Participants were also given the chance to self-report medical conditions on the questionnaire; dental problems, depression, and neuropathy were among the possible conditions.

Diabetes Knowledge

This instrument was developed by the Michigan Diabetes Research Training Center. This brief test of diabetes knowledge was found to be valid.[111] Reliability was demonstrated with the reported Cronbach's alpha, a measure of internal reliability, was reported as 0.72.[112,113] Fourteen of the 23 questions cover general diabetes-management related topics, such as the diabetes diet, blood glucose, physical activity, HbA1c levels. For example, knowledge of carbohydrates (diabetes diet) was assessed by the question "Which of the following is highest in carbohydrate? "Potential responses were baked chicken; swiss cheese; baked potato; and peanut butter. Categories were scored according to the number of questions, thus a category with two questions was out of a score of two.

Diabetes Self-Management

This segment of the questionnaire included 16 questions. Participants were asked to rate their self-care activities related to diabetes management. These answers were scored on a 4-point Likert scale; from 0, does not apply, to 3, applies to me very much. Questions covered a number of topics. Monitoring of blood glucose was assessed with questions such as "I check my blood sugar levels with care and attention." Dietary intakes were also assessed as they related to diabetes management; "The food I choose to eat makes it easy to achieve optimal blood sugar levels." The medical team and keeping appointments was assessed; "I keep all doctors' appointments recommended for my diabetes treatment." Physical activity behaviors were also determined; "I do regular physical activity (30 minutes on 5 or more days of the week) to achieve optimal blood sugar levels." Testing of the validity of this tool was conducted in

individuals with both T1 and T2DM. Each question was correlated with HbA1c levels (-0.23, SD =

0.09).[114] Cronbach's α was 0.77 for Dietary Control and Glucose Management; 0.76 for Physical

Activity, and 0.60 for Healthcare Use. Overall the Cronbach's α was 0.84.[114]

Stages of Change

Participants were given a stages of change questionnaire to determine their level of

readiness behavioral changes related to diabetes-management. This questionnaire consisted of

five questions; one related to physical activity, one to medications, and the remaining three

related to various aspects of diet.

Goal Setting and Problem Solving

Two questions were used to measure goal setting and one problem solving. A

dichotomous scale (yes or no) was provided for participants to state if they set one or more

goals related to diabetes management within the last month and whether they accomplished at

least one of the goals. Similarly, participants were asked to check whether they were able to

solve problems that come about in their daily life.

Quality of Life

The two quality of life questions were derived from the CDC's Healthy Days Measure. The questions included: "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" Seven responses were possible (0, 1-5, 6-10, 11-15, 16-20. 21-25 and 26-30 days). Lower scores depicted better mental health. This tool is used on the Behavioral Risk Factor Surveillance System (BRFSS), the Medicare Health Outcomes Survey (HOS), as well as the National Health and Nutrition Examination Survey (NHANES).[115] Validity and reliability of this tool has been assessed in many different clinical populations.[116,117]

Reliability was high for the tool; a random sample of adult BRFSS respondents in Missouri were re-tested two weeks after participating in the BRFSS questionnaire, resulting in a re-test reliability of 0.75 or greater (deemed excellent) on the Healthy Days Measure.[118] This measure has not been specifically tested in the urban, low income population with T2DM.

Food Security

Food security was assessed with the Six-Item Short Form of the USDA Food Security Survey Module.[119] These six questions were a shortened version of the questions taken from the Guide to Measuring Household Food Security. Those that report food insecurity answered all six questions in order to provide a better picture of their food security and hunger levels.[119] An advantage to using this tool is that information gathered from the study population can be compared to national data gathered using the standard practice module. This tool is valid, and derived from the reliable 18-question survey which assesses a more broad range of food security in US households.[56] The USDA Six Item Short Form Food Security Module allows for participant responses to stratify into the levels of food security. Affirmative answers to any of the questions (sometimes, often, or yes) are scored as 1 point, with a total of six points on the scale.

Scores from 0-1 indicate high or marginal food security; scores from 2-4 indicate low food security, and scores from 5-6 indicate very low food security.[119]

Vegetable Intake

Participants were provided with a list of 35 vegetables and were asked circle the items they ate during the last month. They were also provided with space to list other vegetables that were not included in the list. To analyze reported intakes, available options were divided into five categories as defined by the USDA's vegetable subtypes.[120] These subtypes were not discussed as part of the questionnaire, but served to facilitate a closer look at the types of foods consumed. Nearly half (16 out of 35) of the foods were under the "other" category, such as zucchini, artichokes, bean sprouts, and mushrooms. Red and orange vegetables were the next most frequent, with eight out of the 35 options; this included pumpkins, tomatoes, carrots, and sweet potatoes/yams. Dark green and leafy vegetables accounted for seven out of the 35 items; these included watercress, brussels sprouts, broccoli, and leaf lettuce. Starchy vegetables accounted for two items; peas and potatoes. Finally, beans and peas (dried items rather than fresh beans or peas) accounted for none of the included options.

Clinical and Anthropometric Measures

Clinical and anthropometric data included HbA1c pre- and post-intervention, HDL, LDL, total cholesterol, body mass index (BMI), height, and weight which were collected from each participant's electronic medical record. Laboratory and anthropometric values were collected at appointments; hospitalization values were not used. Data were pulled in February 2018 and reviewed for completeness in April 2018. At the beginning of the study and at the time of the pretest (questionnaire) participants were assigned a participant's study number by the clinician authorized to view patient health information. The clinician assigned the numbers on the pretest questionnaire and matched the numbers for the posttest questionnaire. Based on participant appointment dates, follow-up information was collected after the intervention

concluded. Each follow-up HbA1c was ensured to be at least three months after the pre-intervention HbA1c to ensure that potential changes in glycemic control would have adequate time to manifest.

Qualitative Approach – Focus Groups

All participants who attended the intervention were invited to take part in an interview to collect qualitative data. Each individual who attended any of the curriculum sessions was contacted by the graduate student/dietetic intern and asked to participate in a focus group session for approximately 1.5 hours. A focus group guide book consisting of thirteen potential questions was developed with the assistance of the OSU Research Methodology Center to determine the feasibility and acceptability of the produce-provisioning and educational intervention.

Three general questions were asked to explore participants' perceptions regarding managing their diabetes. Following questions were related to acceptability (What motivated you to come to the sessions?); demand for the intervention (What types of diabetes education have you had in the past?), adaptation (What parts of the curriculum would you change if you had the opportunity to?) and limited-efficacy testing (Tell me about something new you started doing because of attending these classes?). Questions were validated by the OSU Research Methodology Center and content validity was verified by an expert in feasibility studies. Participants who attended the focus group session were given a $20 gift card to Wal-Mart.

The focus group was recorded and transcribed verbatim by the graduate student/dietetic intern. Questions were independently coded and verified by two qualitative researchers using content analysis. Steps involved reading and re-reading transcripts; emerging ideas identified; common concepts, ideas, and perceptions sought out; co-researchers independently undertook steps 1-3. Co-researchers then met to critically discuss concepts that

emerged and classified them as themes. Discussion continued until a consensus was achieved.

Alternate meanings for themes were then sought out.[121]

Educational session/curriculum

The University of Kentucky Cooperative Extension "Taking Ownership of Your Diabetes" was used to provide diabetes information in a format that is easy to understand and that allows individuals to modify lifestyle risks and solve problems related to diabetes management. The curriculum was developed by Adams (2010).[122] A multi-disciplinary team of reviewers that included registered dietitians, an endocrinologist, and certified diabetes educators reviewed the curriculum for accuracy. Family and Consumer Sciences (FCS) agents and individuals with T2DM in the community ensured relevance and stakeholder input.

The curriculum is based on the National Diabetes Education publication (NDEP) "4 Steps to Control Your Diabetes. For Life." The Stages of Change Model[108] and a model of critical thinking developed by the author[122] were used as theoretical bases. Lessons were structured to move individuals from pre-contemplation to actions. Elements of the critical thinking model such as empowerment, problem solving and goals setting are infused throughout the curriculum. The curriculum contains four units: (1) Understanding diabetes; (2) The ABCs of Diabetes; (3) Nutrition for Diabetes; and (4) Getting Routine Care. Each of the four curriculum sessions contained the main components of the twelve-week curriculum. The four sessions covered the broad scope of diabetes care and self-management to a shallower degree while containing the most salient pieces of each lesson from the full curriculum. The shortened version of the curriculum was created in order to decrease the burden on participants while determining the feasibility of implementing such a curriculum in a low income, urban population.

Introduction	Introductory Lesson	Unit One	Unit Two	Unit Three	Unit Four	Final Lesson
Diabetes information Note to Agents Agents' Role Lesson Content	Introduction to the Program Power Point	**Lesson 1:** Diabetes Basics	**Lesson 4:** A1C	**Lesson 7:** The Diabetes Food Guide Pyramid	**Lesson 10:** Monitoring Blood Glucose	Summing Up the Program
Outcomes Curriculum Theory and Approach	**Evaluation (Pre-Test)**	**Lesson 2:** Managing Diabetes **Lesson 3:** Physical Activity and Diabetes	**Lesson 5:** Blood Pressure **Lesson 6:** Cholesterol	**Lesson 8:** Carbohydrate Counting **Lesson 9:** Think Your Plate	**Lesson 11:** Foot Care **Lesson 12:** Working with Your Health Care Team	**Evaluation (Post-Test)** Power Point

Table 3.1 Taking Ownership of Your Diabetes Curriculum

Unit One	Unit Two	Unit Three	Unit Four
Understanding Diabetes Includes aspects of Diabetes Basics; Managing Diabetes; and Physical Activity and Diabetes) **Evaluation (Pre-Test)**	ABCs of Diabetes Include aspects of A1C; Blood Pressure; And Cholesterol)	Nutrition for Diabetes Includes aspects of Carbohydrate Counting; and Think Your Plate)	Diabetes and the Health Care Team Includes aspects of Monitoring Blood Glucose; Foot Care; and Working with Your Health Care Team) **Evaluation (Post-Test)**

Table 3.2: Condensed Curriculum

Data Analysis

Pre-tests were administered after participants completed informed consent, and post-tests were completed either at the final session of the curriculum, or afterwards around the time during which the focus group was scheduled. Individuals who attended curriculum sessions completed brief reflections to indicate their perception of the session attended as well as potential changes that they would like to see in potential future iterations of the curriculum.

Data were examined for variable distribution and outliers with statistical and graphical methods. Data was examined for outliers and determination was made on the sample to include for analysis. SPSS software was used to perform all analyses (IBM SPSS Statistics for Windows, Version 24.0). Demographic data were examined to characterize the sample and descriptive statistics were conducted to summarize the variables of interest: race, sex, age, education, employment status, marital status, whether participants lived alone, BMI, height, and weight. Changes in responses to goal setting, food insecurity, and mental health were examined by comparing scores on pre- and post-questionnaires. Diabetes knowledge was examined by comparing mean scores on diabetes knowledge pre- and post-intervention. Mean values on HgbA1c were examined pre- and post-intervention. Other lab values such diastolic and systolic blood pressure, blood glucose, cholesterol, LDL, and high-density lipoprotein (HDL) were examined as available in the medical record. Finally, paired sample t-tests were used to examine differences diabetes self-management pre- and post-intervention.

Chapter 4: Results and Discussion

Results:

Intervention Attendance

	Unit 1: Understanding Diabetes	Class 1A: Understanding Diabetes	Class 2: ABCs of Diabetes	Class 3: Nutrition for Diabetes	Class 4: Diabetes and the Healthcare Team, and Monitoring Glucose
Participants per Curriculum Session	4	6	2	3	2

Table 4.1: Attendance of Participants per Session

Each participant was personally recruited by the clinician or graduate student; contact was attempted with 78 individuals. Six of the contacted individuals, or 7.7 percent, attended any of the intervention sessions. Participants attended 1-4 sessions; two individuals each attended 1, 2, and 3 classes while one individual attended all four classes (See Table 4.1). Reminder calls were made to each participant on Tuesdays, the day before each class was offered, between noon and 2:00 PM. Individuals who attended the focus group indicated that the reminder calls were

helpful and encouraged them to come as well as ensuring that they did not forget the date or

location of the event.

Demographics and Anthropometric Data

	n(%)
Race	
Black/ African American	4 (66.7)
White, non-Hispanic	1 (16.7)
Asian/Pacific Islander	1 (16.7)
Sex	
Female	5 (83.3)
Male	1 (16.7)
Age (years)	
40-49	1 (16.7)
50 and over	5 (83.3)
Education	
High School/GED	2 (33.3)
Some College	3 (50.0)
College Graduate	1 (16.7)
Employment	
Employed	1 (16.7)
Unemployed/Retired	5 (83.3)
Marital Status	
Never Married	1 (16.7)
Widowed	2 (33.3)
Divorced	1 (16.7)
Married	2 (33.3)
Live Alone	
No	4 (66.6)
Yes	2 (33.3)
BMI (kg/m^2) (mean(SD))	32.0 (4.7)
Height (inches) (mean (SD))	71.0 (4.5)
Weight (pounds) (mean (SD))	183.0 (25.0)

Table 4.2 Participant Demographic and Anthropometric Data

Six individuals attended at least one class; five (83 percent) participants were women and one was male. One participant (17 percent) was currently employed, while the majority (83 percent) indicated that they were retired. Three participants (50 percent) attended 1-3 years of college; one (17 percent) was a college graduate, and three (50 percent) attended school up to grade 12 or received a general equivalency diploma (GED). The majority (67 percent) of participants designated their race as Black or African American, one was Indian (categorized as other), and one was white, non-Hispanic. Most participants (66 percent) live alone. Close to 90 percent of the individuals were aged 60 or above, and 1 fell within the 40-49 age group. On average participants had body mass indices that classified them as obese (mean= 32.0 kg/m^2, SD = 4.7). See Table 4.2.

Medical Concerns
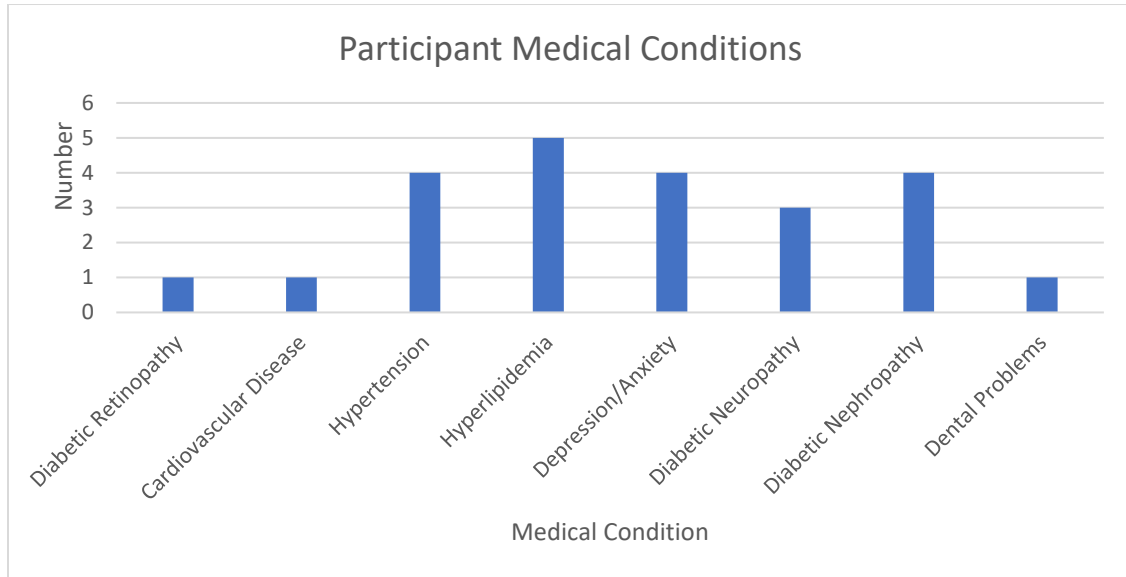
Figure 4.1 Participant Medical Concerns

Depression/anxiety was reported by four participants (66.7 percent) while dental problems were reported by one individual (16.7 percent). See Figure 4.1. Reported health problems were compared to diagnoses from patient medical chart information. One participant (16.7 percent) had diagnosed retinopathy, neuropathy was present in half (50.0 percent), nephropathy in four (66.7 percent), hyperlipidemia in five (83.3 percent), and hypertension in four (66.7 percent). The possible list of medical conditions was based on common diabetes comorbidities; diagnosed comorbidities were found in participant medical charts. See Figure 4.1.

Measure	Mean	SD	Range
HbA1c[1] pre n=5*	8.3	0.6	7.8-9.2
HbA1c post n= 5	7.9	0.6	7.0-8.5
Random Blood glucose (mg/dL)	195	111	105-381
Total Cholesterol (mg/dL)	216	54	159-290
LDL (mg/dL)[2]	156	72	76-219
HDL (mg/dL)[3]	49	10	40-64
Systolic blood pressure- post	129	24	100-174
Diastolic blood pressure-post	74	6	68-82
BMI[4]	32.0	4.0	26-36.0

Table 4.3 Participant Laboratory Values

* Five (out of six) participants had HbA1c values pre- and post-intervention

[1]HbA1c: Glycosylated hemoglobin

[2]LDL: Low density lipoprotein

[3]HDL: High density lipoprotein

[4]BMI: Body mass index
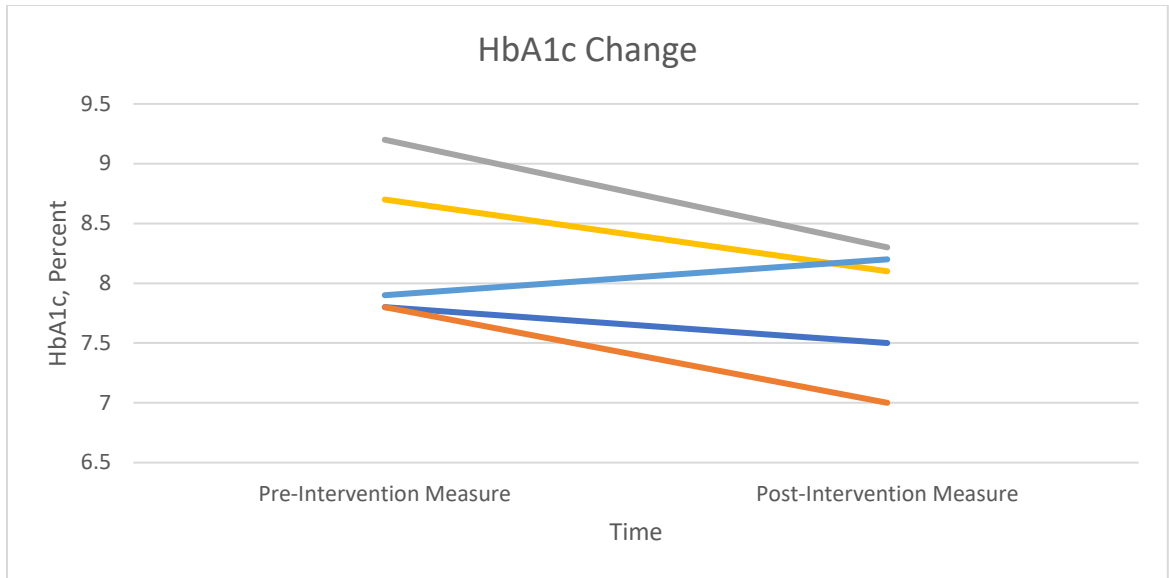
HbA1c Change

Figure 4.2 Change in Glycemic Control per Medical Record

Prior to the intervention, participants' mean HbA1c was 8.3 percent on average. After the intervention, the mean decreased approximately 0.4 points to 7.9 percent. Laboratory values were reported according to availability in electronic medical records.

Mean POC blood glucose was 195 mg/dL (SD= 111), total cholesterol mean was 216 mg/dL (SD=54), LDL levels 156 mg/dL (SD=72) on average. HDL was 49 (SD=10) and mean blood pressure was approximately 129/73 mmHg on average (SD= 22 systolic/29 diastolic). See Table 4.4.

Diabetes Knowledge

Category	Pre (n=4)[1]	Post (n=4)	Possible Section Score
	mean		
Diet	1.8	1.5	2
Carbohydrate	0.5	0.8	1
Fat	0.5	0.8	1
HbA1c	0.5	0.5	1
Blood glucose diet	3.5	4.0	4
Blood glucose measure	4.5	4.8	6
Feet	1.0	1.0	1
Comorbidities	2.5	2.8	3
Ketoacidosis	0.0	0.0	1
Illness	0.5	0.8	1
Insulin	1.5	1.5	2

Table 4.4 Diabetes Knowledge Scores

1: Four out of six participants completed the Diabetes Knowledge Test pre- and post-intervention.

Participants displayed small improvements in diabetes related knowledge in the post-intervention questionnaires. Questions regarding carbohydrates, fat, sick care (illness), and measuring blood glucose increased by 0.3 after the intervention. Knowledge of comorbidities related to diabetes as well as proper measurement of blood glucose increased by 0.4. Knowledge of HbA1c (0.5), foot care (1.0), ketoacidosis (0.0), and insulin (1.5) remained the same. Knowledge of the diabetic diet decreased by 0.3. See Table 4.4.

		Pre (n=3)[1]		Post (n=3)	
Mental Health		n	%	n	%
Stress(days)[2]	0	0	0.0	0	0.0
	1-5	0	0.0	3	100.0
	6-10	0	0.0	0	0.0
	11-15	1	50.0	0	0.0
	16-20	0	0.0	0	0.0
	21-25	1	50.0	0	0.0
Poor mental health(days)	0	0	0.0	1	33.3
	1-5	1	33.3	2	66.6
	6-10	1	33.3	0	0.0
	11-15	1	33.3	0	0.0
	26-30	0	0.0	0	0.0
Goal Setting					
Set goals	Yes	2	66.6	3	100.0
	No	1	33.3	0	
Accomplish goals	Yes	2	66.6	3	100.0
	No	1	33.3	0	0.0
Solve problems	Yes	1	33.3	3	100.0
	No	2	66.6	0	0.0
Food Insecurity					
No money to buy more food	Never	1	33.3	2	66.6
	Sometimes	2	66.6	1	33.3
Can't afford balanced meals	Never	2	66.6	1	33.3
	Sometimes	1	33.3	2	66.6
Cut down meal size	Never	2	66.6	2	66.6
	Sometimes	1	33.3	1	33.3
Eat less because of money issues	Yes	0	0.0	1	33.3
	No	3	100.0	2	66.6
Hungry but didn't eat	Yes	0	0.0	1	33.3
	No	3	100.0	2	66.6

Table 4.5 Additional Variables: Mental Health, Goal Setting, Food Insecurity

1: Three (out of six) participants completed this test portion pre- and post- intervention

2: Two (out of three) participants answered this question

Post-intervention, more participants reported never experiencing issues related to food insecurity such as no money to buy more food (pre, 33.3 percent; post, 66.6 percent). Participants indicated that they had an increased frequency with which they could not afford balanced meals (pre, 33.3 percent; post, 66.6 percent). Two out of the three (66 percent) of participants indicated pre- and post- intervention that they never cut down on meal size. Participants reported increased instance of eating less due to money issues (pre, 0.0 percent, post: 33.3 percent) and being hungry but not eating (pre, 0.0 percent, post 33.3 percent).

Mental Health

Participants reported anywhere from 11 to 25 mental health stress days, and 1 to 15 poor mental health days for the pre-intervention period. At post-intervention, all participants (100 percent) reported five or less stress days compared to one (33.3 percent) pre-intervention. Poor mental health days decreased post-intervention for one participant (33.3 percent) to zero days and two (66.6 percent) to 1-5 days, versus one individual each (33.3 percent) reporting 1-5; 6-10; and 11-15 days. See Table 4.5.

Goal Setting

Participants set (66.6 percent) and accomplished (66.6 percent) goals to the same degree prior to the intervention. After the intervention, participants indicated that they all (100.0 percent) were able to set and accomplish goals. One participant (33.3 percent) on the pre-test indicated that they were able to solve problems that could occur in daily life related to diabetes management; post-intervention, all (100 percent) respondents felt that they were able to solve those problems.

Food Insecurity

Prior to the intervention, two individuals had low food security (three out of six questions marked affirmative), while post-intervention responses indicated two individuals had high or marginal food security, and one had very low food security (six out of six questions marked affirmative). Measures of food insecurity generally improved after the intervention. Fewer participants noted that they had no money to buy food, or difficulty affording balanced meals pre- (66.6 percent) to post-intervention (33.3 percent), however one participant indicated that they often struggled prior to the intervention, and no individuals noted frequently struggling after the intervention. Cutting down on meal size was reported "sometimes" by one respondent (33.3 percent) prior to and after the intervention.

Participants reported that they did not eat less because of money issues prior to the intervention (100 percent), however one of the three (33.3 percent) after the intervention indicated that they ate less. Participants indicated that they (100 percent) had not been 'hungry but didn't eat' prior to the intervention, but one indicated that this scenario had occurred after the intervention (33.3 percent).

Vegetable Intake

Vegetable Subgroup	Total Possible	Pre, item intake n= 4[1]	Mean	Post, item intake	Mean
Dark Green Leafy	7	5, 4, 2, 2	3.3	5, 5, 3, 2	3.8
Starchy	3	2,2, 1, 2	1.8	3, 2, 3, 2	2.5
Beans/Peas	0				
Red and Orange	8	6, 5, 4, 4	4.8	6, 6, 5, 5	5.5
Others	17	8, 10, 7, 11	9.0	12, 12, 10, 8	10.5
Total	35	21, 21, 14, 19	18.8	26, 25, 21, 17	22.3

Table 4.6 Vegetable Item Intakes

1: Four (out of six) participants completed this section pre- and post-intervention

During the post-intervention period, participants reported increased mean intake of most vegetable subgroups. Dark green leafy (pre- 3.3, post- 3.8), starchy (pre- 1.8, post- 2.5), red and orange (pre- 4.8, post- 5.5), and others (pre- 9.0, post- 10.5).

All of those who responded to the food intake segment of the questionnaire indicated that they had consumed leaf lettuce, okra, green beans, and onion in the last month. Other foods were consumed by five percent of the respondents (83 percent); potatoes, sweet potatoes, green or red peppers, tomatoes, and Swiss chard/kale/spinach. Four (67 percent) of the respondents indicated that they had eaten cucumber, mushrooms, cabbage, iceberg lettuce, carrots, corn, mixed vegetables, or tomato sauce within the last month.

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The post-intervention survey indicated that participants (75 percent) had slightly increased their diet diversity; scores ranged from 17-26 total items with an average of 22.3 items per person versus 18.7 pre-intervention. Two out of the three respondents (67 percent) indicated that their overall produce intake increased during the intervention period. Items consumed per vegetable subgroup increased for every category except beans and peas, which did not have any items represented on the questionnaire. See Table 4.6.

Stages of change

All six participants completed the stages of change questionnaire. The majority of individuals indicated that they were in the preparation, action, or maintenance stages for the five measures of stages of change. Stages of change were not assessed post-intervention. One individual each was in the action, precontemplation, and preparation stages. Two participants were in the maintenance stage, and one was split between preparation and action stages of their diabetes management.

Qualitative Approach –Focus Group

The focus group consisted of four participants and began with a broad question on what comes to mind when participants were asked "What comes to mind when I say diabetes management." Four themes emerged, medication, moderation, manage food intake and negative emotions such as worry and fear. For example, one participant mentioned regarding medication *"I need to take my medication… you know my five medications just for my blood pressure. And I'm on three medications plus insulin to control my diabetes."* Related to moderation, one participant stated that- "*there are certain times you want dessert, but everything is done in moderation…"* Participants also indicated that they thought of managing their food intakes in relation to diabetes management. Regarding managing food intake, one participant stated that "*…I went back to eating meat, but I eat very little of it, I eat more*

vegetables and fruits with my meals." Participants also discussed that they had negative

emotions regarding diabetes management. In this light, one participant stated, *"I was so*

worried…[I] keep on worrying about my diabetes, my body's going down." Another participant

relayed that *"My challenge was I was still working, and my job had become very stressful."* and

"I think stress is a big part of all health issues."

Participants also discussed struggling with social situations in which food would be

present, which was often. One participant mentioned *"My thing is that… at least with my friends*

– every day is this, baby shower, whatever it is, the first thing everybody says is let's meet up at

red lobster, let's meet up at the steak house… is that everybody's birthday or whatever I attend,

95 percent of the time there is food involved, a lot of food."

When participants were asked about the challenges they felt were unique to dealing

with their diabetes, most mentioned stress as the biggest challenge. For example, job stress was

mentioned, as well as stress related to health problems, people's perception, and the stress to

partake in unhealthy foods at social gathering such as church events, birthday parties, and

restaurants.

Participants were asked to "tell us about some things that make managing your diabetes

easier or to describe what would really help you in terms of managing your diabetes." Most

individuals mentioned support groups or the support of family and friends. One participant

conveyed that they had a friend who understood her condition and did her best to

accommodate it; *"We're planning to go out and she knows what's going to harm me, and*

everything, she'll say well we'll go to this place or that place to help me. She's not going to say to

go to this place if I'll be sick as a dog." One individual expressed the desire for a support group,

while another had found one; *"I joined a grandmother's group. I go and talk to elderly people,*

and I love it. They love to exercise… The more I exercise the better I feel.

The majority of participants mentioned that the teaching style of the dietetic graduate student and the calls she made to remind them of the meetings motivated them to attend the sessions. One participant stated "*… I was having some problems with my diabetes and I needed education, so it was right on target for me. It's like she was God sent, she called me for the class*" Another participant remarked that they wanted this kind of program: "*Knowledge is key. I came to get more knowledge about what I need to do to help myself. With Hannah teaching the class, it's just like a baby when you pick them up and he's trying to walk. You need to hear over and over again until you get it*." Another participant noted that they felt the relationship with the instructor was an important factor; "*I think Hannah is a good presenter, and when you attend classes like that you need somebody that you can comfortably speak and information which she went over she was very helpful and very thorough.*"

Participants were asked how much of a motivator the incentives were for attending class. It was stated that the stretch bands were excellent and expressed satisfaction with the pedometer and the portion plate. One participant relayed that *"The stretch bands are excellent, and when I'm walking I have the meter on and it tells me how far I'm walking. Also the plate portions out, does it for you. We had in class about portions and servings, and that worked great."*

In addition, when participants were asked to identify things that would be more of a motivator instead of the current incentives for them to attend classes, participants mentioned the opportunity to exercise and the opportunity to come together and learn from each other in a social setting. One individual remarked "*I think we need a place we can come and exercise, for like half an hour or an hour. When people come together they do better…*" Another stated the importance of being around others going through the same thing; "*I thought I was the only*

diabetic person and suffering alone in my class. Different cultures, everybody is facing the same

like me. We are equal.”

Participants were asked to describe how they felt about the produce they received as

part of the intervention. A theme was, "I love the eggplants" and implementing what they had

learned because of the produce and recipes that were provided. Multiple participants stated

that *"I love the eggplant."* One participant displayed how she used the knowledge and skills

gained from the intervention to cook for their family; *"For Thanksgiving I had 12 bunches of*

collard greens and I had 6 of kale, and I cooked them down and I had 3 of spinach, and my clan

loved it. There were 36 of us… everyone loved the greens. Sometimes you gotta implement what

you learn into something.”

When asked what they had started new or what behavior they started as a result of

attending the classes, participants mentioned several food related behaviors such as trying new

foods, particularly eggplant and zucchini, paying attention to nutrition labels, better snacking

practices and drinking more water. They also mentioned that they had started exercising or

exercising more than previously. One participant stated *"I have started exercising, I have*

started walking…. I said I eat enough stuff I don't need to try anything else. What came to me

was I had tried everything else, but 90 percent of that wasn't good for me, so it was time to try

something else.” Another participant said that they had changed a few behaviors; "*I have*

started exercising more, and I'm taking more classes, and I'm paying more attention to the labels

to see what's in there and if I can eat that. And I'm doing better with my snacks." Another

person increased water intake by finding a way to make it more palatable; "*I have learned to*

drink more water. I was not drinking - I got to the point where I said water's nasty, so I put a

lemon wedge in it.”

Discussion

The purpose of this study was to determine the efficacy, feasibility, and acceptability of a shortened Type 2 diabetes mellitus curriculum in a low-income, urban population in Columbus, Ohio. Participants in this study were at high risk for complications related to diabetes management. Most of the participants were minorities, female, over the age of 60 and about one-third had only a high school education. In addition, most were obese and had been diagnosed with nephropathy, hyperlipidemia, or hypertension. Research shows that there is a greater prevalence of T2DM in ethnic minorities such as non-Hispanic blacks and Hispanics versus non-Hispanic whites,[123] and that these individuals also tend to have a higher number of complications related to retinopathy, neuropathy, nephropathy, and amputations.[124] Among these complications are the higher risk of amputations which are nearly doubled in African Americans versus non-Hispanic whites.[125]

Effective management of diabetes, such as dietary control, regular exercise, psychosocial coping skills, medication use and self-monitoring of blood glucose requires a knowledge of self-care practices, which is related to health literacy. Self-care behaviors were found to vary by race and ethnicity in 2011 BRFSS data.[126] A study conducted in a public hospital setting in San Francisco suggests that increased levels of health literacy increase glycemic control in individuals with T2DM.[127] These data suggest that diabetes-related self-care behaviors may be strongly impacted by socioeconomic factors including race, ethnicity, education level, and geography.

Most individuals with diabetes do not follow the recommended self-care practices, and certain ethnicities are less likely to adhere to specific goals.[123,128] African Americans were found to exercise less than other ethicities.[129] These behaviors may be related to perceptions of the recommendations and perceived benefits thereof that some individuals may hold. Low income

African-Americans revealed that they often did not take their medicines because they felt that

they knew better than their physicians.[130] This study provided information on diabetes and

different aspects of diabetes self-management for each of the four weeks of intervention and

saw increases in diabetes knowledge related to diet, carbohydrates, fat, HbA1c, the relationship

between blood glucose and diet and comorbidities. These findings and the literature underscore

the need to provide targeted interventions for low income and minority populations to improve

health outcomes as they relate to diabetes and its related complications.

Increases in diabetes knowledge are likely to result in improved health outcomes; as

patients with diabetes understand the disease, potential complications, as well as how their

dietary intakes can impact blood sugar they are likely to have better self-care behaviors.

Increasing opportunities for patients with diabetes to learn about the disease, its management,

and how they can avoid complications may enable more people to have better health outcomes.

Improvements in levels of diabetes-related knowledge are also likely to result from meeting

with registered dietitians, performing self-monitoring of blood glucose, and/or attending

programs aimed at educating patients on diabetes.[111] Interventions such as the one performed

in this study were effective in increasing diabetes-related knowledge, without requiring a great

amount of resources. As previously discussed, diabetes costs the US healthcare system over

$300 billion as of 2017.[43] Therefore, this study suggests that this may be an acceptable approach

to increase diabetes self-management knowledge among low-income audiences.

In this study, participants' ability to set and accomplish goals and to solve problems

increased post intervention. In this study at the end of each session participants were asked to

set goals and they were followed up in subsequent classes to determine whether the goals were

accomplished. Over three-quarters of participants mentioned that they set and accomplished

goals. Similar results were found regarding goal setting and the use of this curriculum in the

state of Kentucky. During the first 18 months of implementation, a total of 3,085 individuals

participated in the "Taking Ownership of Your Diabetes" program, of these, 45 percent stated

that they set and accomplished goals for themselves. Although this study was a feasibility study,

it showed that individuals also accomplished goals as in the larger study conducted at a state

level in Kentucky.[131]

Participants in this study also reported that they were also able to solve problems

related to managing diabetes after the intervention. The American Association of Diabetes

Educators includes problem solving as one of the seven areas of self-care behaviors related to

diabetes management.[132] A sample of 506 multiracial adults was assessed based on skills related

to problem solving and diabetes management. They found diabetes problem solving to be an

important skill related to several key areas of diabetes self-management. Glasgow et al. also saw

improvement in problem solving post intervention.[133] Increases in T2DM self-management are

related to improved ability to solve problems in daily life related to the various aspects of

managing a chronic disease. This study was able to improve participants' problem-solving ability,

indicating that the potential to increase T2DM self-management may also exist.

Diabetes outcomes and self-care measures are likely to be related to mental health

status, which was considered in this study. Reported days of poor mental health and frequency

with which it impacted the ability to perform daily activities decreased on average from pre- to

post-intervention. Studies have shown that a diagnosis with diabetes may increase the risk of

anxiety,[134] lead to lower reported quality of life, as well as decreased time spent with family or

friends.[135] While diabetes and mental health cause negative outcomes in the other disease,

various interventions targeting mental and physical health have resulted in improved HbA1c as

well as mental health measures. This was shown by Harkness et al. in a systematic review and

meta-analysis of interventions aimed at improving mental and physical health in individuals with

diabetes.[136] During the focus group portion of this study, participants discussed the fear that came with having a diagnosis of diabetes, as well as the difficulties they had encountered in navigating social situations in which food would be present.

Mental health may improve post-intervention due to improvements in diabetes control and goal-setting behaviors. In a review of literature, Harvey found that patients with diabetes demonstrate improvements in the psychosocial realm, and have modest improvements in glycemic control, as a result of psychosocial or behavioral interventions.[137]

Focus group attendees also expressed an interest in attending more classes and establishing support groups in which they could meet with other people also coping with diabetes in order to socialize and provide encouragement for each other. Other studies and meta analyses have found that individuals with diabetes struggle with self-management as it relates to emotions and the medication they must take to control diabetes, and that these individuals were interested in support groups to meet with others who had similar experiences and concerns.[138–140] Studies show that community and group-based interventions have the potential to improve glycemic control as well as mental health.[81,141–143] Individuals in this study mentioned stress as one of the main challenges in dealing with type 2 diabetes. Studies have shown stress as an important element in diabetes control and onset; worsening the ability to control blood sugar levels and potentially contributing to the developing of diabetes.[141]

After this intervention there were small decreases in HbA1c levels. The literature shows that changes in HbA1c occur as a result of diabetes self-management education. Redmond et al. examined the effect of a T2DM intervention on HbA1c levels in congregate meal recipients in senior centers in north Georgia.[144] The intervention consisted of eight lessons related to nutrition and diabetes self-management and included topics related to "what diabetes is all about," monitoring blood glucose, portion control, meal time and nutrition, foot care

complications, and physical activity. After the intervention, there was a significant decrease in mean HbA1c levels that was not significantly associated with changes in medication. Additionally, mean scores for self-management diabetes activities increased for following an eating plan, spacing carbohydrates, participating in 30 minutes of physical activity and testing blood sugars.[144] Similarly, in this study, participants were taught similar self-management skills related to understanding diabetes, managing diabetes, HbA1c, blood cholesterol, blood pressure, foot care, monitoring, and nutrition for diabetes.

Participants mentioned several positive diabetes self-management behavior changes that could have possibly helped in decreasing HbA1c. Based on the post-intervention questionnaire, participants increased their knowledge in various diabetes-related domains. Increases were seen in diet, carbohydrate, fat, HbA1c, relationship between diet and blood glucose, and comorbidities. These questions were valid and reliable measures of diabetes knowledge in a variety of populations.[111,145] Compared to prior measures, participants were able to demonstrate that their knowledge increased as a result of attending curriculum sessions. Participants also mentioned during the focus group that they had increased physical activity, drank more water, and included more vegetables in their diet.

Measures of food intakes and security were also taken to examine the diet portion of management of diabetes. Food insecurity is linked to poorer glycemic control due in part to decreased ability to choose healthy foods that adhere to diabetes self-management guidelines. Lyles et al. in a 2013 study in low-income individuals with diabetes found that 69 percent of those who reported food insecurity were unable to bring their HbA1c below the 7 percent target.[63] A 2013 prospective cohort study over 37 months revealed that food insecurity and increased HbA1c levels were positively correlated, with an increase of approximately 0.6 percent.[34] Participants in this study indicated during the pre- and post-tests that they sometimes

struggled with having enough or the right kinds of foods and that they sometimes struggled with

having enough money for food in the right amounts or types required to support health. This

information is echoed in the literature.[23] The increases in vegetable variety and consumption

seen post-intervention as a result of providing produce to participants may potentially decrease

food insecurity and improve glycemic control.

Fruits and vegetables may be some of the first items someone neglects when money is a

limitation. Produce is much less calorie dense than processed or convenience foods – which

have the additional effect of making glycemic control more difficult.[63] Racial minorities, low

income households, and single-parent households are more likely than their counterparts to

experience food insecurity.[63] When given access to produce, people tend to increase produce

intake, thereby decreasing food insecurity.[146,147] Focus group results indicate that participants

were delighted with the produce they were given; several had never tried eggplant or zucchini

before the intervention, and afterwards had incorporated these and new items into their diets.

Besides providing the produce items, participants were able to sample various cooked and fresh

vegetables during curriculum sessions, and were given relevant recipes to try at home. Future

interventions should focus on alleviating food insecurity in minority and low-income individuals

with diabetes, while working to educate and empower those same people.

The goal of this study was to determine the feasibility of a pre-existing diabetes self-

management curriculum. The limited efficacy study showed that this curriculum with a produce-

provisioning component is feasible in helping low income, minority populations manage their

T2DM. Participants generally reported that the classes they attended were effective. Focus

group participants expressed interest in attending more classes, as well as establishing support

groups in which they could meet with other individuals managing T2DM. This would provide an

opportunity for socialization and encouragement from people familiar with the types of

problems individuals encounter in managing their diabetes.

Other studies have found that individuals with diabetes struggle with self-management

as it relates to emotions and the medication they must take to control diabetes.[148] These

individuals were interested in creating and attending support groups to meet with others who

had similar concerns and experiences. Studies show that community and group-based

interventions have the potential to improve glycemic control and mental health.[76] Individuals in

this study mentioned stress as one of the main challenges in dealing with T2DM. Studies have

shown stress is an important element in diabetes control as well as onset; worsening ability to

control blood sugar levels and potentially contributing to the developing of diabetes.[141]

Diabetes management curricula in a group setting can be an effective way to reach

multiple individuals at once,[142,143] while providing individuals with diabetes a form of support

group and encouragement that can be found in realizing that they were not alone to face their

by themselves. Participants in this study indicated that they appreciated the social aspect made

possible by coming together and discussing triumphs and challenges that they faced each week.

Limitations and Challenges

The sample size for this study was low, and attrition was an issue throughout the

curriculum sessions. Participants were recruited by individually contacting each person by

phone. This method was time-intensive and had limited success. Logistical problems, such as

organizing transportation or childcare, may be a barrier for participation while involvement of

primary care providers may increase the number of potential recruits.[149] Working closely with

clinics located in communities where desired populations of possible participants reside may

increase participation rates, as may working with community partners from selected areas.[150]

This study utilized facility-based sampling, with CarePoint East clinics being the point of

reference for potential participants. Identifying reasons for not participating, as well as barriers that prevent individuals from attending, may be beneficial and allow for tailored recruitment approaches to increase attendance and participation.

The survey used for assessing various measures of diabetes self-care, knowledge, and food security was compiled using a number of validated tools. This survey was extensive due to the breadth of data sought, and one participant did not complete the whole pre-intervention survey; this resulted in fewer comparison points for knowledge, food security, and self-care behaviors. Access to fresh produce was not assessed in the survey, however specific vegetable intakes and food security were both assessed.

The intention of this study was to determine if low income urban dwellers would attend curriculum sessions and find the content and format helpful. The majority of those contacted for participation indicated that they were not interested in study involvement. While it is possible to hypothesize a number of reasons why this was the case, it is well-documented that minorities and low income populations tend to present more difficulties to recruit.[151]

During the recruitment portion of this study, individuals often indicated why they were unable to attend. A lack of transportation was commonly cited as a barrier to participation, despite interest from many participants. Other concerns included family or themselves having health issues, or a lack of childcare. Most participants were retired, which may have been a factor contributing to their weekday afternoon availability. A few individuals were interested in participating at a future time but were not currently able to join the study. Recruitment was purely voluntary once participants met the inclusion criteria. Despite the perceived benefits, those contacted must weigh conflicting priorities in order to attend weekly educational sessions.

Conclusion

Diabetes, a chronic disease that is increasing in prevalence disproportionately impacts

low income, minority, and food insecure populations. This study sought to determine the

feasibility of a T2DM curriculum with a produce provisioning component in a low income urban

population in Columbus, Ohio. Participants reported that there was a need for the intervention

and that they were interested in more opportunities to participate in group learning and

interact with others with diabetes as well as a knowledgeable educator. Quantitative results

showed that this brief intervention was effective in decreasing HbA1c values, increasing mental

health indicators, produce intake, and diabetes-related knowledge and self-care behaviors. This

study indicates that the inclusion of the produce aspect to the diabetes curriculum was well-

liked, feasible, and served to increase the awareness and use of several new vegetables.

Chapter 5: The Feasibility of a Type 2 Diabetes Curriculum in a Low Income Urban Population

Abstract

Purpose: The goal of this study is to determine the feasibility and acceptability of an adapted type 2 diabetes mellitus (T2DM) self-management (DSME) curriculum with an added produce component in an urban, underserved population.

Methods: A mixed methods approach consisted of a one group, pretest-posttest, 3-month follow-up design and focus group. Adults residing in the Near East side of Columbus, with poor glycemic control (HbA1c >7), enrolled in Medicare and Medicaid, and patients of the Ohio State University CarePoint East Clinic were recruited by phone. Participants received evidence-based DSME weekly for four consecutive weeks led by a Medical Dietetics graduate student. Sessions included information on diabetes management; the ABC's of diabetes, nutrition for diabetes, and getting routine care. Opportunities for tasting vegetables were included as well as recipes. Outcome measures included diabetes knowledge, blood glucose self-management, produce intake, and food insecurity.

Results: Participants (n=6) were mostly females, aged 60 or older and African American. Diabetes related knowledge increased in six out of eleven survey categories, including goal setting, mental health, and problem solving. HbA1c decreased (mean 8.2 to 7.8). Vegetable intake increased across all measured categories. Focus group attendees (n=4) enjoyed and utilized the fresh produce provided with the intervention and continued to use them post intervention.

Conclusions: DSME is an important component of diabetes care. Combining fresh produce with DSME interventions may improve access and intake of vegetables, diet quality, food insecurity, and potentially glycemic control. DSME with a fresh produce component is feasible with low-

income populations. Future studies should focus on evaluating the efficacy of these interventions.

Background of the Problem

Type 2 diabetes mellitus (T2DM), the 7th leading cause of death in the US, impacts more than 27 million Americans.[1,2] Minority populations may be at an increased risk of developing diabetes; ethnic minorities in the United States have two to six times greater risk than non-Hispanic whites. African Americans are at 77 percent greater risk, and Hispanic/Latino individuals 66 percent greater risk than white, non-Hispanic individuals.[3]

Diabetes is associated with increased mortality due to greater risk for cardiovascular disease, stroke, kidney disease and cancer.[4] Socioeconomic factors such as education, income and age increase a person's risk for diabetes and comorbidities.[6] Age is an additional risk factor for diabetes, with rates as high as 25 percent of the population above 65 years old.[3] As the population ages it is predicted that the incidence of diabetes will continue to rapidly increase.

Low income urban dwellers experience unique challenges in diabetes self-management; they face a lower degree of health than those individuals who make more money. Low income was found to predict increased risk for developing T2DM in a Canadian study; low income individuals had a four-time greater risk of diabetes than the top income group in Canada. More frequent periods of low income, versus fewer or a single instance, resulted in increased risk for developing diabetes.[5]

Food security modifies diabetes risk and severity. Low food security indicates that eating patterns have become disrupted and consumption of food has decreased. Those who are food

insecure are more likely to reduce the size of or frequency of meals, worry about food, and/or

have difficulty making food last long enough.[6] Food insecurity is linked to poorer glycemic

control due in part to decreased ability to choose healthy foods that adhere to diabetic diet

guidelines. Researchers found that 69 percent of those who reported food insecurity were

unable to bring their HbA1c below the 7 percent target.[23] Black, non-Hispanic households were

more likely to be food insecure at a rate of 22.5 percent, Hispanic households at a rate of 18.5

percent, and households under 185 percent of the Federal Poverty Line at a rate of 31.6

percent.[6] Non-Hispanic white households experience food insecurity at a rate of 9 percent.[7]

Food insecurity was independently associated in U.S. adults over the age of 55 with being part of

a minority and diabetes diagnosis.[8]

Low household income is linked to an increased prevalence of mental health

problems.[9,10] Poverty is associated with higher levels of stress, anxiety, and depression, while

existing psychological issues can also predict for lower income.[9] Decreased mental health status

may result in poorer diabetes management and increase risk for diabetes-related

complications.[11] Individuals with diabetes have a two times greater risk for diagnosis with major

depressive disorder compared to individuals who do not have diabetes mellitus. Furthermore,

depression results in poorer self-care with diabetes, increasing the rate of complications,

worsening glycemic control, quality of life,[11] glucose monitoring, exercise,[12] and dietary

guideline adherence.[13] Individuals who were food insecure also were more likely to report

higher levels of depression and diabetes distress than those who were food secure.[14]

Evidence for the efficacy of diabetes education on HbA1c exists,[27,28] but an integrated

diabetes education program combined with produce provisioning has not been well

documented in low income, urban populations. This feasibility study may serve to fill the gap in

information regarding the acceptability and outcomes of a modified diabetes curriculum

combined with produce provisioning.

Methods

A mixed methods approach was used to measure the feasibility of the adaptation of an

existing T2DM self-management curriculum with an added produce provisioning component in

an urban, underserved population, and determined the extent to which a shortened version of

the curriculum helped individuals manage their diabetes. A one group pre-test posttest design

was used to determine the limited efficacy of the existing T2DM self-management curriculum.

Baseline information was gathered with a pre-test for the group of participants. The

Diabetes Knowledge and Behaviors questionnaire administered at the beginning and end of the

intervention was created using a variety of validated tools aimed at assessing participant

demographics, behaviors, knowledge, and diabetes management-related socioeconomic factors.

The survey consisted of eight sections: Demographics, Medical concerns, Diabetes knowledge,

Diabetes self-management, Goal setting and problem solving, Quality of life, Food security, and

Vegetable intake.

Diabetes knowledge was assessed with 23 multiple choice questions developed by the

Michigan Diabetes Research Training Center. This brief test of diabetes knowledge was found to

be valid.[15] Reliability was demonstrated with the reported Cronbach's alpha, a measure of

internal reliability, was reported as 0.72.[16,17] The Diabetes Self-management segment asked

participants to rate their self-care activities related to diabetes management. These answers

were scored on a 4-point Likert scale; from 0, does not apply, to 3, "applies to me very much."

Questions covered a number of topics including healthy diet, insulin use, and exercise. Each

question was correlated with HbA1c levels (-0.23, SD = 0.09)[18]. Cronbach's α was 0.77 for Dietary

Control and Glucose Management; 0.76 for Physical Activity, and 0.60 for Healthcare Use.

Overall the Cronbach's α was 0.84.[18]

The two quality of life questions were taken from the CDC's Healthy Days Measure. This tool is used on the Behavioral Risk Factor Surveillance System (BRFSS), the Medicare Health Outcomes Survey (HOS), as well as the National Health and Nutrition Examination Survey (NHANES).[19] Validity and reliability of this tool has been assessed in several different populations.[20,21]

Food security questions were taken from the Six-Item Short Form of the USDA Food Security Survey Module.[22] . Those that report food insecurity answered all six questions in order to provide a better picture of their food security and hunger levels.[22] An advantage to using this tool is that information gathered from the study population can be compared to national data gathered using the standard practice module. This tool is valid, and derived from the reliable 18-question survey which assesses a more broad range of food security in US households.[23] The USDA Six Item Short Form Food Security Module allows for participant responses to stratify into the levels of food security. Affirmative answers to any of the questions (sometimes, often, or yes) are scored as 1 point, with a total of six points on the scale. Scores from 0-1 indicate high or marginal food security; scores from 2-4 indicate low food security, and scores from 5-6 indicate very low food security.[22]

Participants were also provided with a list of 35 vegetables and were asked circle the items they ate during the last month. To analyze reported intakes, available options were divided into five categories as defined by the USDA's vegetable subtypes.[24]

All participants who attended the intervention were invited to take part in the focus group to collect qualitative data. A focus group guide book consisting of thirteen potential questions was developed (Figure 1 lists the questions asked). Each question had additional

probes to facilitate deeper discussion on topics as participants shared their experiences. The questions were related to acceptability, demand for the intervention, and Limited-efficacy testing. Participants who attended the focus group session were given a $20 gift card. Transcription of the focus group audio files was verbatim. The transcripts were independently coded and verified by comparing themes and ideas that were identified by the two independent qualitative researchers.

The University of Kentucky Cooperative Extension "Taking Ownership of Your Diabetes" was used to provide diabetes information for the curriculum in a format that is easy to understand and that allows individuals to modify lifestyle risks and solve problems related to diabetes management. The curriculum was developed by Adams (2010).[25] The curriculum is based on the National Diabetes Education publication (NDEP) "4 Steps to Control Your Diabetes. For Life." The Stages of Change Model[26] and a model of critical thinking developed by the author[27] were used as theoretical bases. Lessons were structured to move individuals from pre-contemplation to actions. Elements of the critical thinking model such as empowerment, problem solving and goals setting are infused throughout the curriculum. The curriculum contains four units: (1) Understanding diabetes; (2) The ABCs of Diabetes; (3) Nutrition for Diabetes; and (4) Getting Routine Care.

Results

Each participant was personally recruited by the clinician or graduate student; contact was attempted with 78 individuals. Six of the contacted individuals, or 7.7 percent, attended any of the intervention sessions. Participants attended 1-4 sessions; two individuals each attended 1, 2, and 3 classes while one individual attended all four classes (See Table 4.1). Reminder calls were made to each participant on Tuesdays, the day before each class was offered, between noon and 2:00 PM. Individuals who attended the focus group indicated that the reminder calls

were helpful and encouraged them to come as well as ensuring that they did not forget the date or location of the event.

Five (83.3 percent) participants were women and one was male. One participant (17 percent) was currently employed, while the majority (83.3 percent) indicated that they were retired. Three participants (50.0 percent) attended 1-3 years of college; one (16.7 percent) was a college graduate, and three (50.0 percent) attended school up to grade 12 or received a general equivalency diploma (GED). The majority (66.7 percent) of participants designated their race as Black or African American, one was Asian/Pacific Islander, and one was white, non-Hispanic. Most participants (66.7 percent) live alone. Close to 90 percent of the individuals were aged 60 or above, and 1 fell within the 40-49 age group. On average participants had body mass indices that classified them as obese (mean= 32.0 kg/m^2, SD = 4.7). See Table 4.2.

Depression/anxiety was reported by four participants (66.7 percent) while dental problems were reported by one individual (16.7 percent). See Figure 4.1. Reported health problems were compared to diagnoses from patient medical chart information. One participant (16.7 percent) had diagnosed retinopathy, neuropathy was present in half (50.0 percent), nephropathy in four (66.7 percent), hyperlipidemia in five (83.3 percent), and hypertension in four (66.7 percent). The possible list of medical conditions was based on common diabetes comorbidities; diagnosed comorbidities were found in participant medical charts. See Figure 4.1.

Prior to the intervention, participants' mean HbA1c was 8.3 percent on average. After the intervention, the mean dropped approximately 0.4 points to 7.9 percent. Laboratory values were reported according to availability in electronic medical records. Mean point of care (POC) blood glucose was 195 mg/dL (SD=111), cholesterol mean was 216 mg/dL (SD 54), LDL levels 156 mg/dL (SD=72) on average. HDL was 49 (SD=10) and mean blood pressure was approximately 129/73 mmHg on average (SD=22 systolic/29 diastolic). See Table 4.3.

Participants displayed small improvements in diabetes related knowledge in the post-intervention questionnaires. Questions regarding carbohydrates, fat, and the relationship between diet and blood glucose increased by 0.2 after the intervention. Knowledge of comorbidities related to diabetes as well as proper measurement of blood glucose increased by 0.4. Knowledge of HbA1c (0.4), foot care (1.0), ketoacidosis (0.0), and glycemic control while sick (0.8) remained the same. Knowledge of the diabetic diet and insulin use decreased by 0.2 and 0.4, respectively. See Table 4.4.

Post-intervention, fewer participants reported never experiencing two issues related to food insecurity such as no money to buy more food (pre, 50.0 percent; post, 25.0 percent), and can't afford balanced meals (pre, 50.0 percent; post, 25.0 percent)). Participants pre- and post-intervention reported that they never cut down on meal size (100.0 percent pre- and post-intervention) Participants reported increased instance of eating less due to money issues (pre, 0.0 percent, post: 50.0 percent) and being hungry but not eating (pre, 0.0 percent, post 25.0 percent).

Mental Health

Participants reported anywhere from 0 to 25 mental health stress days, and 0 to 30 poor mental health days for the pre-intervention period. At post-intervention, all participants (100 percent) reported five or less stress days compared to one (25.0 percent) pre-intervention. Poor mental health days decreased post-intervention for half of participants (50 percent) to zero days and half (50 percent) to 1-5 days, versus one individual each (25.0 percent) reporting 1-5; 6-10; 11-15; and 26-30 days. See Table 4.5.

Goal Setting

Participants set (75 percent) and accomplished (75 percent) goals to the same degree pre- and post-intervention. Participants were evenly split (50 percent) on the pre-test regarding

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their ability to solve problems that could occur in daily life related to diabetes management; post-intervention, all (100 percent) respondents felt that they were able to solve problems.

Food Insecurity

Prior to the intervention, two individuals had low food security, while post-intervention responses indicated one individual had high or marginal food security, and two had very low food security. Measures of food insecurity generally improved after the intervention. Fewer participants noted that they had no money to buy food, or difficulty affording balanced meals pre- (50 percent) to post-intervention (25 percent), however one participant indicated that they often struggled prior to the intervention, and no individuals noted frequently struggling after the intervention. Cutting down on meal size was reported "sometimes" by all six respondents (100 percent) prior to the intervention, versus three (75 percent) after the intervention. The remaining participant indicated that they never had to decrease meal size, which is a change from the pre-intervention period.

Participants reporting that they eat less because of money issues were split evenly (50 percent) between yes and no. Participants diverged from that pattern with the 'hungry but didn't eat' question as only one (25 percent) indicated yes, and three (75 percent) reported that they did not face this problem, as opposed to four (66.7 percent) prior to the intervention.

During the post-intervention period, participants reported increased mean intake of most vegetable subgroups. Dark green leafy (pre- 3.3, post- 3.8), starchy (pre- 1.7, post- 2.5), red and orange (pre- 4.2, post- 5.5), and others (pre- 9.5, post- 10.5).

During the post-intervention period, participants reported increased mean intake of most vegetable subgroups. Dark green leafy (pre- 3.3, post- 3.8), starchy (pre- 1.8, post- 2.5), red and orange (pre- 4.8, post- 5.5), and others (pre- 9.0, post- 10.5).

All of those who responded to the food intake segment of the questionnaire indicated that they had consumed leaf lettuce, okra, green beans, and onion in the last month. Other foods were consumed by five percent of the respondents (83 percent); potatoes, sweet potatoes, green or red peppers, tomatoes, and Swiss chard/kale/spinach. Four (67 percent) of the respondents indicated that they had eaten cucumber, mushrooms, cabbage, iceberg lettuce, carrots, corn, mixed vegetables, or tomato sauce within the last month.

The post-intervention survey indicated that participants (75 percent) had slightly increased their diet diversity; scores ranged from 17-26 total items with an average of 22.3 items per person versus 18.7 pre-intervention. Two out of the three respondents (67 percent) indicated that their overall produce intake increased during the intervention period. Items consumed per vegetable subgroup increased for every category except beans and peas, which did not have any items represented on the questionnaire. See Table 4.6.

All six participants completed the stages of change questionnaire. The majority of individuals indicated that they were in the preparation, action, or maintenance stages for the five measures of stages of change. Stages of change were not assessed post-intervention. One individual each was in the action, precontemplation, and preparation stages. Two participants were in the maintenance stage, and one was split between preparation and action stages of their diabetes management.

Qualitative Approach – Focus

The focus group consisted of four participants and began with a broad question on what comes to mind when participants were asked "What comes to mind when I say diabetes management." Four themes emerged, medication, moderation, manage food intake and negative emotions such as worry and fear. For example, one participant mentioned regarding medication *"I need to take my medication… you know my five medications just for my blood*

pressure. And I'm on three medications plus insulin to control my diabetes." Related to

moderation, one participant stated that- *"there are certain times you want dessert, but

everything is done in moderation…"* Participants also indicated that they thought of managing

their food intakes in relation to diabetes management. Regarding managing food intake, one

participant stated that *"…I went back to eating meat, but I eat very little of it, I eat more

vegetables and fruits with my meals."* Participants also discussed that they had negative

emotions regarding diabetes management. In this light, one participant stated, *"I was so

worried…[I] keep on worrying about my diabetes, my body's going down."* Another participant

relayed that *"My challenge was I was still working, and my job had become very stressful."* and

"I think stress is a big part of all health issues."

Participants also discussed struggling with social situations in which food would be

present, which was often. One participant mentioned *"My thing is that… at least with my friends

– every day is this, baby shower, whatever it is, the first thing everybody says is let's meet up at

red lobster, let's meet up at the steak house… is that everybody's birthday or whatever I attend,

95 percent of the time there is food involved, a lot of food."*

When participants were asked about the challenges they felt were unique to dealing

with their diabetes, most mentioned stress as the biggest challenge. For example, job stress was

mentioned, as well as stress related to health problems, people's perception, and the stress to

partake in unhealthy foods at social gathering such as church events, birthday parties, and

restaurants.

Participants were asked to "tell us about some things that make managing your diabetes

easier or to describe what would really help you in terms of managing your diabetes." Most

individuals mentioned support groups or the support of family and friends. One participant

conveyed that they had a friend who understood her condition and did her best to

accommodate it; "*We're planning to go out and she knows what's going to harm me, and everything, she'll say well we'll go to this place or that place to help me. She's not going to say to go to this place if I'll be sick as a dog.*" One individual expressed the desire for a support group, while another had found one; "*I joined a grandmother's group. I go and talk to elderly people, and I love it. They love to exercise… The more I exercise the better I feel.*

The majority of participants mentioned that the teaching style of the dietetic graduate student and the calls she made to remind them of the meetings motivated them to attend the sessions. One participant stated "*… I was having some problems with my diabetes and I needed education, so it was right on target for me. It's like she was God sent, she called me for the class*" Another participant remarked that they wanted this kind of program: "*Knowledge is key. I came to get more knowledge about what I need to do to help myself. With Hannah teaching the class, it's just like a baby when you pick them up and he's trying to walk. You need to hear over and over again until you get it.*" Another participant noted that they felt the relationship with the instructor was an important factor; "*I think Hannah is a good presenter, and when you attend classes like that you need somebody that you can comfortably speak and information which she went over she was very helpful and very thorough.*"

Participants were asked how much of a motivator the incentives were for attending class. It was stated that the stretch bands were excellent and expressed satisfaction with the pedometer and the portion plate. One participant relayed that *"The stretch bands are excellent, and when I'm walking I have the meter on and it tells me how far I'm walking. Also the plate portions out, does it for you. We had in class about portions and servings, and that worked great."*

In addition, when participants were asked to identify things that would be more of a motivator instead of the current incentives for them to attend classes, participants mentioned

the opportunity to exercise and the opportunity to come together and learn from each other in a social setting. One individual remarked "*I think we need a place we can come and exercise, for like half an hour or an hour. When people come together they do better…*" Another stated the importance of being around others going through the same thing; "*I thought I was the only diabetic person and suffering alone in my class. Different cultures, everybody is facing the same like me. We are equal.*"

Participants were asked to describe how they felt about the produce they received as part of the intervention. A theme was, "I love the eggplants" and implementing what they had learned because of the produce and recipes that were provided. Multiple participants stated that *"I love the eggplant."* One participant displayed how she used the knowledge and skills gained from the intervention to cook for their family; *"For Thanksgiving I had 12 bunches of collard greens and I had 6 of kale, and I cooked them down and I had 3 of spinach, and my clan loved it. There were 36 of us… everyone loved the greens. Sometimes you gotta implement what you learn into something."*

When asked what they had started new or what behavior they started as a result of attending the classes, participants mentioned several food related behaviors such as trying new foods, particularly eggplant and zucchini, paying attention to nutrition labels, better snacking practices and drinking more water. They also mentioned that they had started exercising or exercising more than previously. One participant stated *"I have started exercising, I have started walking…. I said I eat enough stuff I don't need to try anything else. What came to me was I had tried everything else, but 90 percent of that wasn't good for me, so it was time to try something else."* Another participant said that they had changed a few behaviors; "*I have started exercising more, and I'm taking more classes, and I'm paying more attention to the labels to see what's in there and if I can eat that. And I'm doing better with my snacks."* Another

person increased water intake by finding a way to make it more palatable; "*I have learned to drink more water. I was not drinking - I got to the point where I said water's nasty, so I put a lemon wedge in it.*"

Discussion

The purpose of this study was to determine the efficacy, feasibility, and acceptability of a shortened Type 2 diabetes mellitus curriculum in a low-income, urban population in Columbus, Ohio. Participants in this study were at high risk for complications related to diabetes management. Most of the participants were minorities, female, over the age of 60 and about one-third had only a high school education. In addition, most were obese and had been diagnosed with nephropathy, hyperlipidemia, or hypertension. Research shows that there is a greater prevalence of T2DM in ethnic minorities such as non-Hispanic blacks and Hispanics versus non-Hispanic whites,[123] and that these individuals also tend to have a higher number of complications related to retinopathy, neuropathy, nephropathy, and amputations.[124] Among these complications are the higher risk of amputations which are nearly doubled in African Americans versus non-Hispanic whites.[125]

Effective management of diabetes, such as dietary control, regular exercise, psychosocial coping skills, medication use and self-monitoring of blood glucose requires a knowledge of self-care practices, which is related to health literacy. Self-care behaviors were found to vary by race and ethnicity in 2011 BRFSS data.[126] A study conducted in a public hospital setting in San Francisco suggests that increased levels of health literacy increase glycemic control in individuals with T2DM.[127] These data suggest that diabetes-related self-care behaviors may be strongly impacted by socioeconomic factors including race, ethnicity, education level, and geography.

Most individuals with diabetes do not follow the recommended self-care practices, and certain ethnicities are less likely to adhere to specific goals.[123,128] African Americans were found to exercise less than other ethicities.[129] These behaviors may be related to perceptions of the recommendations and perceived benefits thereof that some individuals may hold. Low income African-Americans revealed that they often did not take their medicines because they felt that they knew better than their physicians.[130] This study provided information on diabetes and different aspects of diabetes self-management for each of the four weeks of intervention and saw increases in diabetes knowledge related to diet, carbohydrates, fat, HbA1c, the relationship between blood glucose and diet and comorbidities. These findings and the literature underscore the need to provide targeted interventions for low income and minority populations to improve health outcomes as they relate to diabetes and its related complications.

Increases in diabetes knowledge are likely to result in improved health outcomes; as patients with diabetes understand the disease, potential complications, as well as how their dietary intakes can impact blood sugar they are likely to have better self-care behaviors. Increasing opportunities for patients with diabetes to learn about the disease, its management, and how they can avoid complications may enable more people to have better health outcomes. Improvements in levels of diabetes-related knowledge are also likely to result from meeting with registered dietitians, performing self-monitoring of blood glucose, and/or attending programs aimed at educating patients on diabetes.[111] Interventions such as the one performed in this study were effective in increasing diabetes-related knowledge, without requiring a great amount of resources. As previously discussed, diabetes costs the US healthcare system over $300 billion as of 2017.[43] Therefore, this study suggests that this may be an acceptable approach to increase diabetes self-management knowledge among low-income audiences.

In this study, participants' ability to set and accomplish goals and to solve problems increased post intervention. In this study at the end of each session participants were asked to set goals and they were followed up in subsequent classes to determine whether the goals were accomplished. Over three-quarters of participants mentioned that they set and accomplished goals. Similar results were found regarding goal setting and the use of this curriculum in the state of Kentucky. During the first 18 months of implementation, a total of 3,085 individuals participated in the "Taking Ownership of Your Diabetes" program, of these, 45 percent stated that they set and accomplished goals for themselves. Although this study was a feasibility study, it showed that individuals also accomplished goals as in the larger study conducted at a state level in Kentucky.[131]

Participants in this study also reported that they were also able to solve problems related to managing diabetes after the intervention. The American Association of Diabetes Educators includes problem solving as one of the seven areas of self-care behaviors related to diabetes management.[132] A sample of 506 multiracial adults was assessed based on skills related to problem solving and diabetes management. They found diabetes problem solving to be an important skill related to several key areas of diabetes self-management. Glasgow et al. also saw improvement in problem solving post intervention.[133] Increases in T2DM self-management are related to improved ability to solve problems in daily life related to the various aspects of managing a chronic disease. This study was able to improve participants' problem-solving ability, indicating that the potential to increase T2DM self-management also exists.

Reported days of poor mental health and frequency with which it impacted the ability to perform daily activities decreased on average from pre- to post-intervention. Studies have shown that a diagnosis with diabetes may increase the risk of anxiety,[134] lead to lower reported quality of life, as well as decreased time spent with family or friends.[135] While diabetes and

mental health cause negative outcomes in the other disease, various interventions targeting

mental and physical health have resulted in improved HbA1c as well as mental health measures.

This was shown by Harkness et al. in a systematic review and meta-analysis of interventions

aimed at improving mental and physical health in individuals with diabetes.[136] During the focus

group portion of this study, participants discussed the fear that came with having a diagnosis of

diabetes, as well as the difficulties they had encountered in navigating social situations in which

food would be present.

Mental health may improve post-intervention due to improvements in diabetes control

and goal-setting behaviors. In a review of literature, Harvey found that patients with diabetes

demonstrate improvements in the psychosocial realm, and have modest improvements in

glycemic control, as a result of psychosocial or behavioral interventions.[137]

Focus group attendees also expressed an interest in attending more classes and

establishing support groups in which they could meet with other people also coping with

diabetes in order to socialize and provide encouragement for each other. Other studies and

meta analyses have found that individuals with diabetes struggle with self-management as it

relates to emotions and the medication they must take to control diabetes, and that these

individuals were interested in support groups to meet with others who had similar experiences

and concerns.[138–140] Studies show that community and group-based interventions have the

potential to improve glycemic control as well as mental health.[81,141–143] Individuals in this study

mentioned stress as one of the main challenges in dealing with type 2 diabetes. Studies have

shown stress as an important element in diabetes control and onset; worsening the ability to

control blood sugar levels and potentially contributing to the developing of diabetes.[141]

After this intervention there were small decreases in HbA1c levels. The literature shows

that changes in HbA1c occur as a result of diabetes self-management education. Redmond et al.

examined the effect of a T2DM intervention on HbA1c levels in congregate meal recipients in senior centers in north Georgia.[144] The intervention consisted of eight lessons related to nutrition and diabetes self-management and included topics related to "what diabetes is all about," monitoring blood glucose, portion control, meal time and nutrition, foot care complications, and physical activity. After the intervention, there was a significant decrease in mean HbA1c levels that was not significantly associated with changes in medication. Additionally, mean scores for self-management diabetes activities increased for following an eating plan, spacing carbohydrates, participating in 30 minutes of physical activity and testing blood sugars.[144] Similarly, in this study, participants were taught similar self-management skills related to understanding diabetes, managing diabetes, HbA1c, blood cholesterol, blood pressure, foot care, monitoring, and nutrition for diabetes.

We also saw a decrease in HbA1c levels post-intervention. Participants mentioned several positive diabetes self-management behavior changes that could have possibly helped in decreasing HbA1c. Based on the post-intervention questionnaire, participants increased their knowledge in various diabetes-related domains. Increases were seen in diet, carbohydrate, fat, HbA1c, relationship between diet and blood glucose, and comorbidities. These questions were valid and reliable measures of diabetes knowledge in a variety of populations.[111,145] Compared to prior measures, participants were able to demonstrate that their knowledge increased as a result of attending curriculum sessions. Participants also mentioned during the focus group that they had increased physical activity, drank more water, and included more vegetables in their diet.

Food insecurity is linked to poorer glycemic control due in part to decreased ability to choose healthy foods that adhere to diabetes self-management guidelines. Lyles et al. in a 2013 study in low-income individuals with diabetes found that 69 percent of those who reported food

insecurity were unable to bring their HbA1c below the 7 percent target.[63] A 2013 prospective

cohort study over 37 months revealed that food insecurity and increased HbA1c levels were

positively correlated, with an increase of approximately 0.6 percent.[34] Participants in this study

indicated during the pre- and post-tests that they sometimes struggled with having enough or

the right kinds of foods and that they sometimes struggled with having enough money for food

in the right amounts or types required to support health. This information is echoed in the

literature.[23] The increases in vegetable variety consumption seen post-intervention as a result

of providing produce to participants may potentially decrease food insecurity and improve

glycemic control.

   Fruits and vegetables may be some of the first items someone neglects when money is a

concern. Produce is much less calorie dense than processed or convenience foods – which have

the additional effect of making glycemic control more difficult.[63] Racial minorities, low income

households, and single-parent households are more likely than their counterparts to experience

food insecurity.[63] When given access to produce, people tend to increase produce intake,

thereby decreasing food insecurity.[146,147] Focus group results indicate that participants were

delighted with the produce they were given; several had never tried eggplant or zucchini before

the intervention, and afterwards had incorporated these and new items into their diets. Besides

providing the produce items, participants were able to sample various cooked and fresh

vegetables during curriculum sessions, and were given relevant recipes to try at home. Future

interventions should focus on alleviating food insecurity in minority and low-income individuals

with diabetes, while working to educate and empower those same people.

   The goal of this study was to determine the feasibility of a pre-existing diabetes self-

management curriculum. The limited efficacy study showed that this curriculum with a produce-

provisioning component is feasible in helping low income, minority populations manage their

T2DM. Participants generally reported that the classes they attended were effective. Focus group participants expressed interest in attending more classes, as well as establishing support groups in which they could meet with other individuals managing T2DM. This would provide an opportunity for socialization and encouragement from people familiar with the types of problems individuals encounter in managing their diabetes.

Other studies have found that individuals with diabetes struggle with self-management as it relates to emotions and the medication they must take to control diabetes.[148] These individuals were interested in creating and attending support groups to meet with others who had similar concerns and experiences. Studies show that community and group-based interventions have the potential to improve glycemic control and mental health.[76] Individuals in this study mentioned stress as one of the main challenges in dealing with T2DM. Studies have shown stress is an important element in diabetes control as well as onset; worsening ability to control blood sugar levels and potentially contributing to the developing of diabetes.[141]

Diabetes management curricula in a group setting can be an effective way to reach multiple individuals at once,[142,143] while providing individuals with diabetes a form of support group and encouragement that can be found in realizing that they were not alone to face their by themselves. Participants in this study indicated that they appreciated the social aspect made possible by coming together and discussing triumphs and challenges that they faced each week.

Limitations and Challenges

The sample size for this study was low, and attrition was an issue throughout the curriculum sessions. Participants were recruited by individually contacting each person by phone. This method was time-intensive and had limited success. Logistical problems, such as organizing transportation or childcare, may be a barrier for participation while involvement of primary care providers may increase the number of potential recruits.[149] Working closely with

clinics located in communities where desired populations of possible participants reside may increase participation rates, as may working with community partners from selected areas.[150]

This study utilized facility-based sampling, with CarePoint East clinics being the point of reference for potential participants. Identifying reasons for not participating, as well as barriers that prevent individuals from attending, may be beneficial and allow for tailored recruitment approaches to increase attendance and participation.

The survey used for assessing various measures of diabetes self-care, knowledge, and food security was compiled using a number of validated tools. This survey was extensive due to the breadth of data sought, and one participant did not complete the whole pre-intervention survey; this resulted in fewer comparison points for knowledge, food security, and self-care behaviors. Access to fresh produce was not assessed in the survey, however specific vegetable intakes and food security were both assessed.

The intention of this study was to determine if low income urban dwellers would attend curriculum sessions and find the content and format helpful. The majority of those contacted for participation indicated that they were not interested in study involvement. While it is possible to hypothesize a number of reasons why this was the case, it is well-documented that minorities and low income populations tend to present more difficulties to recruit.[151]

During the recruitment portion of this study, individuals often indicated why they were unable to attend. A lack of transportation was commonly cited as a barrier to participation, despite interest from many participants. Other concerns included family or themselves having health issues, or a lack of childcare. Most participants were retired, which may have been a factor contributing to their weekday afternoon availability. A few individuals were interested in participating at a future time but were not currently able to join the study. Recruitment was

purely voluntary once participants met the inclusion criteria. Despite the perceived benefits, those contacted must weigh conflicting priorities in order to attend weekly educational sessions.

Conclusion

Diabetes, a chronic disease that is increasing in prevalence disproportionately impacts low income, minority, and food insecure populations. This study sought to determine the feasibility of a T2DM curriculum with a produce provisioning component in a low income urban population in Columbus, Ohio. Participants reported that there was a need for the intervention and that they were interested in more opportunities to participate in group learning and interact with others with diabetes as well as a knowledgeable educator. Quantitative results showed that this brief intervention was effective in decreasing HbA1c values, increasing mental health indicators, produce intake, and diabetes-related knowledge and self-care behaviors. This study indicates that the inclusion of the produce aspect to the diabetes curriculum was well-liked, feasible, and served to increase the awareness and use of several new vegetables.

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Appendix A: Instrumentation

TAKING OWNERSHIP OF YOUR DIABETES SURVEY

Pretest/Posttest

Please take time to answer the following questions. It will provide information about the program and the progress you have made.

General Information

1. Participant Number: _____

2. Gender: Male   Female

3. Age:
    __18-29
    __30-39
    __40-49
     __50-59
    __60 and over

4. Do you live alone?   __Yes   __ No

5. Marital Status: __Married   __ Divorced   __Widowed   __Separated
    __Never Married   __Member of an unmarried couple

6. Which one or more of the following would you say is your race?:
    ___White, non-Hispanic
    ___Hispanic/Latino
    ___Asian/Pacific Islander
    ___Black/African-American
    ___American Indian/Alaskan Native
    ___Other (please indicate)   _____

7. Education:
___Never attended school or only attended kindergarten
___Grades 1 through 8 (Elementary)
___Grades 9 through 11 (Some high school)
___Grade 12 or GED (High school graduate)
___College 1 year to 3 years (Some college or technical school)
___College 4 years or more (College graduate)
___Refused

8. Are you currently employed?   Yes   No

9. What is your occupation? _____

10. Height (in feet and inches) _____

11. Weight in pounds_____

MEDICAL CONCERNS

Have you been told you have any of the following?
 __ eye issues   __heart disease   ___kidney issues   __ arthritis
__ high blood pressure   __high cholesterol   __dental issues   __depression/anxiety
__ numbness/tingling/loss of feeling in your feet
__Other/comments_____

DIABETES KNOWLEDGE

12. The diabetes diet is:
a. the way most American people eat
b. a healthy diet for most people
c. too high in carbohydrate for most people
d. too high in protein for most people

13. Which of the following is highest in carbohydrate?
a. Baked chicken
b. Swiss cheese
c. Baked potato
d. Peanut butter

14. Which of the following is highest in fat?

a. Low fat (2%) milk

b. Orange juice

c. Corn

d. Honey

15. Which of the following is a "free food"?

a. Any unsweetened food

b. Any food that has "fat free" on the label

c. Any food that has "sugar free" on the label

d. Any food that has less than 20 calories per serving

16. A1C is a measure of your average blood glucose level for the past:

a. day

b. week

c. 6-12 weeks

d. 6 months

17. Which is the best method for home glucose testing?

a. Urine testing

b. Blood testing

c. Both are equally good

18. What effect does unsweetened fruit juice have on blood glucose?

a. Lowers it

b. Raises it

c. Has no effect

19. Which should not be used to treat a low blood glucose?

a. 3 hard candies

b. 1/2 cup orange juice

c. 1 cup diet soft drink

d. 1 cup skim milk

20. For a person in good control of blood sugar, what effect does exercise have on blood glucose?

a. Lowers it

b. Raises it

c. Has no effect

21. What effect will an infection most likely have on blood glucose?

a. Lowers it

b. Raises it

c. Has no effect

22. The best way to take care of your feet is to:

a. look at and wash them each day

b. massage them with alcohol each day

c. soak them for one hour each day

d. buy shoes a size larger than usual

23. Eating foods lower in fat decreases your risk for:

a. nerve disease

b. kidney disease

c. heart disease

d. eye disease

24. Numbness and tingling may be symptoms of:

a. kidney disease

b. nerve disease

c. eye disease

d. liver disease

25. Which of the following is usually not associated with diabetes:

a. vision problems

b. kidney problems

c. nerve problems

d. lung problems

26. Signs of ketoacidosis (DKA) include:

a. shakiness

b. sweating

c. vomiting

d. low blood glucose

27. If you are sick with the flu, you should:

a. Take less insulin

b. Drink less liquids

c. Eat more proteins

d. Test blood glucose more often

 28. If you have taken rapid-acting insulin, you are most likely to have a low blood glucose reaction in:

a. Less than 2 hours

b. 3-5 hours

c. 6-12 hours

d. More than 13 hours

29. You realize just before lunch that you forgot to take your insulin at breakfast. What should you do now?

a. Skip lunch to lower your blood glucose

b. Take the insulin that you usually take at breakfast

c. Take twice as much insulin as you usually take at breakfast

d. Check your blood glucose level to decide how much insulin to take

30. If you are beginning to have a low blood glucose reaction, you should:

a. exercise

b. lie down and rest

c. drink some juice

d. take rapid-acting insulin

31. A low blood glucose reaction may be caused by:

a. too much insulin

b. too little insulin

c. too much food

d. too little exercise

32. If you take your morning insulin but skip breakfast, your blood glucose level will usually:

a. increase

b. decrease

c. remain the same

33. High blood glucose may be caused by:

a. not enough insulin

b. skipping meals

c. delaying your snack

d. skipping your exercise

34. A low blood glucose reaction may be caused by:

a. heavy exercise

b. infection

c. overeating

d. not taking your insulin

DIABETES SELF-MANAGEMENT

The following statements describe self-care activities related to your diabetes. Thinking about your self-care over the last 8 weeks, please specify the extent to which each statement applies to you.	Applies to me very much	Applies to me to a consider-able degree	Applies to me to some degree	Does not apply to me
35.	I check my blood sugar levels with care and attention. ☐ *Blood sugar measurement is not required as a part of my treatment.*	☐3	☐2	☐1	☐0
36.	The food I choose to eat makes it easy to achieve optimal blood sugar levels.	☐3	☐2	☐1	☐0
37.	I keep all doctors' appointments recommended for my diabetes treatment.	☐3	☐2	☐1	☐0
38.	I take my diabetes medication (e. g. insulin, tablets) as prescribed. ☐ *Diabetes medication / insulin is not required as a part of my treatment.*	☐3	☐2	☐1	☐0

The following statements describe self-care activities related to your diabetes. Thinking about your self-care over the last 8 weeks, please specify the extent to which each statement applies to you.	Applies to me very much	Applies to me to a consider-able degree	Applies to me to some degree	Does not apply to me
39. Occasionally I eat lots of sweets or other foods rich in refined carbohydrates.	□3	□2	□1	□0
40. I record my blood sugar levels at least daily (or analyze the value chart with my blood glucose meter). □ *Blood sugar measurement is not required as a part of my treatment.*	□3	□2	□1	□0
41. I tend to avoid diabetes-related doctors' appointments.	□3	□2	□1	□0
42. I do regular physical activity (30 minutes on 5 or more days of the week) to achieve optimal blood sugar levels.	□3	□2	□1	□0
43. I strictly follow the dietary recommendations given by my doctor or diabetes specialist.	□3	□2	□1	□0
44. I do not check my blood sugar levels frequently enough as would be required for achieving good blood glucose control. □ *Blood sugar measurement is not required as a part of my treatment.*	□3	□2	□1	□0
45. I avoid physical activity, although it would improve my diabetes.	□3	□2	□1	□0
46. I tend to forget to take or skip my diabetes medication (e. g. insulin, tablets).	□3	□2	□1	□0

The following statements describe self-care activities related to your diabetes. Thinking about your self-care over the last 8 weeks, please specify the extent to which each statement applies to you.	Applies to me very much	Applies to me to a consider-able degree	Applies to me to some degree	Does not apply to me
☐ Diabetes medication / insulin is not required as a part of my treatment.				
47. Sometimes I have real 'food binges' (not triggered by hypoglycemia).	☐3	☐2	☐1	☐0
48. Regarding my diabetes care, I should see my medical practitioner(s) more often.	☐3	☐2	☐1	☐0
49. I tend to skip planned physical activity.	☐3	☐2	☐1	☐0
50. My diabetes self-care is poor.	☐3	☐2	☐1	☐0

51. I have used a diabetes meal plan to manage my diabetes.

_____Yes   _____No

If so, which one? _____

52. I have set one or more goals for myself within the last month related to diabetes management.

_____Yes_____ No

If so, which goal(s)? _____

53. I have accomplished at least one of the goals I set for myself in the last month that relates to diabetes management.

  _____Yes   _____ No

   If so, which goal(s)? _____

54. Do you think that you are able to solve problems that come about in your daily life as you deal with your diabetes?

  _____Yes   _____ No

55. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?

__0 days
__1-5days
__6-10days
__11-15days
__16-20 days
__21-25 days
__ 26-30days

56. During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

__0 days
__1-5days
__6-10days
__11-15days
__16-20 days
__21-25 days
__ 26-30days

USDA Household Food Security Module (6 Question)

57. The first statement is, "The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more." Was that often, sometimes, or never true for (you/your household) in the last 12 months?
[ ] Often true
[ ] Sometimes true
[ ] Never true
[ ] Don't Know or Refused

58. I/we worried whether (my/our) food would run out before (I/we) got money to buy more.
[ ] Often true
[ ] Sometimes true
[ ] Never true

59. "(I/we) couldn't afford to eat balanced meals." Was that often, sometimes, or never true for (you/your household) in the last 12 months?
[ ] Often true
[ ] Sometimes true
[ ] Never true
[ ] Don't Know or Refused

60. In the last 12 months, since last (name of current month), did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?
[ ] Yes
[ ] No
[ ] Don't Know

60a. [IF YES ABOVE, ASK] How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?
[ ] Almost every month
[ ] Some months but not every month
[ ] Only 1 or 2 months
[ ] DK

61. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?
[ ] Yes
[ ] No
[ ] Don't Know

61a. In the last 12 months, were you every hungry but didn't eat because there wasn't enough money for food?
[ ] Yes
[ ] No
[ ] Don't Know

FOOD INTAKE

Please circle each of the vegetables you ate during the last month?

Artichokes	Eggplant	Pumpkin
Asparagus	Green beans	Swiss chard, kale, spinach,
Bean sprouts	Lettuce (leaf)	Summer squash (thin skin)
Beets	Lettuce (iceberg)	Tomatoes
Bok Choy	Mixed vegetable	Tomato sauce
Broccoli	Mushroom	Winter squash (hard skin)
Brussels sprouts	Okra	Zucchini
Cabbage	Onion	Turnip, other than greens
Carrots	Peas	Sweet potatoes or yams
Cauliflower	Green or red peppers	Watercress
Celery	Parsnips	
Corn	Potatoes	
Cucumber		

Others? Please list.

_____

_____

_____

_____

END OF QUESTIONNAIRE

Appendix B: Stages of Change Tool

Stages of Change Questions

1. Physical Activity

Tell me how many times a week you do exercise. (This can include fast walking, bicycling, heavy work… anything that makes your heart go faster and you breathe a little faster.) For how many minutes each time? Exercising five times a week for about 30 minutes each time is very important to your health and diabetes control. Do you usually get this much exercise?

NO __

 YES __

I do not want to do that   __

I am now (for less than 6 months) __

I can't in the next 6 months __

I have for more than 6 months __

I may in the next 6 months __

I will start in the next 30 days __

2. Taking medications correctly

Tell me how you took your medicines yesterday. Did you take all the pills the doctor has prescribed?

Taking medications correctly, all the time, can prevent complications of diabetes like heart attacks, amputations, and strokes. Do you intend to start taking all your medications correctly every day?

NO __

 YES __

I do not want to do that   __

I am now (for less than 6 months) __

I can't in the next 6 months __

I have for more than 6 months __

I may in the next 6 months __

I will start in the next 30 days __

3. Small Frequent Meals

Tell me the times that you had something to eat yesterday, including meals and snacks.

 Spacing your meals so that you have something at least every 3-5 hours is an important way to

control your blood sugar. Do you have something to eat every 3-5 hours?

NO __

 YES __

I do not want to do that __

I am now (for less than 6 months) __

I can't in the next 6 months __

I have for more than 6 months __

I may in the next 6 months __

I will start in the next 30 days __

4. Counting carbohydrate servings

Tell me what you ate yesterday in your meals and your snacks. Please tell me about how many

carbohydrate servings that was for each meal or snack. The type of food you eat and the amount you

eat, determine how high your blood sugar goes after a meal. Do you limit the amount of high

carbohydrate foods you eat in any one meal during the day, in order to keep your blood sugar under

control?

NO __

 YES __

I do not want to do that   __

I am now (for less than 6 months) __

I can't in the next 6 months __

I have for more than 6 months __

I may in the next 6 months __

I will start in the next 30 days __

5. Five a Day

How many servings of fruits and vegetables do you usually eat each day? A serving of fruit is a small

piece, or a cup when cut. A serving of vegetable is half a cup when cooked and a whole cup if it is

green leafy vegetables. Do you eat 5 or more servings of fruits and vegetables a day?

NO __

 YES __

I do not want to do that   __

I am now (for less than 6 months) __

I can't in the next 6 months __

I have for more than 6 months __

I may in the next 6 months __

I will start in the next 30 days __

Appendix C: Focus Group Questions

Question 1: Tell me what you think about when you hear "managing diabetes?"

Question 2: What are some of the challenges that you have encountered when managing your diabetes?

What are some of the coping mechanisms that you have found in dealing with food?

Question 3: Tell us about some of the things that you have found to make managing your diabetes easier?

Question 4: What motivated you to attend the curriculum sessions?

Question 5: Tell us about the experiences you had regarding the curriculum during the session(s) you attended?

What would work for incentives for you or others to attend classes like this?

Question 6: What could we do with the curriculum to better meet your needs?

Question 7: How did you feel about the produce portion of the intervention?

Question 8: What have you started doing as a result of the curriculum sessions you attended?

Question 9: What other diabetes classes have you attended, before or after the intervention?