1. **Background**

Dietary habits and physical activity levels are both extremely important for the prevention of Type 2 Diabetes (T2D). A systematic review by Hemmingsen et al. compared dietary, physical activity, and dietary plus physical activity interventions for individuals with prediabetes.1 The results indicated that physical activity plus diet result in the lowest incidence of T2D in the long-term, which demonstrates the effectiveness of a multifactorial lifestyle intervention for the prevention of T2D.1 The combined effects of a healthy diet and increased physical activity are more powerful than either intervention alone, so a successful health promotion program for individuals with prediabetes must incorporate both of these crucial lifestyle factors.

Lack of physical activity is a leading risk factor for the development of Type 2 Diabetes Mellitus (T2D), as a sedentary lifestyle can lead to obesity and insulin resistance.2 At least 150 minutes per week of moderate-intensity aerobic exercise is recommended for all adults, including those with chronic diseases.3,4 Additionally, adults should include two or three days of resistance exercises, flexibility exercises, and neuromotor exercises.3,4 A lifestyle intervention program for individuals with prediabetes should provide education regarding these guidelines, ideas for increasing physical activity throughout the day (e.g. monitoring step count on smart phone or fitness device), and group exercise classes. The Diabetes Prevention Program (DPP) included 150 weekly minutes of exercise with an intensity at least as great as brisk walking, and allowed 75 of these minutes to consist of strength training (equal to approximately 700 kcal weekly energy expenditure).5 This goal is achievable, and has been shown to reduce the risk of diabetes (each 500 kcal per week increase in physical activity correlates to a 6% decreased risk of T2D).5 Participants should be encouraged to meet this goal by engaging in any physical activity of their choosing, including biking, brisk walking, dancing, swimming, or another moderate to high intensity activity.

The health promotion program will include a choice of three different biweekly exercise classes, including a strengthening class, an aerobics class, and a mindful movement class (e.g. yoga, pilates). Both aerobics and strength training can help prevent T2D, as these activities can both improve insulin action, blood glucose levels, lipid profile, cardiovascular risk, blood pressure, and mortality.6 Yoga is a good way to combine aerobic, strengthening, flexibility, and neuromotor training. In fact, McDermott et al. investigated the impact of an eight-week yoga program that included counseling sessions for prediabetic individuals.7 The intervention resulted in significant reductions in BMI, weight, and waist circumference compared to a walking group.7 The group exercise classes will work on an interpersonal level by fostering a competitive yet friendly environment. This social support will help hold participants accountable for achieving their goals, and will likely provide motivation to put in more effort. The group format will also allow participants to relate to each other through the shared struggles of making difficult lifestyle changes. By allowing participants the freedom to choose their own classes and personal exercise habits, the program will encourage self-efficacy, social engagement, and perhaps facilitate new passions for different types of exercise.

The program will include evidence-based dietary recommendations, meal plans, recipes, and tips for reducing expenses. Filipattos et al. demonstrated that adherence to the Mediterranean Diet (MD) is correlated with a decreased incidence of T2D and cardiovascular disease development for individuals with prediabetes (7% risk for high adherence vs. 40% for low adherence).8 This whole food, low-fat, anti-inflammatory diet can reduce caloric intake, improve nutrient intake, protect the brain and cardiovascular system, and ultimately promote healthy aging.8 The suggested meal plans will be inspired by the MD, as they will include high amounts of fruits, vegetables, whole grains, fish, and olive oil, and low amounts of sugar, processed foods, and meats.8 The participants will also be divided into “support” groups, and encouraged to have monthly “pot lucks” in which each person brings in an MD dish or side item to share. This interpersonal event will help encourage social acceptance of a healthy diet, and will also allow the exchange of healthy eating strategies and recipes.

Utilizing the Health Belief Model (HBM) will be very helpful for developing the framework of a lifestyle intervention for prediabetic individuals. In order for participants to join and adhere to this program, they will need to perceive themselves to be at risk, and believe that the program will provide substantial benefits.9 They will also need to perceive that the consequences of having T2D are severe, and the barriers to participating in the program are low.10 To ensure long-term adherence, self-efficacy should be encouraged and helpful cues to action should be included.10 Through an outreach program and during an initial information session, the potential participants will be educated on the extremely high risk of developing T2D given their risk factors (obesity, impaired glucose metabolism, etc.), as well as the severity of the disease (high mortality, risk of blindness, amputation, vascular disease, etc). They will be provided with education regarding the benefits of a lifestyle program for the prevention of T2D, emphasizing the extremely important roles of diet and physical activity. The program will provide user-friendly materials, not require any fancy equipment, and offer recommendations for the most time-efficient and inexpensive exercise activities and meals to decrease any perceived barriers. There will be structure yet flexibility in the program, and individuals will be encouraged to have freedom and independence in their participation to increase self-efficacy. The program will provide training and guidance, utilize progressive goal setting, and the clinicians will utilize frequent verbal reinforcement and feedback.10 Through routine check-ins, physical activity events, and use of reminders and motivational techniques, there will be many cues to action that will help ensure adherence.10 Utilizing this model will act on an intrapersonal level to increase recruitment and adherence to this program. This approach was very successful when used during a study by Sharifirad et al., which targeted the constructs of the HBM to improve the attitude, knowledge and nutritional habits of patients with T2D.11

Body composition has an extremely important role in the development of T2D and insulin resistance. In fact, body mass index (BMI) and central fat distribution are directly related to insulin sensitivity at any degree of weight gain.2 Therefore, body weight, BMI, and waist to hips ratio should be used as objective measures to assess progress throughout this lifestyle intervention. According to the World Health Organization, waist to hips ratio is an important predictor of T2D, and can indicate obesity if above 0.85 for women or 0.90 for men.12 A BMI above 25 is considered overweight, and above 30 is considered obese, both of which result in a higher risk of T2D.9 In a prediabetes lifestyle intervention study by Eriksson & Lindegarde, the intervention group experienced a 2.4% reduction in BMI compared to an increase of 0.5% in the control group, which resulted in a 10.6% five-year incidence of T2D compared to 28.6% for the control group.13 The DPP encouraged body weight loss of at least 7% over a six-month period, which half of participants achieved.9 This program resulted in a 58% decreased incidence of T2D, demonstrating the importance of weight loss as a relevant outcome measure.9 Fasting glucose levels should also be assessed, as individuals with impaired fasting glucose have a 10 times greater risk of developing T2D than people with normoglycaemia.9 Impaired fasting glucose is considered 6.1-7.0 mmol/l, so the goal of the program should be to decrease the levels to below 6.1.9

     The best methods to achieve and maintain a healthy weight are through diet and physical activity. In order to compare an individual's objective changes in body composition to program adherence, it will be important to include self-report measures that address physical activity levels and dietary habits. A useful physical activity outcome measure is the Recent Physical Activity Questionnaire (RPAQ).14 This measure assesses activity levels over the past four weeks, and includes the domains of travel, work, domestic life, and recreation.14 It has been shown to be a valid tool for ranking individuals according to time spent performing physical activity as well as total energy expenditure, which will be useful for assessing progress towards goals (at least 150 weekly minutes or 700 kcal).5,14 To assess changes in dietary habits, it would useful to include the MedDietScore test to determine adherence to the Mediterranean diet.8 This test categorizes adherence as low, medium, or high, which has been correlated with a 10-year T2D incidence of 40%, 19%, and 7%, respectively.8 If participants are able to maintain a high adherence to this dietary protocol, they may be able to prevent the development of T2D and related pathologies.

The six-minute walk test (6MWT) would be an appropriate outcome measure to assess cardiorespiratory fitness and response to physical activity interventions. This sub-maximal test of aerobic capacity/endurance is easy to administer and does not require any special training or equipment. The 6MWT was used in the study by Higgs et al. to assess cardiorespiratory fitness during a 12-week community wellness program for adults with diabetes or prediabetes.15 The intervention group achieved a clinically and statistically significant improvement in 6MWT distance (87m and 60m, respectively), which may be indicative of an improved cardiorespiratory capacity and ability to participate in a variety of daily activities.15

1. **Program Goals**

The overall goal of the Prediabetes Intervention Program (PIP) is to improve the health and wellness of people with prediabetes through education, social support, dietary counseling, and physical activity interventions. If successful, this program will help participants reduce their risk of developing T2D over the long-term. This program is modeled after the Diabetes Prevention Program, which was a 24-week lifestyle intervention that reduced the incidence of T2D by 58%.9 The following goals by the end of the 24-week program will help these individuals decrease their T2D risk and may help facilitate long-term adherence to healthy lifestyle choices:  
1. Participants will improve their 6MWT distance by at least 50 meters by the end of 12 weeks, and maintain this improvement at 24 weeks, to meet the minimal clinically important difference for change in this outcome measure, indicating improved fitness level and ability to participate in a variety of physical activities.16  
2. At 12 and 24 weeks, participants will participate in an average of at least 150 weekly minutes of moderate-intensity physical activity for the previous four weeks as indicated on the RPAQ, which is indicative of improved self-management and can reduce the risk of T2D development.5  
3. At the 24-week follow-up, participants will have lost at least 7% of their body weight, as this can decrease risk of T2D development and indicate responsiveness to lifestyle interventions.5

4. At 12 and 24 weeks, participants will have high adherence to the Mediterranean Diet as indicated by their MedDietScore, which demonstrates improved lifestyle choices and can decrease risk of T2D development and related pathologies.

5. At 12 and 24 weeks, patients will have a fasting plasma glucose concentration of less than 6.1 mmol/l, as this demonstrates a physiological response to intervention that is associated with a reduced risk of T2D development.9

1. **Methods**

**1) Participants:**

This program will be advertised with fliers that will be posted in local physical therapy clinics, physician’s offices, and wellness centers. The flier will contain a brief description of the program, as well as a link to a website that contains more in-depth information as well as an eligibility screening tool. Participants must have a diagnosis of prediabetes based on impaired fasting glucose concentration. They must also be overweight or obese (BMI > 25.0), and not currently participating in any structured exercise or dietary programs. If eligible, the participants will fill out a form that includes health history information as well as demographics. They will also be required to have a brief phone call check-in with the organizer of the program, who will answer questions and ensure eligibility. The program will strive to include 40 participants.

**2) Personnel:**

A physical therapist and yoga teacher (Jake Tyson, DPT, RYT-200) will be the head organizer of the program. He will construct the website, the physical activity intervention plans, administer physical outcome measures, lead the exercise educational sessions, and teach a yoga class as well as a strength training class. There will be one other physical therapist (PT) on staff who will assist with program materials, outcome measure administration, participant education, and will teach an aerobics class. There will also be two registered dieticians (RD) on staff who will screen participant’s blood glucose levels using a glucose meter, administer body composition outcome measures, organize potluck groups, educate during group sessions, and offer individualized meal plans, dietary counseling, and resources to the participants. The 40 participants will be divided into two groups, so each PT and each RD will be responsible for 20 individuals. There will also be volunteer exercise teachers recruited who will sign up to teach the classes not covered by the PTs, including another yoga teacher, a Pilates instructor, a strength and conditioning coach, and an aerobic/aquatics fitness teacher. These volunteers will be recruited from local fitness centers, and they will be allowed to attend all educational sessions and exercise classes as an incentive.

**3) Location:**

The program will take place at the Chapel Hill Community Center gym as well as the indoor pool. It will begin in early March, as this facility is busy during November-February due to basketball season. We will attempt to secure classrooms for the educational sessions, or perhaps install temporary dividers in the gymnasium for both educational sessions and exercise classes. On certain days depending on weather and participant transportation restrictions, sessions will take place outdoors at the Community Center as well as at various locations such as local parks and walking trails. If available, certain exercise sessions will also take place at community multi-purpose fields and tennis courts.   
**4) Equipment:** This program will not require participants to bring any equipment. However, participants and program staff are encouraged to bring yoga mats, hand weights, tennis racquets, balls, and other portable exercise equipment, which can be left securely in the Community Center. We will also request used equipment from physical therapy clinics and gyms, and may also purchase equipment from discount retail stores and donation centers. Several sets of small weights ranging from 2-25 lbs will be collected for the strengthening classes. There will also be various colors of theraband available for participants. The RDs will use a blood glucose meter for testing, and the PTs will require only a stopwatch and measuring tape.

**5) Program Schedule, Initial Sessions, and Check-ins**

When 40 eligible participants are recruited, an initial session will occur on the first Monday of the month. Participants will arrange for a time to come into the community center between 6-9pm, and must make sure to fast for the previous eight hours. All outcome measures will be administered at this time. The PTs will administer the 6MWT and the RPAQ, and the RDs will administer body composition outcome measures, the Mediterranean-Style Dietary Pattern Score test (MSDPS), and assess fasting glucose levels. There will also be a brief information session regarding the goals of the program, the structure, and the requirements. For the next 12 weeks, participants will be required to attend 90 minute sessions twice per week, and must maintain at least 80% attendance each month. These sessions will include an educational/discussion portion as well as a supervised physical activity, each of which will be 45 minutes in duration (6-7:30 pm Tuesday and Thursday). There will be mandatory phone call check-ins with the RD and PT at the beginning of the program and after every four weeks, and optional phone call check-ins available every weekend if extra guidance is required. Outcome measures will be re-administered every six weeks until the completion of the program. During the phone call check-in after week 12, the clinicians will discuss the participant’s progress towards the goals of the program, and will also help each participant develop strategies for maintaining adherence over the remaining 12 weeks, as the program will become much less structured after this point. In order to gradually increase the independence and self-efficacy of participants, optional phone call check-ins will still be offered each weekend, and mandatory check-ins will still occur every four weeks. During this second phase of the program, there will be one optional exercise class offered each week. Participants will be encouraged to have a monthly MD potluck dinner with their group, which should continue until the end of the program. On Friday of week 24, all outcome measures will be re-administered. During this weekend, participants may choose to have a final “check-out” phone call with the PT and/or RD, and must complete an exit survey by Sunday evening of this week.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mon | Tues | Weds | Thurs | Fri | Sat | Sun |
| Week 1 | Initial Session:  6-9 pm | Physical Activity Seminar +  Exercise class 6-7:30pm |  | Nutrition Seminar + Exercise class 6-7:30pm |  | Initial phone call check-in/counseling with RD (30 minutes) | Initial phone call check-in/counseling with PT (30 mins) |
| Week 2 |  | Physical Activity Seminar +  Exercise class 6-7:30pm |  | Nutrition Seminar + Exercise class  6-7:30pm |  | Optional RD check-in | Optional PT check-in |
| Week 3 |  | Health & Wellness Seminar +  Exercise class 6-7:30pm |  | Health & Wellness Seminar +  Exercise class  6-7:30pm |  | Optional RD check-in | Optional PT check-in |
| Week 4 | Group potluck encouraged this week | Physical Activity Seminar +  Exercise class  6-7:30pm |  | Nutrition Seminar + Exercise class 6-7:30pm |  | RD phone call check-in/counseling (20 mins) | PT phone call check-in/counseling (20 mins) |
| Week 5 |  | Physical Activity Seminar +  Exercise class  6-7:30pm |  | Nutrition Seminar + Exercise class  6-7:30 pm |  | Optional RD check-in | Optional PT check-in |
| Week 6 |  | Health & Wellness Seminar +  Exercise class 6-7:30pm |  | Health & Wellness Seminar +  Exercise class  6-7:30  pm | Outcome measure administration: 6-9pm | Optional RD check-in | Optional PT check-in |
| Week 7 |  | Physical Activity Seminar +  Exercise class 6-7:30pm |  | Nutrition Seminar + Exercise class 6-7:30pm |  | Optional RD check-in | Optional PT check-in |
| Week 8 | Group potluck encouraged this week | Physical Activity Seminar +  Exercise class 6-7:30pm |  | Nutrition Seminar + Exercise class 6-7:30pm |  | RD phone call check-in/counseling (20 mins) | PT phone call check-in/counseling (20 mins) |
| Week 9 |  | Health & Wellness Seminar+ Exercise class 6-7:30pm |  | Health & Wellness Seminar +  Exercise class 6-7:30pm |  | Optional RD check-in | Optional PT check-in |
| Week 10 |  | Physical Activity Seminar +  Exercise class 6-7:30pm |  | Nutrition Seminar + Exercise class  6-7:30pm |  | Optional RD check-in | Optional PT check-in |
| Week 11 |  | Physical Activity Seminar+  Exercise class 6-7:30pm |  | Nutrition Seminar + Exercise class 6-7:30pm |  | Optional RD check-in | Optional PT check-in |
| Week 12 | Group potluck encouraged this week | Health & Wellness Seminar +  Exercise class 6-7:30  pm |  | Health & Wellness Seminar +  Exercise class  6-7:30pm | Outcome measure administration: 6-9pm | RD phone call check-in/counseling (20 mins) | PT phone call check-in/counseling (20 mins) |
| Week 13 |  |  |  | Optional exercise class  6-7pm |  | Optional RD check-in | Optional PT check-in |
| Week 14 |  |  |  | Optional exercise class  6-7pm |  | Optional RD check-in | Optional PT check-in |
| Week 15 |  |  |  | Optional exercise class 6-7pm |  | Optional RD check-in | Optional PT check-in |
| Week 16 | Group potluck encouraged this week |  |  | Optional exercise class 6-7pm |  | RD phone call check-in/counseling (20 mins) | PT phone call check-in/counseling (20 mins) |
| Week 17 |  |  |  | Optional exercise class  6-7pm |  | Optional RD check-in | Optional PT check-in |
| Week 18 |  |  |  | Optional exercise class  6-7pm | Outcome measure administration: 6-9pm | Optional RD check-in | Optional PT check-in |
| Week 19 |  |  |  | Optional exercise class  6-7pm |  | Optional RD check-in | Optional PT check-in |
| Week 20 | Group potluck encouraged this week |  |  | Optional exercise class  6-7pm |  | RD phone call check-in/counseling (20 mins) | PT phone call check-in/counseling (20 mins) |
| Week 21 |  |  |  | Optional exercise class  6-7pm |  | Optional RD check-in | Optional PT check-in |
| Week 22 |  |  |  | Optional exercise class  6-7pm |  | Optional RD check-in | Optional PT check-in |
| Week 23 |  |  |  | Optional exercise class  6-7pm |  | Optional RD check-in | Optional PT check-in |
| Week 24 | Group potluck encouraged this week |  |  | Optional exercise class  6-7pm | Final outcome measure administration: 6-9 pm | Optional RD check-out | Optional PT check-out. Exit survey due |

**6) Intervention Specifics:**

**Physical Activity:**

Participants will be encouraged to participate in at least 150 weekly minutes of moderate to vigorous intensity exercise. They will keep an exercise log to record their adherence, which will be discussed with the PT. During the first week and every four weeks, each participant will have a phone call meeting with a PT. During these meetings, the PT will discuss with each participant the interpretation of their 6MWT score, and the relevance of this test for their physical activity goal. The PT will also discuss exercise habits based on the RPAQ, and inquire about any barriers the participants may have (lack of access to a gym, chronic pain, etc.). The PT will address these barriers appropriately, and provide ideas for gradually increasing physical activity levels based on participant’s individual situation. For example, a PT might suggest that a sedentary desk worker should take the stairs instead of the elevator, walk to work, take five-minute movement breaks throughout the day, or perhaps find time to go to the gym during lunch. The PT will provide community resources and suggestions based on participant preference, such as details about a walking group, free yoga classes, discount gym memberships, local hiking trails, and much more. During optional check-ins and mandatory check-ins, the PT will ask about adherence to the physical activity goal, and provide motivation and strategies accordingly.

The program will have required meetings twice per week, which will include a 45-minute group exercise class. Participants will choose between three available activities, which may include yoga, aerobics, water aerobics, Pilates, balance training, strength training, high intensity interval training (HIIT), calisthenics, walking/jogging, hiking, soccer, kickball, and tennis. The available activities will depend on instructor availability, weather, and location availability. The participants must choose at least one aerobics activity each week, which includes aerobics, water aerobics, walking/jogging, hiking, HIIT, calisthenics, and any of the three sports. The instructors will help motivate participants to put in their maximum effort during activities, provide feedback and modifications when necessary, and will ensure there is adequate time for rest breaks and hydration. The group setting will improve social support and accountability, and will likely foster a competitive yet friendly environment. This may improve long-term adherence, and many participants may develop intrinsic enjoyment for some of the exercise activities. In addition to the offered exercises classes, the participants will be expected to complete at least 60 additional minutes of exercise of their choosing each week outside of the program. After the first 12 weeks of the program, there will only be one optional exercise class offered each week depending on participant preference and instructor availability. This will provide a stepping stone towards integration into exercise programs in the community or independently. Participants will still be expected to meet the quota of 150 minutes of exercise every week until the end of the program.  **Nutrition:**

Participants will be encouraged to adhere to the MD, and gradually decrease intake of processed foods that are high in sugar and saturated fats. Each participant will keep a log of their eating habits each week, which will be discussed with the RD. The RD will review each participant’s MSDPS, and create an individualized plan based on these results. During the initial phone call check-in of the first week, the RD will touch base with each participant regarding their food preferences, their perceived barriers to healthy eating, and their access to healthy foods. Based on this conversation, the RD will provide a realistic meal plan that gradually increases in adherence to the MD over the course of the first 12 weeks of the program. For example, if a participant tends to eat dessert every day, the RD might suggest taking one day off dessert during the first week. Then two days, three days, etc. The RD will offer tips and tricks for adhering to this suggestion, such as eating fruit instead of ice cream, or simply not buying any sweets at the store. During optional check-ins and mandatory check-ins, the RD will assess the progress of the participant, and address any barriers or questions they may have. The RD will congratulate any successes of the participants, big or small, and provide guidance for maintaining and increasing adherence to a healthy diet to encourage self-efficacy. The website of the program will also provide many healthy recipes as well as ideas for saving money at grocery stores. Additionally, the RD will divide the participants into groups of five. These groups will be encouraged to have monthly potlucks in which they are each assigned to bring in a MD friendly dish for dinner. This will foster social support, accountability, and will be a helpful cue to action for participants to start cooking healthy foods independently. It will also be a great opportunity for the group members to share recipes and strategies for staying healthy.   
  **Group Seminars:**

The discussions will be presentations on various topics of health and wellness that are relevant to individuals with prediabetes. As evident on the schedule, there will be seminars regarding physical activity as well as nutrition. The discussions will occur concurrently in separate rooms, as an RD will lead the nutrition seminar for one group (20 participants) while a PT leads the physical activity seminar for the other group (20 participants). In other words, one group of 20 will attend the physical activity seminar on Tuesday, and that same group will attend the nutrition seminar on Thursday (and vice versa for the other group).

The topics will be presented in regards to the HBM in order to foster behavioral changes. Participants will be educated on their susceptibility to T2D due to their impaired glucose tolerance, body weight, dietary habits, physical activity levels, and other relevant risk factors. They will also be educated on the severity of the disease, including the symptoms, complications, and the mortality associated with T2D. The presentations on physical activity will be led by a PT, and will include topics such as the ACSM exercise guidelines, how physical activity levels are related to T2D development, various health benefits of exercise, ideas for increasing physical activity throughout the day, reducing barriers to physical activity, motivational techniques for increasing exercise adherence, and community fitness resources. The topics of presentation regarding nutrition will include current dietary guidelines for preventing T2D, how certain dietary factors are related to the pathophysiology of T2D, a thorough explanation of the Mediterranean diet and other evidence-based dietary protocols, the profound benefits of a healthy diet, motivational techniques for controlling eating habits, and tips and tricks for meal planning, grocery shopping, portion control, and restaurant meal selection. There will also be various health and wellness seminars throughout the program, with topics including the dangers of smoking and excessive alcohol consumption for prediabetics, as well as sleep hygiene, stress management, social factors, meditation and mindfulness techniques, emotional and spiritual health, chronic disease management, and miscellaneous topics.

Group discussion will be encouraged, especially following the lecture portion of these meetings. Participants will be asked to share their personal struggle with the lifestyle change of discussion through the lens of the HBM. For example, a participant may share the barriers they experience that prevent them from getting enough physical activity and preparing healthy food while working an extremely busy desk job. Other participants may relate to this struggle, which may increase social support and create a sense of camaraderie among these people. Participants as well as the instructor may be able to offer advice for minimizing these barriers, or perhaps provide motivational strategies or helpful cues to action for implementing a health behavior change. By fostering social support and interpersonal relationships, participants can learn from each other, share their challenges, and perhaps develop a sense of social accountability to make healthy lifestyle changes.

1. **Program Evaluation**

This program will be evaluated based on many factors, including the activities and the outputs.17 The activities include the physical activity and nutritional interventions, group discussions, and phone call check-ins. The outputs are the products of the activities, which include biweekly meetings, and phone call check-ins every four weeks at the minimum. All subjects will be required to attend at least 80% of the biweekly sessions, and must participate in all mandatory phone calls. Participants will be given a warning if their attendance drops below 80%, and will be removed from the program if this continues. Other participants may also choose to discontinue the program due to personal factors. This attrition can certainly impact the quality of this program, as a retention rate of less than 80% can pose threats to internal and external validity.18 Additionally, if attendance is poor, fewer people will benefit from the program, and the staff may feel like their time and effort is not being spent efficiently. For this reason, if at least 80% of participants abide by the attendance policy, this will be considered a success.

The program will be evaluated based on the outcomes, which are changes that occur as a result of the outputs and activities.17 The evaluation of outcomes will be based on the program goals, which include measures of self-reported physical activity levels, self-reported MD adherence, physical performance, and fasting glucose levels. These outcomes will be administered during the initial session of the program, as well as after every six weeks. By re-administering these tests throughout the program, participants and program staff will be able to assess progress towards goals. This performance measure will help inform intervention approaches, as those who do not experience improvements may require additional counseling, education, or resources.

In order to be considered successful, it is expected that the mean of the sample meets each goal. For example, the average improvement in the 6MWT for all participants must be at least 50 meters, there must be an average of at least 7% weight loss, etc. This will account for the fact that not everyone will be extremely responsive and/or adherent to this program, but hopefully the majority of participants will experience meaningful changes. By removing the structure of the program after 12 weeks, the outcome measure administration at 18 and 24 weeks will help demonstrate the long-term efficacy of the program. According to the transtheoretical model of health behavior change, if changes are maintained after 24 weeks, it is likely that the individual is past the action stage and is now in the maintenance stage.19 This means that they have made overt lifestyle changes, and likely have improved self-efficacy that will help them maintain these changes over the long term.19 Ultimately, if this program is successful, the majority of the participants will avoid T2D development, and possess strategies for maintaining a healthy, active lifestyle.

The program will also be evaluated based on the feedback from participants. The frequent phone call check-ins will give participants a chance to voice any frustrations or suggestions they have regarding the program, which the staff will take into account. Additionally, each participant will complete a mandatory exit survey. This feedback will be extremely useful for determining the strengths, weaknesses, and areas for improvement of this program.17 The survey will include questions regarding the performance of the instructors, the effectiveness of the intervention programs, the feasibility of completing the program, and any changes that would improve the program in the future. Participants will also have the opportunity to have a “check-out” phone call with an RD and/or PT to voice any more feedback they may have.

1. **Conclusion**

The Prediabetes Intervention Program will be an extremely beneficial program for individuals at risk for T2D development, as well as for our healthcare system at large. PIP will spread awareness about the prevalence and severity of prediabetes, and the susceptibility of these individuals to the development of T2D. T2D leads to extremely serious health complications, and also creates exorbitant healthcare costs in our country.20 86 million people in our country (one in three adults) have prediabetes, and only 10% of them are aware of this. By educating patients, families, and communities on the details of this devastating yet preventable disease, more people may begin to take lifestyle actions to decrease their risk. The PIP is inexpensive, evidence-based, and can ultimately improve the health and quality of life of anyone with prediabetes.

The PIP uses an approach informed by the HBM to help guide individuals towards making and maintaining healthy lifestyle changes. This program incorporates aspects of a variety of research studies and successful lifestyle programs including the Diabetes Prevention Program. This approach is person-centered, and emphasizes education, self-efficacy, and social support. A great variety of health and wellness topics are taught, and group discussions, group exercise classes, and potlucks are encouraged to help foster an interpersonal environment of support and accountability. The PIP is also individualized, as each participant will form a rapport with two clinicians who will help them achieve and maintain their goals. The program has both structure and flexibility, as participants may choose physical activities and foods based on personal preference, but will be held accountable for working towards their goals. The flexibility increases at 12 weeks, after which the participants must maintain their lifestyle changes with less guidance from the staff. This is to promote self-efficacy, independence, and integration into community health and wellness opportunities. The program continues for 24 weeks, which is enough time for participants to achieve their goals and experience the benefits of a healthier lifestyle.

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