Diabetes Management Knowledge and Behavior Change Amongst At-risk Women

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Abstract

Background: People with diabetes are at greater risk for comorbid cardiovascular disease, end stage organ damage, disability, and early death. There is substantial evidence that individualizing self-care education, such as eating a healthy diet, greatly improves diabetes management.

Objective: The purpose of this paper is to review the outcomes of a diabetes education program offered to underserved women in the Southwestern United States.

Methods: Four weekly nutrition classes were individualized and taught at a nonprofit organization in the southwest United States. Behavior change was measured using the Summary of Diabetes Self-Care Activities (SDSCA) tool. Classes were advertised via the center's monthly class calendar and fliers. A total of nine participants (N=9) came to every class and took the SDSCA survey before and after class instruction.

Results: Descriptive statistics and two 2-tailed t-tests with the critical value set at $p<0.05$ were used for data analysis. The participants were Hispanic women, most between the ages of 40-49, and had an income between \$0-14,000. The mean difference between the variables of both general diet and specific diet pre and post-tests were significantly different from zero. The assumptions of normality and homogeneity were met. The results of both two-tailed paired sample *t*-tests were significant suggesting the means of general and specific diet pre-tests were significantly lower than the means of the general and specific diet post-tests.

Discussion: The assumptions of normality and homogeneity were met and the results were significant. The pre-intervention scores for both categories were statistically significantly lower than the post-intervention scores for both categories. Thus, the desired outcome of helping clients within the organization modify, adapt, or change self-care behaviors related to diet was met.

Keywords: diabetes mellitus type 2, women, ethnic minority, diet, low income, low education, educational intervention

Diabetes Management Knowledge Amongst At-risk Women

Diabetes type 2 continues to impact millions of people throughout the United States (U.S.). Racial, ethnic, minority, rural communities, and low-income populations are especially vulnerable to diabetes due to the lack of resources and low health literacy experienced by these communities. Additionally, women are at higher risk for diabetes due to higher waist circumference, impaired glucose tolerance, low testosterone, job strain, less leisure time, low education and socioeconomic status, previous gestational diabetes, and polycystic ovarian syndrome (Kautzky-Willer et al., 2016).

Background and Significance

Problem Statement

The incidence and prevalence of diabetes continues to grow in the United States and worldwide. People with diabetes are at greater risk for comorbid cardiovascular disease, end stage organ damage, disability, and early death. In the U.S., the prevalence of diagnosed type 2 diabetes was 8.6% or 21.0 million adults in 2016 (Bullard et al., 2018). There was a total of 7.8 million hospital discharges amongst diabetic adults in the United States in 2016 (Diabetes Research Institute, 2020). These discharges included 1.7 million related to cardiovascular diseases, 130,000 related to lower-extremity amputation, and 209,000 related to hyperglycemic crisis. In addition to hospitalizations, emergency room visits related to diabetes amongst adults in 2016 totaled 16 million (Diabetes Research Institute, 2020).

Not only can diabetes lead to poor quality of life, disability, and early death, it can lead to high healthcare costs as well. About 10% of total healthcare budgets are spent on treating diabetes and its associated complications worldwide (Xin et al., 2020). Hospital costs alone have

been identified as the main contributor to total costs of the economic/societal burden of diabetes

(Janssen et al., 2020; Andersson et al., 2020).

Purpose and Rationale

Diabetes rates in Arizona are slightly higher than the national rates and higher than about

half of all U.S. states (America's Health Rankings, 2021). Socioeconomic factors such as

gender, race, level of education, and income level greatly influence these rates in Arizona. An

effective diabetes education program focusing on nutrition positively impacts obesity and

diabetes management (Sanchez et al., 2021). Since lower obesity rates and better diabetes

management positively impacts health, the hope is that hospital visits, mortality, disability, and

healthcare costs will decrease accordingly. The purpose of this review was to identify methods

to address diabetes prevention and management education with an emphasis in nutrition to at-

risk women within a nonprofit organization in an urban setting.

Epidemiological data

According to the Behavior Risk Factor Surveillance System (BRFSS), a U.S. survey that

collects data on disease rates and health-related risk behavior, Arizona has a type 2 diabetes

prevalence rate of 9.1% (Jaycox, S. & Paglialunga, 2018). In Maricopa County, the type 2

diabetes prevalence rate is even higher at 10.8%. The cost of diabetes type 2 in Arizona is

estimated to be about $6.4 billion (American Diabetes Association, 2016). In the U. S., the cost

of diabetes type 2 in 2017 was estimated to be $327 billion (Yang et al., 2018). Globally,

diabetes type 2 prevalence among adults rose from 4.7% in 1980 to 8.5% in 2014 causing an

estimated 1.6 million deaths worldwide (World Health Organization, 2021).

Internal Evidence

Population

The current literature discusses gender differences, social disparities, and behavioral change related to diabetes type 2. Low-income women have a higher lifetime risk of diabetes compared to men and/or higher income women (Silva-Tinoco et al., 2020; Van Herpt et al., 2020). In addition, Thornton et al. (2020) describes how minorities are socially disadvantaged and have a higher risk for diabetes. Morales et al (2020), appreciates that both diagnosed and undiagnosed diabetics with cardiovascular complications are approximately twice as high in the U. S. Hispanic population compared to the non-Hispanic white population due to skepticism of the healthcare system, food insecurity, and language barriers. The nonprofit organization where this project was conducted that serves low-income women has a Hispanic population of 61% of the total population; which is greater than the reported Hispanic population in Phoenix at 42.6% (United States Census Bureau, 2019).

Interventions

There is a gap of knowledge about diabetes prevention and management that can be addressed by providing self-care education through tailored interventions suitable for patients of different education levels and cultural backgrounds (Abouammoh & Alshamrani, 2020; Mufunda et al., 2018). In addition, access to resources and motivation to change self-behavior is imperative when teaching about self-care to prevent or manage diabetes (Muhwava et al., 2019; Yee et al., 2020). The project site offers resources and group classes, such as parenting and life skills classes that increase knowledge and motivation efforts. There is a great deal of literature supporting the use of lifestyle modifications via diet to aid in preventing and managing diabetes.

Current Practice

In the Glucose Lowering through Weight management (GLoW) trial, tailored diabetes education and a behavioral weight management program (DEW) offered more effective results than diabetes education alone in treating diabetes (Ahern et al., 2020). In a prospective cohort study by Hendryx et al. (2020), many variables contributing to diabetes among women were explored including psychosocial variables such as optimism, depression, and social support. Providing resources to control these variables was deemed helpful when managing diabetes. The nonprofit organization chosen to address diabetes prevention and management education offers classes addressing the discussed variables, however, there were no specific diabetes related classes.

Outcome

The final desired outcome of this project was to help clients within the nonprofit organization where the project was implemented modify, adapt, or change self-care behaviors related to diabetes prevention and management via diet. In this manner, diabetes diagnosis and its associated complications should hopefully decrease among this group leading to less hospital visits, deaths, resource utilization, and healthcare costs (Ahern et al., 2020; Andersson et al., 2020; Janssen et al., 2020). Generalized diabetes care has shown to be ineffective when treating diabetic patients holistically. As evidenced by the reviewed literature, individualizing interventions for patients of different education levels, cultural backgrounds, socioeconomic status, and gender will help improve overall health and reduce the incidence of diabetes diagnosis and complications.

In a nonprofit organization serving women and teen girls in the metro Phoenix area who are facing difficult life situations, diabetes education was a missing piece to the classes and programs offered at this organization. Staff at the center verbalized the need for diabetes

education because their clients asked for information on this subject. The organization serves over 1,000 clients per month who are predominantly low-income (86% under $14,000 per year income) women. The largest group of clients who utilize the resources at this organization are Hispanic (61%) and in their 30's (32%). There is no data or electronic medical records on diabetes percentages of the clients within this organization, as it is not a health clinic.

PICOT

Interest in this problem led to a review of current evidence to determine the best interventions for diabetes prevention and management. Self-care, access to resources, and change in behavior are common themes found in the literature related to successful diabetes prevention and management. This inquiry has led to the clinically relevant PICOT question: In at-risk women, what is the effect of diabetes prevention and management education, compared to current practice, on behavior change within 4 weeks?

Evidence Synthesis

Search Strategy

A thorough review of current evidence was done to answer the PICOT question using three databases. PubMed, Cochrane, and CINAHL were chosen because they cover the topics of interest and provide peer reviewed literature. These databases were extensively searched and the most relevant articles were chosen for this review.

Combinations of key terms were used to search these databases. The key terms used included: *underserved women, underprivileged women, neglected women, poor women, at risk women, diet teaching, nutritional teaching, healthy cooking teaching, healthy diet, nutritious diet, diabetes, adult-onset diabetes, diabetes mellitus type 2, non-insulin dependent diabetes mellitus (NIDDM).* Boolean connector OR was used for each group of key words within a

component of the PICO question while the Boolean connector AND was used to connect those components. A limitation to the search included the dates of publication, 2018 to 2021. In the final evaluation of the evidence, all included studies had dates of publication between 2018-2020. When search results yielded close to 200 articles in each database, titles of those articles were reviewed.

An initial search of PubMed using the key terms and Boolean connectors *underserved women* OR *underprivileged women* OR *neglected women* AND *diet teaching* OR *nutritional teaching* OR *healthy cooking teaching* AND *diabetes mellitus type 2* OR *adult-onset diabetes* OR *NIDDM* yielded six results. The search was repeated using *underserved women* OR *underprivileged women* AND *diet teaching* OR *nutritional teaching* AND *diabetes mellitus type 2* OR *adult-onset diabetes* and yielded five results. The terms and Boolean connectors *underserved women* AND *nutritional teaching* AND *diabetes mellitus type 2* only yielded two results. *Underserved women* AND *nutritional teaching* AND *diabetes* yielded four results.

The terms and Boolean connectors *at risk women* OR *poor women* AND *diet* OR *nutrition* AND *diabetes* yielded 9,053 results. Therefore, filters were applied for the date of publication (2015-2021) for this particular search yielding 4,571 results. Then, the date of publication was further changed from 2015-2021 to 2020-2021 yielding 1,010 results. The terms and Boolean connectors *At risk women* AND *diet* AND *diabetes* yielded 4,796 results. Then, the date of publication of 2021 was included in this particular search and only yielded 27 results. *Poor women* AND *diet* AND *diabetes* were then searched yielding 480 results. Date of publication of 2021 was included in this specific search and only yielded four results. Date of publication was further adjusted to this search (2015-2021) yielding 217 results. The titles of 217 articles were reviewed.

The initial search of CINAHL using the terms and Boolean connectors *poor women* AND *diet* AND *diabetes* yielded 24 results. *At risk women* AND *diet* AND *diabetes* yielded 571 results. *At risk women* OR *poor women* AND *diet* OR *nutrition* AND *diabetes* yielded 757 results. Publication dates of 2015 to 2021 were then added to these terms yielding 317 results. The titles of 317 articles were reviewed.

The initial search of Cochrane using the terms and Boolean connectors *poor women* AND *diet* AND *diabetes* with publication dates 2020-2021 yielded two results. The search was broadened and publication date was changed from 2015-2021 yielding 128 results. The terms and Boolean connectors *poor women* AND *knowledge* AND *diabetes* were also searched yielding 38,840 results. The search was restricted using publication dates 2020-2021 yielding 131 results. The titles of 131 articles were reviewed.

After reviewing all 3 databases using the key words mentioned above, Six-hundred and sixty-five titles were reviewed for content in totality. Abstracts were chosen with the inclusion criteria of people with diabetes or risk of diabetes, high BMI, lifestyle modification, minorities, low education, low socioeconomic status, women, adults, families, a component of diabetes knowledge, education, or nutrition. Based on this criteria, sixty abstracts were selected for further review. From those reviewed, 31 full text studies were reviewed in their entirety. A rapid critical appraisal checklist was used in order to finalize the ten studies providing the best evidence to address the PICO question. The studies included three randomized control trials, two systematic reviews, two cohort studies, and two cross sectional studies.

Critical Appraisal

The search strategy yielded quantitative studies addressing several important aspects to consider, such as culture, behaviors, beliefs, socioeconomic status, and education level, when

addressing knowledge deficits and introducing change (see Appendix A, Table A1). Designs

included randomized control trials, systematic reviews, cohort studies, and cross sectional

studies. All studies consisted of multiple authors throughout the world and were published

between 2018-2020.

There were multiple independent variables in these studies. However, self-care behavior

and knowledge were the most widely used independent variables (see Appendix A, Table A2).

The most widely used dependent variables in these studies included DM and HgA1c/glycemic

control. Six studies used a large study sample while four studies used a smaller sample (<100)

(see Appendix A, Table A1). Sampling included mostly adults, with one study including only

women and another study including family units with children older than seven years old. The

most widely used data analysis tools used in the studies included chi-square tests, t-tests, and

logistic regression. Overall, findings in these studies showed that knowledge deficits and social

disparities negatively affect diabetes control while self-care activities such as eating a healthy

diet positively affect diabetes control.

Large sample size, high-level evidence and long length of follow up contributed to the

strengths of the studies. One setting, small sample size, short follow up, variability, self-

reporting and lack of a control group contributed to the limitations of the studies. Heterogeneity

in sample demographics, variables of interest, measurements, and outcomes somewhat obscured

data evaluation. Some bias was found including some studies with no control group or no

blinding of groups.

Impact of Evidence

This evidence suggested that interventions specifically addressing knowledge deficits and

social disparities must be used to effectively produce diabetes education for lifestyle changes.

Knowledge about self-care can be increased by tailoring interventions that are suitable for patients of different education levels and cultural backgrounds while making resources accessible to them. Other variables such as optimism, depression, and social support should be addressed as well. With this information, a personalized diabetes education program was developed to improve knowledge and promote change within this population.

Theoretical Framework and Implementation Framework

Theory Application

The Health Belief Model (HBM) stems from psychological and behavioral theory that was developed in the 1950's by social scientists to better understand why people fail to assume disease prevention strategies for prevention of disease or worsening of a disease process (LaMorte, 2019). Belief in the threat of disease and belief in the effectiveness of a health behavior greatly predicts if a person will adopt that behavior. The desire to avoid disease, get better if already sick, and the belief that certain health behaviors will prevent or cure disease are the foundation of the HBM. There are six constructs to the HBM: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cue to action, and self-efficacy (LaMorte, 2019).

Perceived susceptibility entails a person's subjective perception of the risk of a disease or illness, which includes personal feelings of vulnerability. Perceived severity involves a person's feelings on the seriousness of the disease or illness, which a person considers the medical and social consequences. Perceived benefits become a person's perception of the effectiveness of several behaviors or actions that reduce or eliminate the threat of disease or illness. At this point, a person will consider and evaluate both the perceived susceptibility to disease and benefit of an intervention before actually acting on the intervention. Perceived

barriers affect a person's feelings on the obstacles and constraints to performing a health behavior or action. Obstacles that a person might consider include expense, side effects, unpleasantness, time-consuming, and/or inconvenience. The stimulus needed to make the decision to undertake a health behavior or action constitutes the cue to action construct. Multiple internal and/or external cues greatly affect the decision to action. Lastly, self-efficacy entails the person's confidence and the ability to carry out the behavior or action successfully (See Appendix B, Figure B1).

The HBM was applicable for the desired outcomes from the research evidence. It applied to several factors that were necessary to make a behavior change. The clients learned to commit to change by acknowledging the possibility for them to fall ill to diabetes and diabetic complications. They also realized how severe the complications from diabetes really are. Then, they understood that self-care actions, such as eating a healthy diet, positively affects their health and lowers the risk of diabetes and complications. In addition, barriers that caused them to fail were identified. The time for action was evident when the confidence to carry out the action became evident.

Implementation Framework

The Rosswurm and Larrabee Model uses a six step systematic process for changes to evidence-based practice (Duffy, 2004). This model was suitable for this evidence-based project as it used the six steps in alignment with goals of the project. The first step assesses the need for change in practice via internal data by comparing current practice to external data. There was no practice on diabetes prevention and management available at a nonprofit organization serving women and teen girls in the metro Phoenix area. Therefore, there was a need for implementation of a diabetes education program at this facility. The second step links the problem (lack of

diabetes education) with an intervention (diabetes education) to improve outcomes. The third step synthesizes the best evidence by a literature review and critical appraisal of research on the topic (diabetes).

Next, the fourth step is to design a practice change based on feedback from stakeholders utilizing the available resources. The stakeholders provided their feedback and made it clear that they wanted to focus on nutrition for diabetes prevention and management. Step five consists of implementing and evaluating the change in practice. Classes were implemented and evaluated at this nonprofit organization. Data were collected and analyzed to determine efficacy of the project. Lastly, step six integrates and maintains the change in practice if the results support the new practice into standards of care. This project can become a legacy project as there are several topics to cover within diabetes . (See Appendix B, Figure B2).

Methods

Ethical Considerations

Project managers for this project did not have access to any client's personal, identifiable data. The center's staff collects their own data so that they may track class attendance and demographics. This data is stored in the CEO's office computer and paper records located in her office, in which she locks when she is not in her office. The CEO of the center never shares her computer password with anyone. The data is stored there indefinitely since clients may come and go at different intervals of their lives. There were not any audio or visual recordings of any kind during the project implementation.

There were not any signed consents to store since the filling out of the survey by the clients served as consent for this project. Only the project managers had access to the completed surveys with no identifiable data on them and they were locked in a cabinet at the implementer's

home until completion of the project. The surveys will then be shredded after project completion and dissemination. No contact information was needed for follow up.

Clients have already been assigned a unique ID by the center's staff upon initial registration for the center's records. The unique ID was written at the top of the survey by center staff in order to link the pre and post surveys together. All demographic data was de-identified prior to releasing to the project manager. There were no foreseeable risks, discomforts, or inconveniences related to participation in the project other than time. The time it took to fill out the survey was approximately 10-15 minutes each time.

Population and Setting

The organization where the project was implemented is a faith-based, nonprofit organization serving women and teen girls in the metro Phoenix area who are facing difficult life situations. The women who come to this organization endure addiction, domestic abuse, sexual abuse, unplanned pregnancy, unemployment, loss of support system, human trafficking, the foster care system, and/or homelessness. Grief and recovery support groups, along with mentoring, are offered here.

In addition, the organization provides multiple classes such as parenting, life skills, job skills, faith-based education, anger management, and prenatal classes. Crisis counseling is available at this center as well. Point incentive programs are used for material assistance. Women can attend the support groups, classes, and counseling in person or via Zoom to earn points to buy material goods and assistance. The center provides childcare for those that attend in person.

Key stakeholders for this practice change included women and their families who utilize services at the center where the intervention took place, providers, and healthcare organizations.

The center is instrumental to the project because this is where the intervention took place since many women are gathered here for learning purposes already. The intervention outcome aligned with the center's mission and values of encouraging, engaging, and supplying women and teen girls with education and resources.

The criteria that were needed to participate in this project included: Women who were receiving services at the center, were 18 years old or older, were able to speak, read, and write either English or Spanish. Participants benefited by learning how to manage positive behavioral changes allowing them to eat healthier and prevent diabetes and its complications. Participants also benefited from learning how to cook healthy, low carb, low fat meals, keeping track of their calories, and learning how to portion control.

Project Description

The pre-intervention phase of the project consisted of IRB approval (which was obtained on 8/26/21), the establishment of a four-week class schedule (55 minutes each) at the center, and advertisement of the classes via the center's monthly class calendar and a flier that was posted at the center in the front office where clients check in for classes. The calendar of classes is normally both printed and available online on the center's website. The flier conveyed information such as the offering of extra points (redeemable in the boutique on campus) and the chance to win a prize for participation in these classes.

The intervention phase consisted of four class interactions over a four-week period. Week one consisted of an introduction of the classes and program overview from the Centers of Disease Control and Prevention (CDC), project details in both English and Spanish, completion of the Summary of Diabetes Self-Care Activities (SDSCA) measure, handouts, and education session. Weekly session titles included: Track your food, Eat well to prevent type 2 diabetes,

Burn more calories than you take in, and Stay Motivated/Get Support. Week four also included

closure, raffle drawing, and completion of the SDSCA once again.

The post-intervention phase consisted of data analysis using Intellectus software.

Descriptive statistics was used to describe the sample and outcome variable. Statistical analysis

was performed using two 2-tailed tests with the critical value set at $p<0.05$.

Data Analysis

The outcomes that were measured consisted of the mediation of self-care behaviors

facilitated by diabetes knowledge. The SDSCA questionnaire that was utilized for this project

was developed by Dr. Deborah J. Toobert, Senior Scientist Emerita at Oregon Research Institute.

The SDSCA tool is a brief, reliable, and valid self-report measure of diabetes self-management

(Toobert, Hampson, & Glasgow, 2000). The original version of the SDSCA (in both English

and Spanish), with permission, was employed for this project. The SDSCA consists of 11

questions related to diet, exercise, blood-glucose testing, foot care, and smoking status.

Reliability of the SDSCA tool was determined to be high when the average inter-item

correlations within scales was measured in several studies (mean=0.47) with the exception of the

specific diet subscale. Test-retest correlations were moderate (mean=0.40). Correlations with

other measures of diet and exercise sustained the validity of the SDSCA subscales (mean=0.23)

(Toobert, Hampson, & Glasgow, 2000).

Nine participants completed both the pre-survey before the intervention and the post-

survey after the intervention. These nine participants came to every class. The maximum

number of participants in one class (the last class) was 15, however, six of these participants

were not present during the first class and therefore did not complete the pre-survey. Scores of

the SDSCA survey were then compared pre-intervention and post-intervention for the nine

participants who completed all four classes.

Per the SDSCA scoring directions, for items 1-10, the number of days per week (0-7) was

used. Higher number scores represented healthier behaviors. The means of each section (items

1-10) general diet, specific diet, exercise, blood glucose testing, and foot care were analyzed.

Item number four was reversed scored. The last section (item 11), smoking status, was scored as

0 for smokers and 1 for non-smokers. Items 1-4 (general and specific diet) were included in the

statistical analysis since answers to all of the other items were not applicable to the participants.

The demographics that were collected by the center included income range, age range, marital

status, and ethnicity/racial background. As previously mentioned, the data was analyzed using

descriptive statistics and two 2-tailed t-tests using Intellectus software. The critical value was set

at $p<0.05$.

Budget

The materials for operation of the classes included ink, paper, and pens. The estimation

of copies needed for classes was based on 20 clients per center staff. Therefore, it was estimated

that 1,024 copies of all participant and facilitator materials would be needed in totality. Also, it

was estimated that 2 black and 3 color ink cartridges would be utilized. Sixty pens were bought

as well. The project manager paid for most of the costs related to the project with assistance

from Mountain Park Health Center, St Joseph's Hospital and Medical Center, and the project

site. Other costs such as gas mileage and prize were paid for by the project manager (See

Appendix C, Table C1). The class instructor was the DNP student project manager and she did

not charge for her time.

Sustainability

The CEO, program support coordinator, and Arizona State University (ASU) will help facilitate the sustainability plan for this project. This project can easily continue on to become a legacy project at ASU since there are several topics for education purposes surrounding diabetes. Also, the program support coordinator would be instrumental in helping with training of both current and new volunteers about the program. The curricula provided by the CDC is easy to follow for both instructors and clients. Each client will continue to earn center points for future classes. The low cost of the program contributes to sustainability.

Results

Descriptive Statistics

Introduction

Frequencies and percentages were calculated for Marital Status, Income Range, Age Range, and Ethnicity/Racial Background.

Frequencies and Percentages

The most frequently observed category of Marital Status was married (n = 6, 66.67%). The most frequently observed category of Income Range was 0-14,000 (n = 7, 77.78%). The most frequently observed category of Age Range was 40-49 (n = 4, 44.44%). The most frequently observed category of Ethnicity/Racial Background was Hispanic (n = 9, 100.00%). Frequencies and percentages are presented in Table 3.

Table 3

Frequency Table for Nominal Variables

Variable	n	$\%$
Marital Status		
single	3	33.33
married	6	66.67
Missing	0	0.00

Income Range		
0-14,000	7	77.78
30-44,000	1	11.11
15-29,000	1	11.11
Missing	0	0.00
Age Range		
50-59	3	33.33
40-49	4	44.44
60-69	2	22.22
Missing	0	0.00
Ethnicity/Racial Background		
Hispanic	9	100.00
Missing	0	0.00

Note. Due to rounding errors, percentages may not equal 100%.

Two-Tailed Paired Samples *t*-Test

Introduction

A two-tailed paired samples *t*-test was conducted to examine whether the mean difference of General Diet Pre and General Diet Post was significantly different from zero.

Assumptions

Normality. A Shapiro-Wilk test was conducted to determine whether the differences in General Diet Pre and General Diet Post could have been produced by a normal distribution (Razali & Wah, 2011). The results of the Shapiro-Wilk test were not significant based on an alpha value of .05, $W = 0.87$, $p = .116$. This result suggests the possibility that the differences in General Diet Pre and General Diet Post were produced by a normal distribution cannot be ruled out, indicating the normality assumption is met.

Homogeneity of Variance. Levene's test was conducted to assess whether the variances of General Diet Pre and General Diet Post were significantly different. The result of Levene's test was not significant based on an alpha value of .05, $F(1, 16) = 0.71$, $p = .413$. This result suggests

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it is possible that General Diet Pre and General Diet Post were produced by distributions with equal variances, indicating the assumption of homogeneity of variance was met.

Results

The result of the two-tailed paired samples *t*-test was significant based on an alpha value of .05, $t(8) = -3.12$, $p = .014$. This finding suggests the difference in the mean of General Diet Pre and the mean of General Diet Post was significantly different from zero. The mean of General Diet Pre was significantly lower than the mean of General Diet Post. The results are presented in Table 1. A bar plot of the means is presented in Figure 1.

Table 1

Two-Tailed Paired Samples t-Test for the Difference Between General Diet Pre and General Diet Post
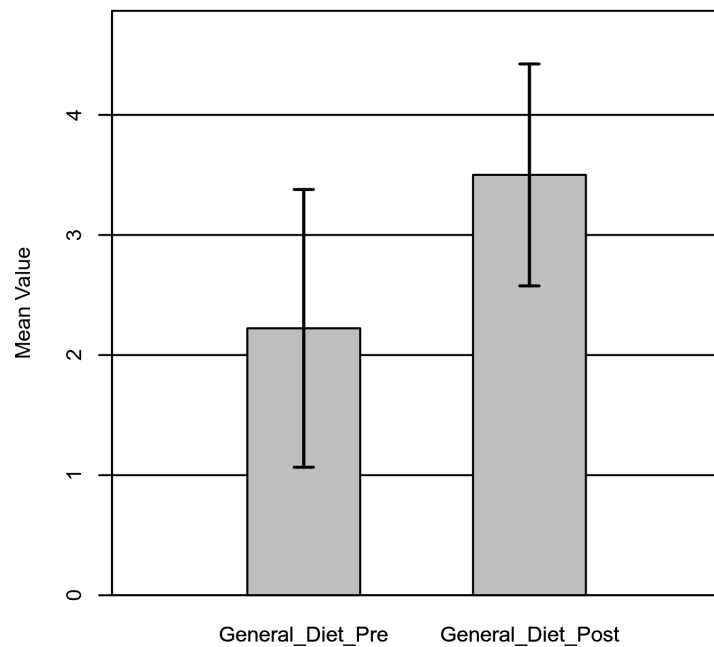
General Diet Pre		General Diet Post				
M	SD	M	SD	t	p	d
2.22	1.77	3.50	1.41	-3.12	.014	1.04

Note. N = 9. Degrees of Freedom for the *t*-statistic = 8. *d* represents Cohen's *d*.

Figure 1

The means of General Diet Pre and General Diet Post with 95.00% CI Error Bars

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Two-Tailed Paired Samples *t*-Test

Introduction

A two-tailed paired samples *t*-test was conducted to examine whether the mean difference of Specific Diet Pre and Specific Diet Post was significantly different from zero.

Assumptions

Normality. A Shapiro-Wilk test was conducted to determine whether the differences in Specific Diet Pre and Specific Diet Post could have been produced by a normal distribution (Razali & Wah, 2011). The results of the Shapiro-Wilk test were not significant based on an alpha value of .05, $W = 0.89$, $p = .195$. This result suggests the possibility that the differences in Specific Diet Pre and Specific Diet Post were produced by a normal distribution cannot be ruled out, indicating the normality assumption is met.

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Homogeneity of Variance. Levene's test was conducted to assess whether the variances of Specific Diet Pre and Specific Diet Post were significantly different. The result of Levene's test was not significant based on an alpha value of .05, $F(1, 16) = 0.24$, $p = .634$. This result suggests it is possible that Specific Diet Pre and Specific Diet Post were produced by distributions with equal variances, indicating the assumption of homogeneity of variance was met.

Results

The result of the two-tailed paired samples *t*-test was significant based on an alpha value of .05, $t(8) = -3.78$, $p = .005$. This finding suggests the difference in the mean of Specific Diet Pre and the mean of Specific Diet Post was significantly different from zero. The mean of Specific Diet Pre was significantly lower than the mean of Specific Diet Post. The results are presented in Table 2. A bar plot of the means is presented in Figure 2.

Table 2

Two-Tailed Paired Samples t-Test for the Difference Between Specific Diet Pre and Specific Diet Post
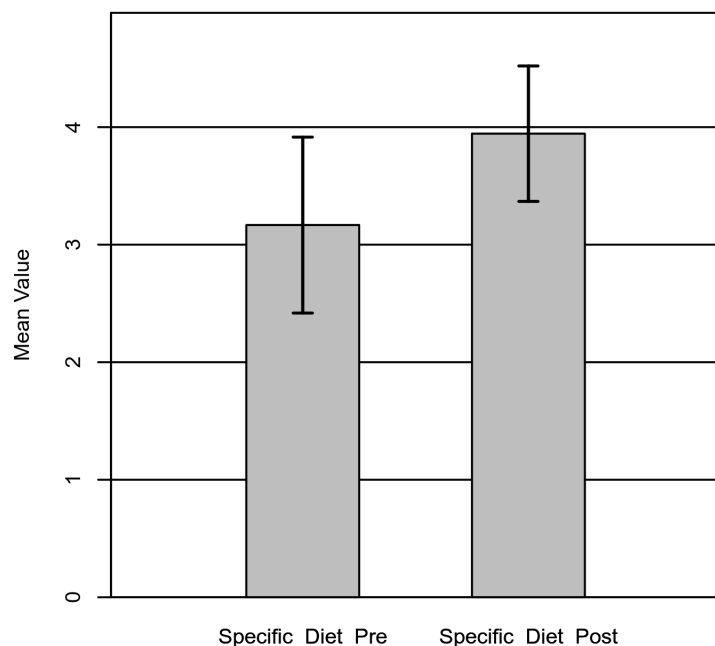
Specific Diet Pre		Specific Diet Post				
M	SD	M	SD	t	p	d
3.17	1.15	3.94	0.88	-3.78	.005	1.26

Note. N = 9. Degrees of Freedom for the *t*-statistic = 8. *d* represents Cohen's *d*.

Figure 2

The means of Specific Diet Pre and Specific Diet Post with 95.00% CI Error Bars

Discussion

The demographic information of marital status, income range, age range, and ethnicity/racial background was collected prior to the intervention per the organization's staff members. The majority of the participants were married, earned less than $14,000 per year, and were aged 40-49. All of the participants were Hispanic and spoke mainly Spanish. A two-tailed paired samples *t*-test was conducted on the general diet and specific diet items of the SDSCA survey as they directly relate to the project purpose: Addressing diabetes management and prevention education gaps with weekly classes with emphasis on nutrition. The mean results of each section pre-intervention and post-intervention were compared. The assumptions of normality and homogeneity were met and the results were significant. The pre-intervention scores for both categories were statistically significantly lower than the post-intervention scores for both categories. Thus, the desired outcome of helping clients within the organization modify, adapt, or change self-care behaviors related to diet was met.

The main limitation of this project was the sample size (N=9). The maximum capacity of each classroom is 20 clients. In addition, the same participants had to be willing to come to at least the first and last class and fill out the SDSCA survey twice in order to be included in statistical analysis. The nine participants did attend all of the classes. Another limitation included convenience sampling because participants were chosen from the same place of gathering. Furthermore, the time frame of four weeks to roll out the project was too short to sufficiently promote and measure behavioral change.

As previously mentioned, Sanchez et al. (2021) articulates how an effective diabetes education program focusing on nutrition positively impacts obesity and diabetes management and prevention. Abouammoh and Alshamrani (2020) and Mufunda et al. (2018) reveal how the gap of knowledge about diabetes management and prevention can be addressed by providing self-care education through tailored interventions suitable for patients of different education levels and cultural backgrounds. Ahern et al. (2020) found that tailored diabetes education and a behavioral weight management program offered more effective results than diabetes education alone in treating diabetes. It is evident that individualizing interventions for people of different education levels, cultural backgrounds, socioeconomic status, and gender help improve overall health, thus improving diabetes management or preventing the onset of diabetes.

There is already a plethora of research about different methods to help individuals manage their diabetes or prevent the onset of diabetes. However, more research needs to be done on which methods, specifically, are the most successful in helping individuals manage or prevent diabetes with behavioral change. This project can be carried out longer and with more participants in order to see if the intervention makes a long-lasting impact on this population's

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health. These findings are not generalizable but the project can be carried out within other organizations with different populations to assess its effectiveness.

Conclusion

The incidence and prevalence of diabetes continues to grow worldwide leading to poor quality of life, disability, early death, and high healthcare costs. It is apparent that Arizona diabetes rates are higher than those in the U. S. and social determinants of health greatly impact how individuals perceive and manage their health. The desired outcome of helping clients within an organization modify, adapt, or change self-care behaviors related to nutrition to help manage or prevent diabetes was achieved with this project. However, there are some limitations to this project and more research needs to be done in order to ascertain specific methods that are most successful in changing health behaviors.

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Appendix A

Evaluation and Synthesis

Table A1

Evaluation Table for Quantitative Studies

Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
Ahern et al. (2020). Clinical and cost-effectiveness of a diabetes education and behavioural weight management programme versus a diabetes education programme in adults with a recent diagnosis of type 2 diabetes: study protocol for the Glucose Lowering	Health Belief Model inferred	**Design:** pragmatic, randomized, single blind, parallel group, 2-arm superiority trial.	n=576 **Demographics:** BMI 25kg/m2 and higher, 18 years and older, dx within 36 months, capable of giving consent, English speaking **Setting:**	**IV1:** DEW **IV2:** DE **DV:** HgA1c	HgA1c	linear regression, chained equations, logistic regression, F-test, ANCOVA	On going, benefits will be measured using HgA1c at 12 months, weight, and well-being. Qualitative data will be collected at	**LOE:** II **Strengths:** 12 months long, large sample, cost effective, patient tailored. **Limitations:**

Key: **ALT**- Alanine aminotransferase; **AR**- autoregressive; **A1c**- glycated hemoglobin; **BIC**- Bayesian information criterion; **SDRI**- Sansum Diabetes Research Institute; **BMI**- body mass index; **CBC**- complete blood count; **CMP**-complete metabolic panel; **DE**- diabetes education; **DEW**- diabetes education and behavioral weight management program; **DM**- diabetes mellitus; **d/o**- disorder; **dx**- diagnosis; **DV**-dependent variable; **GFR**- glomerular filtration rate; **GP**- general practitioner; **GEE**- generalized estimating equations; **IMT**- intima media thickness; **IV**- independent variable; **LCD**- low carbohydrate diet; **MES**- medication effect scores; **n**- number of participants; **NHS**- National Health Service; **NIHR**- National Institute for Health Research; **NR**- not reported; **o/p**- outpatient; **SDSCA**- summary of diabetes self care activities; **SKLLD**-spoken knowledge in low literacy patients with diabetes; **sx**- surgery; **T2D**- type 2 diabetes mellitus; **TDD**- Traditional diabetic diet; **WLP**- weight loss program; **WW**- weight watchers.

Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
through Weight management (GLoW) randomised controlled trial. *BMJ Open*, *10*(4), Article e035020. https://doi.org/10.1136/bmjopen-2019-035020 **Country:** United Kingdom **Funding:** NIHR, WW, NHS **Bias:** Not recognized		**Purpose:** To evaluate the effect of tailored DEW versus DE on HbA1c at 12 months in adults with recent T2D dx.	primary care practices **Exclusion:** using insulin, previous or planned bariatric sx, dx of eating d/o, already received DE, GP considers unsuitable, participation in another program within the last 3 months. **Attrition:** NR				that time as well.	Includes follow up at 6 and 12 months only. **Feasibility:** It is a simple intervention to recommend in practice.

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
Abouammoh, N., & Alshamrani, M. (2020). Knowledge about diabetes and glycemic control among diabetic patients in Saudi Arabia. *Journal of Diabetes Research*, *2020*, 1239735–1239735. https://doi.or/10.1155/2020/123975 **Country:** Saudi Arabia **Funding:** Vice Deanship of Scientific Research Chairs **Bias:** Not recognized	Health Belief Model inferred	**Design:** Cross sectional study design **Purpose:** To assess the level of knowledge related to diabetes and glycemic control.	n=435 **Demographics:** diagnosed with diabetes, over the age of 18, and under the care of the hospital **Setting:** Security Forces Hospital o/p clinics **Exclusion:** pregnant, physical and mental impairment **Attrition:** NR	**IV1-IV7:** Gender, age, qualification, marital status, time since dx, occupation, and present medication regime. **DV:** Knowledge of diabetes	14 item MDKT questionnaire, HgA1	IBM SPSS version 25, descriptive analysis, frequencies, percentages, and Kruskal-Wallos test.	53.3% had poor glycemic control, a diabetic diet is understood only by 40%, 44% were able to explain HgA1c, those in urban areas and/or low education level have poor knowledge	**LOE:** V **Strengths:** Large sample. **Limitations:** One setting, short time frame. **Feasibility:** Would be easy to apply in practice.

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
				and HgA1c			of glycemic control.	
Bekele et al. (2020). Barriers and strategies to Lifestyle and dietary pattern interventions for prevention and management of type-2 diabetes in Africa, systematic review. *Journal of Diabetes Research,* 1-14. https://doi.org/10.1155/2020/7948712 **Country:** Ethiopia	Social Cognitive Theory inferred	**Design:** systematic review **Purpose:** to review published articles that investigate lifestyle and dietary pattern interventi	**n=50** **Inclusion:** 2011-2019, English, African population, LOE I-III **Exclusion:** redundancy **Attrition:** NR	**IV1-IV3:** lifestyle barriers, interventions for diabetes treatment and management, self-care behavior **DV:** diabetes	John Hopkins Method of Research Evidence Appraisal Tool, multivariate logistics regression analysis, cohort study design, convenience sampling	Major themes include: dietary patterns, physical activity, lifestyle changes, adherence	Increased prevalence in diabetes due to lack of knowledge /education, cost, poverty, population changes	**LOE:** I Strengths: High level articles, consistent results, most had large sample sizes, adequate control groups, definitive conclusions,

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
Funding: None **Bias:** publication bias		ons for diabetes prevention and management in Africa.						and consistent recommendations **Limitations:** a few articles had small sample sizes, little evidence, inconsistent results, difficulty of conclusion **Feasibility:** Useful data to utilize in

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
								practice settings
Chen et al. (2020). Effect of a 90 g/day low-carbohydrate diet on glycaemic control, small, dense low-density lipoprotein and carotid intima-media thickness in type 2 diabetic patients: An 18-month randomised controlled trial. *PloS One*, 15(10). https://doi.org/	Health Belief Model	**Design:** Single center, parallel designed open label Randomized Control Trial **Purpose:** To explore	n=92 **Demographics:** adults aged 20-80 yrs with DM 2 for over a year with A1c of 7.5%. **Setting:** o/p clinics Exclusion: pregnant, lactating, impaired renal, liver, heart, gout, WLP, eating	IV1: LCD IV2: TDD DV: A1c, MES, lipids, creatinine, microalbumin,	A1c, MES, lipids, creatinine, microalbumin, IMT, Tanita Body Composition Analyzer, questionnaires	Taves covariate-adaptive randomization, paired t-test, independent t-test, GEE, AR covariance matrix, SAS statistical software	Significant decrease in A1c, MES, BP, weight (p=<0.05) with LCD compared to TDD No significant change in lipid profiles,	**LOE:** II **Strengths:** 18 months long, high completion rate (>90%), easy to follow LCD guide **Limitations:** larger sample size may be needed,

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
10.1371/journal.pone.0240158 **Country:** Taiwan **Funding:** None reported **Bias:** Not recognized		the effect of LCD in type 2 DM over 18 months	d/o, unable to complete questionnaire.	IMT, weight, BP, ALT			creatinine, microalbumin, ALT, IMT (p=>0.05) with LCD compared to TDD	longer follow up duration may be needed **Feasibility:** Easy to recommend in practice (i.e.: dietician student hours)
Garcia-Molina et al. (2020). Improving type 2 diabetes mellitus glycaemic control through lifestyle modification	Social Cognitive Theory inferred	**Design:** systematic review and meta-analysis	**n=28** **Demographics:** adults 50-67 years old, not hospitalized or with diabetes	**IV1:** individualized life style modification	A1c, weight, and BMI	two reviewers, piloted extraction form, a 3rd researcher,	Both types of interventions significantly improve	**LOE:** I **Strengths:** large sample sizes, two reviewers

Key: **ALT**- Alanine aminotransferase; **AR**- autoregressive; **A1c**- glycated hemoglobin; **BIC**- Bayesian information criterion; **SDRI**- Sansum Diabetes Research Institute; **BMI**- body mass index; **CBC**- complete blood count; **CMP**-complete metabolic panel; **DE**- diabetes education; **DEW**- diabetes education and behavioral weight management program; **DM**- diabetes mellitus; **d/o**- disorder; **dx**- diagnosis; **DV**-dependent variable; **GFR**- glomerular filtration rate; **GP**-general practitioner; **GEE**- generalized estimating equations; **IMT**- intima media thickness; **IV**- independent variable; **LCD**- low carbohydrate diet; **MES**-medication effect scores; **n**- number of participants; **NHS**- National Health Service; **NIHR**- National Institute for Health Research; **NR**- not reported; **o/p**-outpatient; **SDSCA**- summary of diabetes self care activities; **SKLLD**-spoken knowledge in low literacy patients with diabetes; **sx**- surgery; **T2D**- type 2 diabetes mellitus; **TDD**- Traditional diabetic diet; **WLP**- weight loss program; **WW**- weight watchers.

Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
implementing diet intervention: a systematic review and meta-analysis. *European Journal of Nutrition*, *59*(4), 1313–1328. https://doi.org/10.1007/s00394-019-02147-6 **Country:** Spain **Funding:** CIBER Epidemiologia y Salud Publica **Bias:** No included studies were blinded		**Purpose:** To analyze the scientific evidence concerning the nutritional intervention in the glycemic control of type-2 diabetes mellitus	complications, recruited from primary health care centers **Inclusion:** randomized controlled studies, including lifestyle modification (diet) with & without physical activity, full texts **Exclusion:** type 1 diabetes mellitus	**IV2:** group-based life style modification **IV3:** both types **DV:** A1c, weight, BMI		Cochrane risk of bias tool for RCT's, randomized effects model, Cochran's Q statistic, I2 statistic, Stata v. 14 software	glycemic control, especially with a weight loss of >5% and is extended over a longer period of time	were utilized while a third was included when there was a discrepancy between the first 2 **Limitations:** variability, inevitable differences in the interventional approaches, and could not consider compliance to

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
								pharmacological treatment **Feasibility:** Easy to apply in practice
Hendryx et al. (2020). Lifestyle and psychosocial patterns and diabetes incidence among women with and without obesity: A prospective latent class analysis. *Prevention Science*, *21*(6), 850–860. https://doi.org/10.1007/s11121020-01130-6	Social Cognitive Theory inferred	**Design:** Prospective cohort study **Purpose:** to identify and characterize underlyin	**n**=64,710 **Demographics:** women aged 50-79 **Setting:** 40 clinical centers throughout the US **Exclusion:** baseline diabetes, CVD, cancer	**IV1-IV7:** smoking, physical activity, diet, sleep, optimism, depression, social support	height, weight, BMI	latent class analysis, chi-square tests, t-tests, BIC, Cox proportional hazards regression models, SAS software version 9.4	women with diabetes tended to be younger, a member of a racial or ethnic minority group, less educated, obese, poor	**LOE:** IV **Strengths:** large & diverse sample representing several regions across the country, long follow up,

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
Country: USA **Funding:** National Heart, Lung, & Blood Institute, National Institutes of Health, US Department of Health & Human Services **Bias:** Not recognized		g subgroups with a heterogeneous population by both health behaviors and & psychosocial factors, then determine the relationships between	**Attrition:** NR	**DV:** diabetes			diet quality, engage in minimal physical activity, higher depressive symptoms, less optimism, & lower social support	availability of multiple risk variables & covariants **Limitations:** self reporting nature of the study, sample was restricted to postmenopausal women **Feasibility:** Each variable can be addressed and applied in

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
		subgroup membership & incidence of type 2 diabetes						practice (i.e.: dietician, psychology student hours)
Morales et al. (2020). Understanding the impact of five major determinants of health (genetics, biology, behavior, psychology, society/environment) on type 2 diabetes in US Hispanic/Latino families: Mil Familias-a cohort study. *BMC Endocrine Disorders*, 20(1), 1–4.	Social Cognitive Theory inferred	**Design:** observational cohort trial that is cross sectional & longitudinal **Purpose:** to	**n**= 1,000 **Demographics:** Latino individuals or families as units **Setting:** Santa Barbara County & surrounding communities or satellite sites	**IV1-IV5:** blood pressure, waist circumference, insulin sensitivity, food security, activity levels	height, weight, waist circumference, BMI, blood pressure, foot screening, DNA, urine, stool, HbA1c, blood work,	Chi-squared tests, t-tests, Z tests, log-normal transformation	community health workers are highly effective in promoting health, particularly in the Latino community; data collected	**LOE:** IV **Strengths:** large sample size, is following a successful pilot study **Limitations:** lack of an active control group

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
https://doi.org/10.1186/s12902-019-0483-z **Country:** USA **Funding:** Eli Lily & Company & SDRI **Bias:** Not recognized		determine the influence of the 5 major determinants of human health on the burden of type 2 diabetes for Latino families	**Inclusion:** 7 years or older, Hispanic, co-resides with family member who is diabetic or self, informed consent **Exclusion:** life expectancy <6 months, language barriers, participation in other studies, known abuse of drugs or alcohol **Attrition:** NR	**DV:** diabetes	questionnaires, activity monitoring		will be used to help determine future effective evidence based prevention and treatment intervention strategies that are equitable and culturally relevant	**Feasibility:** Once completed, information can be utilized in clinics where there is a large Hispanic population (i.e.: dietician student hours)

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
Silva-Tinoco et al. (2020). Influence of social determinants, diabetes knowledge, health behaviors, and glycemic control in type 2 diabetes: an analysis from real-world evidence. *BMC Endocrine Disorders*, *20*(1), 130–130. https://doi.org/10.1186/s12902-020-00604-6 **Country:** Mexico **Funding:** Clinica Especializada en el	Social Cognitive Theory inferred	**Design:** multicenter cross sectional **Purpose:** to explore self care behaviors in relation to diabetes knowledge and glycemic control	n=513 **Demographics:** 66.3% female, mean age 53.7, most reported primary school or less, low or very low socioeconomic status, mean diagnosis time of 12.2 years, 48.4% reported hypertension **Setting:** 28 primary outpatient centers in urban Mexico City	**IV1:** diabetes knowledge **IV2:** self care behaviors **DV:** glycemic control	HbA1c, fundoscopy, albumin/creatinine ratio, GFR, vibratory perception tools, SKILLD scale, SDSCA	univariable & multivariable linear models, multivariable logistic regression models, Baron & Kenny's steps, multiple mediator model, linear regression analysis, product of coefficients	socioeconomic status & education greatly influences diabetes knowledge; self care behaviors mediate the effect of diabetes knowledge on glycemic control	**LOE:** IV **Strengths:** used validated tools, large population size **Limitations:** not able to conclude causality, small sample size, conducted in Mexico city, other factors may

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DIABETES MANAGEMENT KNOWLEDGE

Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
Manejo de la Diabetes, World Diabetes Foundation, National Institutes of Health, & Novo Nordisk **Bias:** not controlled			**Inclusion:** beneficiaries of Seguro Popular **Attrition:** NR			method, multivariable adjusted logistic regression models, R software, Sobel test		contribute to glycemic control, self reporting reliability **Feasibility:** this information can be utilized in primary care clinics whose clients fit this criteria
Xin et al. (2020). Type 2 diabetes remission: 2 year within-trial and lifetime-horizon cost-	Health Belief Model referred	**Design:** within trial cost analysis	n= 298 **Demographics:** in trial data	**IV1:** Counter weight	blood glucose, blood pressure	decision analytic models, intention to	the intervention generated a 1337	**LOE:** VII **Strengths:** large sample

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DIABETES MANAGEMENT KNOWLEDGE

Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
effectiveness of the Diabetes Remission Clinical Trial (DiRECT)/Counterweight-Plus weight management programme. *Diabetologia, 63*(10), 2112–2122. https://doi.org/10.1007/s00125-020-05224-2 **Country:** Mexico **Funding:** Clinica Especializada en el Manejo de la Diabetes, World Diabetes Foundation, National		**Purpose:** to estimate the within trial & lifetime cost-effectiveness of the weight management program which achieved 46%	**Setting:** primary care **Inclusion:** dx of diabetes, BMI 27-45, HbA1c > 6.5 or > 6 if on meds **Attrition:** NR	plus program **DV:** cost		treat principle, boot strap iterations, Monte Carlo simulations, regression coefficient, Stata/MP version 14.2 coefficients method, multivariable adjusted logistic regression models, R software, Sobel test	British pounds cost saving per participant	size, 2 year length **Limitations:** timing is too short for diabetes effects, relapse, weight gain **Feasibility:** this information can be utilized in primary care clinics whose clients fit this

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
Institutes of Health, & Novo Nordisk **Bias:** no control		remissions of type 2 diabetes at year 1 and 36% at year 2 in the Diabetes Remission Clinical Trial (DiRECT)						criteria settings in a similar cost-effective manner
Mufunda et al. (2018). Limited knowledge of diabetes in patients attending an outpatient	Health Belief Model	**Design:** Cross sectional descriptive study	n=96 **Demographics:** Zimbabwean adults	**IV1:** knowledge	Diabetes Knowledge Test	descriptive statistics, bivariate correlations, chi-square	Knowledge was poor in all categories	**LOE:** V **Strengths:** expert consensus

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DIABETES MANAGEMENT KNOWLEDGE

Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
diabetes clinic at a referral hospital in Zimbabwe: A cross-sectional study. *Pan African Medical Journal, 144*(29). https://doi: 10.11604/pamj. 2018.29.144.12301 **Country:** Zimbabwe **Funding:** grants from the Research Committee at the School of Health Sciences & Social Work, University of Vaxjo, & Swedish International Development Aid		**Purpose:** assess patients diabetes awareness & level of diabetes knowledge in Zimbabwean adults with diabetes	**Setting:** outpatient diabetes clinic **Inclusion:** dx > 1yr, mentally sound, able to consent, speak English or Shona **Attrition:** NR	**DV:** diabetes		test, t-test, one-way ANOVA, Mann-Whitney U-test, multiple logistic regression, multiple linear regression, SPSS		**Limitations:** only in central location **Feasibility:** Identify knowledge gaps to be addressed and adapt interventions suitable for patients of different cultural backgrounds

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DIABETES MANAGEMENT KNOWLEDGE

Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/ Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence/ Application To Practice/ Generalization
Bias: Not recognized								

Key: **ALT**- Alanine aminotransferase; **AR**- autoregressive; **A1c**- glycated hemoglobin; **BIC**- Bayesian information criterion; **SDRI**- Sansum Diabetes Research Institute; **BMI**- body mass index; **CBC**- complete blood count; **CMP**-complete metabolic panel; **DE**- diabetes education; **DEW**- diabetes education and behavioral weight management program; **DM**- diabetes mellitus; **d/o**- disorder; **dx**- diagnosis; **DV**-dependent variable; **GFR**- glomerular filtration rate; **GP**- general practitioner; **GEE**- generalized estimating equations; **IMT**- intima media thickness; **IV**- independent variable; **LCD**- low carbohydrate diet; **MES**- medication effect scores; **n**- number of participants; **NHS**- National Health Service; **NIHR**- National Institute for Health Research; **NR**- not reported; **o/p**- outpatient; **SDSCA**- summary of diabetes self care activities; **SKLLD**-spoken knowledge in low literacy patients with diabetes; **sx**- surgery; **T2D**- type 2 diabetes mellitus; **TDD**- Traditional diabetic diet; **WLP**- weight loss program; **WW**- weight watchers.

Table A2

Synthesis Table

| Author	Abouammoh	Ahern	Bekele	Chen	Garcia-Molina	Hendryx	Morales	Mufunda	Silva-Tinoco	Xin
Year	2020	2020	2020	2020	2020	2020	2020	2018	2020	2020
Design	CSDS	RCT	SR	RCT	SR/MA	PCS	CT	CSDS	CS	TCA
Number of subjects	435	576	50	92	28	64,710	1,000	96	513	298
Independent Variables										
DEW/DE		X								
Self-care behavior			X						X	
LCD/TDD				X						
Diet						X				
Knowledge								X	X	
CWP										X
Lifestyle modification					X					
Other	X		X		X	X	X			
Dependent Variables										
Knowledge of DM	X									
HgA1c/glycemic control		X		X	X				X	
DM			X			X	X	X		
Cost of diabetes										X
Weight/BMI				X	X					
Other				X						

Key: **BMI-** body mass index; **CS-** cross sectional; **CSDS-** cross sectional study design; **CT-** cohort trial; **CWP-** counter weight plus program; **DE-** diabetes education; **DEW-** diabetes education and behavioral weight management program; **DM-** diabetes mellitus; **HgA1c-** hemoglobin A1c; **LCD-** low carbohydrate diet; **MA-** meta-analysis; **PCS-** prospective cohort study; **RCT-** randomized control trial; **SR-** systematic review; **TCA-** trial cost analysis; **TDD-** traditional diabetic diet.
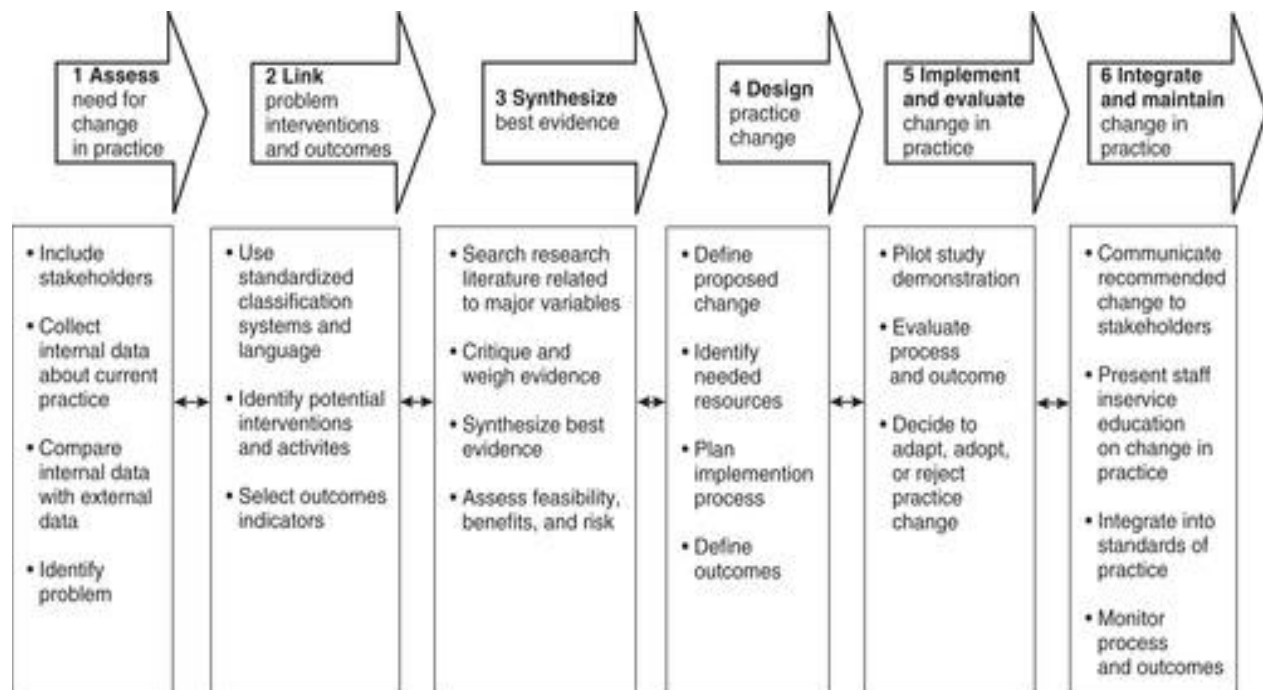
DIABETES MANAGEMENT KNOWLEDGE

Appendix B

Models and Frameworks

Figure B1

The Health Belief Model

The Health Belief Model
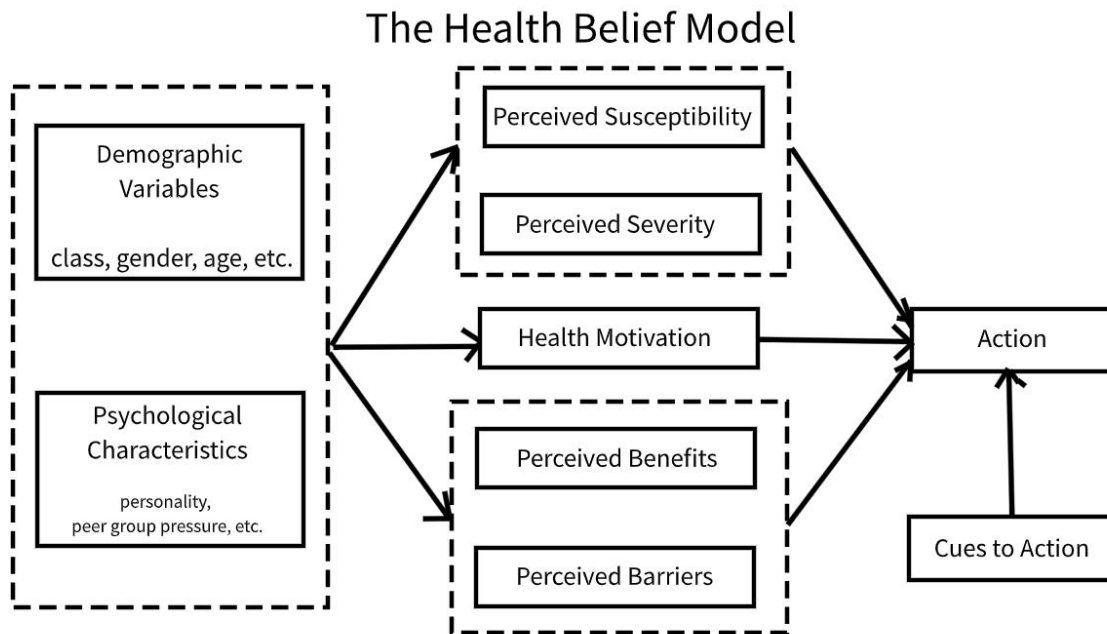
Strecher & Rosenstock (1997)

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Figure B2

Rosswurm and Larrabee Model

Rosswurm & Larrabee (1999)

DIABETES MANAGEMENT KNOWLEDGE

Appendix C

Budget

Table C1

Project Budget

Phase	Activities	Cost	subtotal	Total
Preparation	Download and print class materials for clients and primary investigator (PI). Informed consent and survey print outs will be printed at SJHMC.	Client materials=960 pages PI materials=64 pages Paper case of 1,500 pages=$20 2 black ink cartridges @ $40 each=$80 3 color ink cartridges @ $44 each=$132	$232	
	Pens for notes and to fill out surveys.	60 pens @ $6	$6	
	Create power point presentation. PI already has Microsoft Office.	$0		
	Pick up recipe print outs from Mountain Park Health Center.	$0		
Delivery	Gas milage for travel to center x4 times for class.	30 miles/gallon @ 24 miles round trip	$10 rounded up	

		x4=96 miles @ $3.10/gallon		
	Extra center points and prize for class attendance will be provided by center.	$25	$25	
Evaluation	Results will be analyzed using Intellectus software which PI already has access to.	$0		
	Data will be shredded at home of PI using shredder that PI already owns.	$0		
				$273
Revenue/cost savings	The center is a non-clinical, non-profit organization that does not receive any payments from its clients and staff is primarily made up of volunteers. There will be no revenue or cost savings to the center itself, however, the overall savings to the community may be substantial.	The cost of diabetes in Arizona is estimated to be about $6.4 billion (American Diabetes Association, 2016).		