**Background**

Diabetes mellitus is one of the most common chronic diseases in the United States and a leading cause of morbidity and mortality. However, the prevalence of type II diabetes is not equally distributed across racial and ethnic groups in this country, as an estimated 2.5 million Hispanic Americans 20 years old and above have diabetes.1 Furthermore, Hispanics are 1.7 times more likely to be diagnosed with diabetes, and 50% more likely to die from diabetes than non-Hispanic whites. This disparity is influenced by socioeconomic status, cultural beliefs, health-literacy, and access to quality healthcare services.2 Unmanaged diabetes can lead to complications such as retinopathy, renal disease, and cardiovascular disease, causing increased healthcare costs and decreased ability to fulfill familial roles central to the Hispanic culture.1 This has a negative impact on the individual’s quality of life. Fortunately, type II diabetes is largely preventable. Diabetes prevention and management requires efforts targeting multiple social components of health in order to promote lifestyle changes.The Social Ecological Model provides a framework for evaluating these components and implementing appropriate interventions.3 Initiatives focused on providing proper nutrition and physical activity guidelines for Hispanic individuals with type II diabetes could be beneficial in influencing behavior change and improving health.

Proper nutrition is vital in the prevention and management of diabetes. Healthier eating habits have been shown to positively effect inflammatory markers, reduce hyperglycemia, and improve insulin resistance.4 Programs providing nutritional education in health literacy, healthy meal choices, portion control, and food label use have assisted individuals in making informed food choices.5 Educational interventions should be provided in the community at schools, workplaces, gyms, grocery stores, and media sources.1 An intervention targeting the intrapersonal and community level includes nutritional counseling on food label usage and diet quality. This program takes into consideration the intrapersonal barriers to dietary behavior change, through providing bilingual educators, materials provided at the appropriate education level, and nutritional values with respect to beliefs integral to the Hispanic culture. Sessions are tailored to the individual’s level of literacy and includes information about different macronutrients and the impact of food choice on blood sugar levels and lipid profiles. This program also includes grocery store trips to implement skills learned and find healthy options that fit the individual’s budget. This program has demonstrated increases in food label usage even after program completion, as well as a statistically significant decrease in HbA1c levels.5

Family and social support are important values in the Hispanic culture.6 A nutritional intervention that includes participation from family members has demonstrated positive impacts on behavior change due to interpersonal health determinants. Including family members in health interventions allows for increased emotional and psychological support, thereby increasing self-efficacy. Intrapersonal determinants were also addressed by tailoring the intervention to low-literacy needs, language barriers, and integrated cultural beliefs and values such as healthy alternative ethnic foods and recipes. Interactive modules delivered to the individual and family members discussing exercise, diet, blood sugar levels, medications, self-care, and action plans resulted in significant improvements. This included increased diabetes knowledge, self-efficacy, Summary of Diabetes Self-Care Activities (SDSCA) scores, and health-related quality of life. Improvements in BMI, systolic blood pressure, and fruit and vegetable intake were also demonstrated.6

Hispanic individuals are 30% less likely to participate in physical activity than non-Hispanic whites.7 Physical activity preferences differ among cultural groups, requiring exploration of interests in order to increase motivation and promote behavior change. A fitness program for Hispanic participants that included low-impact exercises and Hispanic dance demonstrated an improvement in A1c, triglyceride, lipid levels, and psychological well-being. Intrapersonal and interpersonal factors were incorporated by evaluating self-reported health, psychological well-being, and promoting social connections through group-based classes.8 Zumba has also proven to be effective in increasing physical activity levels in Hispanic women. Results have demonstrated a reduction in body weight, percent body fat, BMI, waist and hip circumference, improvement in VO2 max, flexibility, and muscular endurance.9

Physical activity is important in maintaining body weight, body fat, cardiorespiratory fitness, waist circumference, HDL cholesterol, A1c levels, and mental health status in patients with diabetes.10 There is strong evidence that strength training exercises can be beneficial in the improvement of muscle strength and quality, as well as metabolic changes in reduction of A1c and Homeostasis Model Assessment- Insulin Resistance (HOMA-IR). Diabetic medication was reduced, indicating increased health status and insulin sensitivity. Strength training utilized the upper back, chest press, leg press, knee extension, and knee flexion pneumatic machines. Proper intensity, frequency, and duration of training is important to consider in optimizing outcomes.10

As previously discussed, family is at the center of the Hispanic culture, and has been related to improved nutrition and physical activity.6 Incorporating interpersonal strategies such as family support into intervention programs fosters behavioral changes through social support and self-efficacy. Evidence indicates that educational modules related to diabetes knowledge, self-management skills, and exercise and dietary guidelines with content tailored to low-literacy participants and Hispanic cultural values has led to positive lifestyle behavior changes. Education provided to individuals and their families is associated with increases in physical activity, walking metabolic equivalent of task per week, total burned calories per week, and number of steps per day.7

In order to evaluate efficacy of the program, appropriate measures of BMI, blood values (i.e. blood glucose via glucometer), diet quality, physical activity, and quality of life need to be administered. According to the NIH Heart, Lung, and Blood Institute, BMI is an appropriate estimate of body fat and risk of disease, with higher values indicating increased risk.Normal BMI values indicating healthy weight are between 18.5-24.9.11 BMI values reflect potential adherence to the program protocol, given that proper nutrition and physical activity influence BMI. Blood glucose testing gives current blood glucose levels. It also indicates the effect of medications, self-care, and behavior changes on diabetes management and glycemic control.Normal blood glucose levels before a meal range from 80-130 mg/dl, and less than 180 mg/dl after a meal.12

Appropriate outcome measures for the program include the Healthy Eating Index-2015 (HEI-2015), International Physical Activity Questionnaire (IPAQ), and SF-12. Dietary quality can be measured using the Healthy Eating Index-2015 (HEI-2015), which compares an individual’s dietary behaviors with federal guidelines. Scores >80 indicate a good diet and adequate adherence with federal nutrition guidance.13 The HEI-2015 has proven to be a valid and reliable tool for assessing diet quality with the ability to detect meaningful differences in diet quality among individuals.14 Pedometers can be used to assess step-counts, which gives an estimation of physical activity vs. sedentary behavior.7 In addition, physical activity can be measured using the International Physical Activity Questionnaire (IPAQ). Scores on the IPAQ classify individuals into physical activity categories of high, moderate, and low, depending on physical activity and intensity levels. MET minutes/week are calculated, with moderate-intensity activities corresponding with 3-6 METs, and vigorous intensity activities corresponding with >6 METs.15 Adequate reliability and validity of the IPAQ has been demonstrated in patients with type II diabetes.7 The IPAQ is a self-reported measure, which may increase chances of response bias; however, concrete health outcomes such as BMI and A1c can assist in evaluating discrepancies. Quality of life is important to consider in this population. Diabetes can severely limit an individual’s ability to participate in their community and maintain social relationships that are vital to the Hispanic culture. It is anticipated that increased physical activity and proper nutrition will result in positive impacts on the individual’s health and well-being, therefore improving their life satisfaction and quality of life. The SF-12 is a shortened version of the SF-36 that addresses 8 domains related to quality of life, including physical functioning, general health perceptions, social functioning, and mental health. A mental component score and physical component score is provided, with scores >50 indicating better physical or mental health than the mean.16 Evidence demonstrates that the SF-12 is a valid tool for measuring quality of life in diabetic individuals.17

The prevention and management of type II diabetes is not possible without consideration of proper nutrition and physical activity. Hispanic individuals are at greater risk of developing diabetes and related complications due to the multiple health determinants previously discussed. Interventions incorporating family members and aimed at increasing health-literacy, diabetes education, nutritional counseling, strength training, and Latin dance have demonstrated favorable outcomes in improving health in Hispanics with diabetes type II. In order to achieve behavior change, it is important to consider these social factors in order to create an effective, evidence-based community health promotion program.

**Program Goals:**

1. Hispanic individuals participating in the program will lower BMI by at least one category of BMI classification by the end of the 12-week program. For example, individuals with 25.29.9 BMI considered “overweight” at baseline will lower their BMI to 18.5-24.9, which is considered “normal”. This will ensure decreased body fat and decrease risk of further disease.11
2. Hispanic individuals participating in the program will maintain healthy blood glucose levels for at least the last 2 weeks of the 12-week program measured by a blood glucose meter and recorded into a log to track levels over time. Target levels before a meal should range from 80-130 mg/dl, and less than 180 mg/dl after a meal.12 This will ensure proper diabetes self-management and prevention of secondary complications.
3. Hispanic individuals participating in the program will increase scores on the Healthy Eating Index-2015 to above 80 by the end of the 12-week program. This will ensure change in healthy dietary behaviors in compliance with federal guidelines.13
4. Hispanic individuals participating in the program will increase physical activity classification by at least one category on the IPAQ by the end of the 12-week program. For example, if participants are classified as “low/inactive” at baseline will increase their classification to “moderate” in order to ensure increased physical activity levels, leading to decreased BMI and increased cardiovascular health (see Table 1 below).15

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| --- | --- | --- |
| **Table 1. IPAQ Classification15** | | |
| **High Physical Activity** | **Moderate Physical Activity** | **Low Physical Activity/ Inactive** |
| 3 or more days of vigorous-intensity activity and at least 1500 MET-minutes/week  OR  7 days of any combination of walking, moderate-intensity or vigorous-intensity activities with at least 3000 MET minutes/week | 5 or more days with at least 20 minutes of vigorous activity  OR  5 or more days with at least 30 minutes of moderate-intensity activity or walking  OR  5 or more days of any combination of walking, moderate-intensity activities with at least 600 MET-min/week | Do not meet criteria for “High” or “Moderate” Physical Activity categories |

1. Hispanic individuals participating in the program will increase scores on the SF-12 to above 50 by the end of the 12-week program, indicating better physical and mental health than the mean.16 This will ensure improved quality of life due to increased health and well-being.

**Methods:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Diabetes Educational Modules6** | **Food Label Education5** | **Hispanic Dance/ Zumba9** | **Strength training10** |
| **Participants** | Hispanic individuals with diabetes participating in program and family members | Hispanic individuals with diabetes participating in program | Hispanic individuals with diabetes participating in program | Hispanic individuals with diabetes participating in program |
| **Personnel** | Dieticians, nurses, and physical therapists bilingual in Spanish | Dieticians bilingual in Spanish | Physical therapists bilingual in Spanish with aerobic dance experience | Physical therapists bilingual in Spanish |
| **Intervention Plan** | -Educational modules discussing exercise, diet, blood sugar levels, use of glucometers, medications, self-care, coping strategies, and action plans  -All modules tailored to low-literacy needs and integrated cultural beliefs and values  -Targets intrapersonal and interpersonal health determinants of the Social Ecological Model (SEM) | -Nutritional counseling and education on food label usage, diet quality, macronutrients, impact of food choices on blood sugar levels and body fat  -Participants can bring in pictures (if able) of pantry and refrigerator items to address food labels on frequent food choices and apply knowledge to create healthier habits  **-**Last session includes trip to grocery store to find healthy options that fit in the participant’s budget  -Targets intrapersonal and community barriers to dietary behavior change | **-**Zumba dance classes incorporating cardio-dance movements that increase HR  -Warm-up and cool-down included  -Classes begin at a lower intensity initially, building to higher intensities as weeks progress  -Initial classes begin with instructor walking participants through dance routine, followed by participants mirroring dance moves in the following weeks  -Participants encouraged to perform aerobic dance at home for 1 hour at least once per week  -Targets intrapersonal and interpersonal factors of the SEM | -Strength training utilizing free weights, exercise balls, resistance bands, and body-weight exercises  -Exercises focus on all large muscle groups and include a warm-up and cool-down  -3 sets of 8 repetitions for each exercise  -Intensity for weeks 1-6 were 50-70% of baseline 1-repetition maximum (1RM), followed by 60-70% of new 1RM for weeks 7-12  -Participants encouraged to perform strengthening exercises with provided resistance bands at home at least twice per week |
| **Location** | Community health center central to targeted Hispanic population | Community health center central to targeted Hispanic population | Community health center gymnasium | Community health center gymnasium |
| **Timing** | 1x per week for first 6 weeks of 12-week program | 1x per week for last 6 weeks of 12-week program | 1x every other week for 12 weeks (rotating with strength training) | 1x every other week for 12 weeks (rotating with Zumba) |

Partnerships created with local dieticians and nurses will provide multidisciplinary care to participants in order to influence the multifactorial patterns of diabetes management. Nurses will deliver health information regarding blood sugar levels, use of glucometers, medications, self-care, coping strategies, and action plans. Dieticians will provide information about heathy nutrition, proper food label usage, and other nutritional counseling. Physical therapists will instruct participants on recommended levels and types of exercise, exercise options for home, and the benefits of an active lifestyle on diabetes management. Participants will be recruited through healthcare clinics, including the Student Health Action Coalition (SHAC), senior centers, social service organizations, and advertisements distributed through town. Hispanic individuals will be eligible to participate if over the age of 18, have a confirmed diagnosis of diabetes type II, ambulatory status, and without diagnosis of other comorbidities or diseases that prevent them from exercising. Enrollment will occur by contacting the physical therapist program director by phone, email, or in person at program director’s place of occupation. Open enrollment will be conducted until two weeks prior to program start date, or when the group reaches maximum capacity of 20 people. If the current cycle is filled, the individual will have the option to participate in the following program cycle. All participants will be required to complete pre-program testing in person one week prior to program start date, and post-program testing one week following program end date. Program participation is free of charge to all eligible Hispanic individuals.

**Program Evaluation:**

Development of the evaluation plan will be in collaboration with stakeholders in order to maintain transparency and ensure that the program vision is understood and agreed upon by all.18 Stakeholders include those involved in program operations, such as program directors and staff, those served by the program, such as Hispanic individuals with type II diabetes, and those who plan to use evaluation findings, such as program developers and funding sources. Evidence reporting activities and outcomes that are important to stakeholders will be discussed, including recruitment, feasibility, costs, and benefits.18

Program description (provided in background and methods) should be provided to all stakeholders in order to clearly define the need, target population, outcomes, activities, outputs, required resources, and relationship between activities and potential benefits of the program. The current state of the program (planning, implementation, or maintenance) will be identified with each evaluation, as well as external influences that may have an effect on the program. This information will assist in maintaining focus on program goals and vision.18

Maintaining focus on the program goal of management of type II diabetes in Hispanic individuals through diet and exercise is important when formulating evaluation questions. Questions will assess program implementation, effectiveness, efficiency, and attribution.19 This includes assessments at the end of each 12-week cycle answering questions regarding outcomes, feasibility, and efficacy of the program short-term. Additional annual assessments will ask questions regarding number of participants over time, recruitment methods, outcomes across groups, program costs, and program changes over the previous year. Strengths, weaknesses, and areas of improvement will be identified in order to increase program impact. Evaluations will allow for accountability and demonstrate to stakeholders the benefit of providing funding to the program.18 As described in the background, each intervention targets different levels of the Social Ecological Model (SEM). Program impact on health behavior through the various levels of the SEM, including intrapersonal, interpersonal, and community levels, will be evaluated through outcomes associated with each intervention.

Evidence will be collected with consideration of indicators based off program goals.18 For example, one goal of the program is for participants to reach healthy eating behaviors in compliance with federal dietary guidelines. An indicator for this would be participants eating 2 cups of fruit and 3 cups of vegetables per day, as recommended by the USDA Food guidelines.20 Another indicator would be adhering to the Department of Health and Human Services physical activity guidelines of 150-300 minutes of moderate intensity aerobic physical activity per week, and muscle strengthening at least twice per week.21 Evidence will be collected at baseline and one week after program completion by physical therapists, dieticians, and nurses involved in program implementation. The same administrators will be used for pre- and post-testing in order to maintain reliability. Nurses will record measures of BMI and blood glucose and provide trends over 12-weeks based off patient logs. Dieticians will administer the Healthy Eating Index-2015, and physical therapists will administer the IPAQ and SF-12. Attendance data and reasons for drop-out will also be collected over the 12-week program. Data analysis and preparation of reports will be conducted by program directors.

Conclusions will be made by stakeholders based on answers to the evaluation questions and evidence collected short-term and long-term in order to demonstrate program effectiveness.18 Data from 12-week cycles will be compared, as well as annual data. The program’s feasibility and value will be discussed by stakeholders after consideration of program outcomes. Areas of improvement will be assessed, and new strategies will be determined moving forward, as needed.

**Conclusion**

Diabetes type II is a largely preventable and manageable disease; however, 30.3 million Americans have diabetes, with average medical expenditures among diabetic patients to be estimated at $327 billion in 2017.22 Hispanics demonstrate higher prevalence of diabetes and risk of diabetes-associated deaths than non-Hispanics whites, indicating the need for interventions targeting this population.2 Secondary complications as a result of unmanaged diabetes influence healthcare costs and lead to increased disability.1 Poor access to healthcare services, low health literacy, language barriers, cultural values, and socioeconomic status prevent many Hispanic individuals from successfully managing their diabetes, increasing the risk of their children developing this chronic disease.2 Evidence indicates that proper nutrition and physical activity can improve health and decrease severity of disease and rates of mortality.5-6,9

This program considers social determinants of health when implementing interventions in order to demonstrate a greater impact on Hispanic individuals with type II diabetes, including intrapersonal, interpersonal, and community levels of the Social Ecological Model. Exercise options, dietary recommendations, family member involvement, and educational materials were considered with cultural values, preferences, and barriers in mind. Program costs are low due to free space and minimal equipment required. Goals were established based on identified behavior changes important in establishing healthy lifestyles that will continue after the participant has completed the program. Program evaluations will determine effectiveness of program and areas of improvement in order to positively impact as many individuals as possible and decrease risk of morbidity in this population. This program will provide healthy nutrition and physical activity interventions to a population in need, with the benefits clearly outweighing the costs.

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