**Background**

The proposed health promotion program for participants with cardiovascular disease will meet a need to provide community-based resources to a large population of individuals managing acute or chronic consequences of coronary artery disease, valve dysfunction, arrythmias, hypertension and heart failure. By utilizing the Health Belief Model, this program will administer interventions including moderate continuous training (MCT), high intensity interval training (HIIT), and educational sessions directed towards nutrition and tobacco use as they pertain to individuals with cardiovascular disease (CVD). In order to track patient progress, several outcome measures will be utilized to inform goal writing and determine the efficacy of the program. These outcome measures will consist of the 6 minute walk test (6MWT) as a performance measure, and a couple self-report measures: The Short-Form Health Survey (SF-36) and 24-hour dietary recall along with the Diet Quality Index (DQI-I).

Physical therapists (PT) and any other staff members involved in program administration will be highly knowledgeable about the concepts included in the Health Belief Model (HBM), as well as specific strategies to use when facilitating health behavior change in participants with CVD.[1–3](https://sciwheel.com/work/citation?ids=11749069,9842329,4571060&pre=&pre=&pre=&suf=&suf=&suf=&sa=0,0,0) PTs will assist participants in identifying perceived benefits and barriers to adopting new behaviors, and expand their knowledge about disease severity and consequences that may affect them in order to encourage adherence and adoption of new health behaviors.[1](https://sciwheel.com/work/citation?ids=11749069&pre=&suf=&sa=0) This process will be facilitated in both individual and group settings, during exercise and educational sessions. Participants will set goals with PTs that are meaningful to them and in line with the programs mission of improving health and wellbeing through targeted exercise and education for this population.

The HBM was chosen to apply to the program at hand because of the evidence stating that individuals are more likely to adopt behaviors to control their CVD when they have more knowledge about the disease severity and consequences and are educated about courses of action to reduce risk and improve their overall health.[1,3](https://sciwheel.com/work/citation?ids=4571060,11749069&pre=&pre=&suf=&suf=&sa=0,0) The HBM has been used to improve health behaviors in patients at different stages of CVD, including those at risk and also with diagnosed cardiovascular conditions. A study in patients with heart failure found that all constructs of the HBM were improved with education sessions, including self-efficacy and performance of suggested health behavior changes to slow or halt disease progression.[4](https://sciwheel.com/work/citation?ids=7657762&pre=&suf=&sa=0)

HIIT has gained popularity in the general public and has been used more frequently in specific disease populations as of late to improve exercise tolerance and functional capacity. This type of training is marked by periods of activity performed at a certain percentage of an individual’s maximum capacity with periods of rest or low-intensity activity interspersed at pre-specified intervals. HIIT is noted to have similar or greater effects on patient increases in CVD related factors such as HRQOL, heart rate response to exercise, maximal oxygen consumption (VO2 max) and overall exercise tolerance.[5,6](https://sciwheel.com/work/citation?ids=11691088,11986030&pre=&pre=&suf=&suf=&sa=0,0) HIIT has been noted to be safe for patients with CVD and has not resulted in significantly more cardiovascular events than moderate intensity exercise.[5,7](https://sciwheel.com/work/citation?ids=11691088,11986031&pre=&pre=&suf=&suf=&sa=0,0) This information does not preclude the need to perform appropriate pre-assessments of patient capabilities and apply clinical reasoning with regards to relative and absolute indications for avoiding and terminating exercise.[5](https://sciwheel.com/work/citation?ids=11691088&pre=&suf=&sa=0) HIIT may also not be appropriate for individuals with low functional status (able to perform activity under 5 METS).[8](https://sciwheel.com/work/citation?ids=5309011&pre=&suf=&sa=0)

There are some specific HIIT protocols that have been studied in the CVD population and recommended for use in patients with different baseline functional capacities. For individuals with low functional capacity (< 5 METS) a short interval protocol is recommended with high intensity activity (RPE 15-17) performed for 1 minute followed by low intensity activity for 2 minutes (RPE 12-14) with 5 total cycles.[5](https://sciwheel.com/work/citation?ids=11691088&pre=&suf=&sa=0) For individuals with moderate to high functional capacity (> 5 METS), a medium or long interval protocol is recommended based on participant progression and physical therapist clinical decision making. The medium interval protocol consists of 5 cycles of high intensity activity as defined above for 2 minutes, followed by low intensity activity for 2 minutes.[5](https://sciwheel.com/work/citation?ids=11691088&pre=&suf=&sa=0) The long interval protocol will consist of 5 cycles of high intensity for 4 and low intensity for 3 minutes.[5](https://sciwheel.com/work/citation?ids=11691088&pre=&suf=&sa=0)

MCT will be another intervention offered in the program and implemented in addition to or instead of HIIT training based on physical therapist recommendation after pre-exercise testing. MCT has also been shown to have good short and long-term benefits in patients with CVD including reduced morbidity and mortality and reduction or relief of common clinical symptoms such as dyspnea, sleep disorders and depressive symptoms.[8](https://sciwheel.com/work/citation?ids=5309011&pre=&suf=&sa=0) Participants will choose a mode of exercise that most appeals to them and exercise for a total of 30 minutes at a time (an average duration recorded in this review) at an intensity of RPE (rating of perceived exertion)11-15 with progression dictated by the physical therapist to allow for appropriate challenge and maximize benefits.[8](https://sciwheel.com/work/citation?ids=5309011&pre=&suf=&sa=0)

To assess improvements in the functional capacity (FC) and exercise tolerance of participants, a 6-minute walk test will be utilized. This performance measure was chosen because of the ease of administration and limited equipment required. The 6MWT has also been validated and shown to be significantly correlated to physiologic measures of FC such as VO2 max in patients with chronic heart failure and is used regularly in cardiopulmonary rehabilitation clinics.[9](https://sciwheel.com/work/citation?ids=7772881&pre=&suf=&sa=0) The program will use a minimum of 30 meters to mark a clinically meaningful change in participant exercise.[10](https://sciwheel.com/work/citation?ids=5889985&pre=&suf=&sa=0) PTs will also maintain records of RPE and dyspnea on exertion (DoE) as some other indicators of exercise tolerance and to assist with goal writing.

All participants will participate in nutrition counseling as a part of the program as well. This aspect of the program is important as it has been estimated that nutritional factors may be responsible for up to 40% of all diagnosed CVD.[11](https://sciwheel.com/work/citation?ids=10144064&pre=&suf=&sa=0) Adoption of a vegetarian or Mediterranean diet has been strongly correlated with reduced risk for CVD events and mortality.[12](https://sciwheel.com/work/citation?ids=8288409&pre=&suf=&sa=0)[13](https://sciwheel.com/work/citation?ids=8169658&pre=&suf=&sa=0) It may be unreasonable to expect participants to fully transition to these diets, but participants will be encouraged to begin adopting certain components through multimodal education sessions.

To track participant progress, a 24-hour dietary recall will be taken periodically and analyzed with the Diet Quality Index (DQI-I) to identify specific areas of concern or improvements and PTs will facilitate conversations about their readiness to change aspects of their diet. The 24-hour dietary recall recorded in a multiple pass technique is a useful tool for self-reporting dietary choices and has been used extensively in the CVD population as a reliable sample that can be generalized well to overall eating habits.[14,15](https://sciwheel.com/work/citation?ids=11863478,11986040&pre=&pre=&suf=&suf=&sa=0,0),[16](https://sciwheel.com/work/citation?ids=11986047&pre=&suf=&sa=0) The DQI-I provides a way to objectively measure the healthy eating habits exhibited in the 24-hour dietary recall, and offers an overall score that is easier to compare at different assessment times.[16](https://sciwheel.com/work/citation?ids=11986047&pre=&suf=&sa=0)

The program will also offer education and counseling for smoking cessation. It has been found that regular counseling in addition to cessation aids like nicotine patches or other medications is more effective in helping patients quit than medication alone and that patients who have recently suffered a CVD event are also more likely to successfully quit.[17](https://sciwheel.com/work/citation?ids=11863484&pre=&suf=&sa=0) Helping participants quit smoking will lower their risk for myocardial infarction and sudden cardiac death and other events and diseases such as peripheral vascular disease and stroke.[18](https://sciwheel.com/work/citation?ids=3429380&pre=&suf=&sa=0) Education sessions will focus on the detrimental effects of tobacco on multiple body systems but focus on the cardiovascular system. These sessions will take place in groups and consist of lectures, videos and discussions to cover different concepts in the HBM.

Participants will be asked to fill out the Short-Form Health Survey or SF-36 to track health-related quality of life throughout the program. Improvements in this measure have been linked to reductions in hospital readmissions and mortality in patients with CVD.[19](https://sciwheel.com/work/citation?ids=11986052&pre=&suf=&sa=0) It has also been shown that increased self-efficacy in exercise can help patients with CVD improve their HRQOL measures.[20](https://sciwheel.com/work/citation?ids=11986051&pre=&suf=&sa=0) Participants will have the greatest buy in and motivation to maintain health behavior changes if they can see a difference in HRQOL as these tasks are likely to make the most clinical difference in their lives. The program will add a question or two at the end of the SF-36 questionnaire for current smokers to assess abstinence or quantity of tobacco they are currently still smoking to track progress in this domain.

**Program Goals**

This program will strive to improve the health and wellness of participants with diagnosed CVD. This will be accomplished through targeted exercise training and education. Participants and the community should expect certain goals to be met to at the end of the 12-week program.

1. Participants will demonstrate an improvement of at least 30 meters on the 6 minute walk test to indicate a clinically meaningful change in functional capacity and exercise tolerance.[9,10](https://sciwheel.com/work/citation?ids=5889985,7772881&pre=&pre=&suf=&suf=&sa=0,0)
2. Participants will demonstrate an improvement of 20 points on the RAND SF-36 to indicate a clinically meaningful change in health-related quality of life.[21](https://sciwheel.com/work/citation?ids=12035184&pre=&suf=&sa=0)
3. Participants will report diet quality in the form of the 24-hour food recall of at least 80% adherence to recommended daily allowances as measured by the Diet Quality Index to indicate positive health behavior change due to nutrition education sessions.[16](https://sciwheel.com/work/citation?ids=11986047&pre=&suf=&sa=0)
4. Participants will demonstrate ability to write goals for themselves that are reasonable and measurable to show the ability to intrinsically motivate themselves and apply this skill outside of the programs end date.
5. Participants who are current or recent smokers at the beginning of the program will demonstrate understanding of detrimental effects of tobacco on the cardiovascular system through teach-back and have written a detailed plan for smoking cessation in collaboration with program staff.[17,18](https://sciwheel.com/work/citation?ids=3429380,11863484&pre=&pre=&suf=&suf=&sa=0,0)

**Methods**

**Personnel**

* Local physical therapists will be recruited to volunteer their time to oversee program administration with one specific program director. Two physical therapists will be on site for evaluation days that occur 4 times during the program. One physical therapist will be required to be on site for every normal session to monitor safety of participants during exercise and lead education sessions.
* Physical therapy and nursing students will be recruited to assist in leading HIIT and MCT activities and to take vitals frequently during sessions. One of each will be present at each session to fill these roles. On days with nutrition and smoking cessation education sessions, these students will assist with presentations and facilitating discussion as needed.
* A volunteer will be trained in administrative assistant duties such as checking participants in each session and distributing, collecting and scanning self-report measures on evaluation days. This volunteer will also coordinate the enrollment of incoming program participants. This volunteer requires no special training although may be a suitable position for prospective students looking to enter one of the health professions. Several individuals may be trained in this position, to reduce the time commitment during the program.

**Location**

* The program will take place at the UNC Wellness Center in NW Cary.
* Participants will be allowed access to certain equipment during the time of their sessions at a reduced rate of 74 dollars per person for the entire 12-week program (this cost is normally a monthly rate). Individuals who have financial burdens that don’t allow this cost will be accommodated.

**Enrollment and Program Schedule**

* Local physician’s offices, physical therapy clinics, inpatient rehabilitation facilities and hospital rehab department staff will be given brochures to hand out to program candidates and their families.
* Prospective participants will call the administrative assistant to answer some preliminary questions confirming their diagnosis of a CVD condition, that they are an adult over 18 years old and intent to attend all sessions. 15 participants will be accepted per program cycle.
* Sessions will be held 3 times a week and begin at 5:30 pm, lasting for 1 hour and 30 minutes. Evaluations will be performed to assess patient progress with 6 minute walk test, SF-36 and dietary recall at baseline and every 4 weeks for a total of 4 assessments during the program. A sample schedule for one month is included below.
* Physical therapists will determine at baseline evaluations what HIIT protocol each participant will use based on average MET level and re-evaluate the need to progress at each subsequent evaluation.



**Intervention Specifics**

|  |  |  |
| --- | --- | --- |
| Functional Capacity | Interval Duration (high/low intensity) | Total Time for 5 Cycles |
| Low (< 5 METs) | 1 minute/2 minutes | 15 minutes |
| Moderate (>5 METs) | 2 minutes/2 minutes | 20 minutes |
| High (>5 METs) | 4 minutes/3 minutes | 35 minutes |

Each session will begin with a 10 minute dynamic warm up consisting of activities the physical therapist sees fit that day, walking, cycling, yoga, dancing etc. On Mondays and Fridays participants will participate in prescribed HIIT protocol using body weight exercises, treadmill and stationary cycling. This training will range from 15 to 35 minutes depending on the functional capacity of the participant as outlined in the table below. Intensity will be determined as RPE 15-17 for high and RPE 12-14 for low.[5](https://sciwheel.com/work/citation?ids=11691088&pre=&suf=&sa=0)

MCT activity will be performed at every session in the program for 30 minutes at an intensity of RPE 11-15.[8](https://sciwheel.com/work/citation?ids=5309011&pre=&suf=&sa=0) Participants will choose walking or stationary cycling each session but must have at least one of each mode per week. A 10 minute cool down will be performed at the end of activity for the day.

Nutrition education sessions will be held once a week for 30 minutes each. A set curriculum will be developed by the program director with consult from a Registered Dietitian to include information about Recommended Daily Allowances for different food groups, suggestions for participants wishing to pursue a vegetarian or Mediterranean diet and ways to reduce sodium intake.[12,13](https://sciwheel.com/work/citation?ids=8288409,8169658&pre=&pre=&suf=&suf=&sa=0,0) Conversations about the culture and tradition behind the foods participants consume will guide discussions about the ways to consume foods high in fat and sugar in moderation while still eating foods they enjoy. Guest lectures or videos from past participants in the form of testimonials and nutritionists or dietitians will serve to shape opinions about the importance of this lifestyle change.[1](https://sciwheel.com/work/citation?ids=11749069&pre=&suf=&sa=0)

Smoking cessation sessions will also be held once a week for participants who are current or recent smokers. Lectures will contain information about the adverse effects of tobacco on the cardiovascular and other systems and the benefits participants can expect after quitting, including reducing risk of heart attack and stroke.[17,18](https://sciwheel.com/work/citation?ids=11863484,3429380&pre=&pre=&suf=&suf=&sa=0,0) Information about various aids to quitting will be compiled to help participants learn about different options they can ask their doctor more about.[18](https://sciwheel.com/work/citation?ids=3429380&pre=&suf=&sa=0)

Participants will have the opportunity to write individualized goals with a physical therapist regarding their function, activities of daily living and health behavior change. PTs will revisit goals and check in with patient progress in down time during sessions.

**Program Evaluation**

This program will be evaluated based on the effectiveness of the program based on the success of participants meeting established goals, input from program personnel and collaboration with community organizations and referral sources.[22](https://sciwheel.com/work/citation?ids=11913313&pre=&suf=&sa=0) By the end of the 12-week program participants are expected to have made clinically meaningful improvements in their 6-minute walk test (6MWT) distance, health-related quality of life, dietary quality and tobacco use as outlined in the program goals section. Participants are expected to have learned skills necessary to write personal goals and apply them to other areas of their lives that they would like to make behavior changes. At baseline and each subsequent evaluation, a physical therapist will administer and score performance and self-report measures to track progress towards program and participant goals. The program director will make sure individual therapists are confident and competent with administration and scoring of tests as outlined by validated instructions.[16,23,24](https://sciwheel.com/work/citation?ids=12035206,12035213,11986047&pre=&pre=&pre=&suf=&suf=&suf=&sa=0,0,0) Tobacco use will be evaluated with an open-ended question asking participants to detail their tobacco product use over the last week and any progress with cessation aids or conversations with their primary care physicians. All participant reported measures will be scanned and saved into a computer system with all personal information de-identified to maintain privacy but allow for comparisons between check points. At the conclusion of the program, participants will be encouraged to reach out to program staff as a resource if they continue to have any questions or need guidance with any aspect of interventions provided and beyond.

Participants will also complete mid-term and final evaluations of their experience to make sure the program is meeting their needs adequately.[22](https://sciwheel.com/work/citation?ids=11913313&pre=&suf=&sa=0) Program staff are encouraged to consistently volunteer for an entire program cycle to promote continuity of care. At the end of each cycle, they too will complete evaluations to comment more on the logistic aspects of the program, education content and delivery methods, clarity of role expectations and support from the program director as well as any other concerns or suggestions.[22](https://sciwheel.com/work/citation?ids=11913313&pre=&suf=&sa=0) Other community stakeholders will be invited to come observe sessions and ask questions including local physicians, physical therapists or other providers and even prospective participants.[22](https://sciwheel.com/work/citation?ids=11913313&pre=&suf=&sa=0) The UNC Wellness Center will also be able to provide comments and guidance about the use of equipment and resources as well as the stewardship of staff and participants in their space.

Since the program cycles are 12 weeks each, this leaves about a week in between each cycle in the year. During this time the program director will stay up to date on current literature to ensure the interventions provided are evidence-based and appropriately changing with current recommendations for this population.[22](https://sciwheel.com/work/citation?ids=11913313&pre=&suf=&sa=0) This will also leave time to go through feedback and discuss with staff ways to improve the program and implement suggestions.[25](https://sciwheel.com/work/citation?ids=7895987&pre=&suf=&sa=0) The program director will also be responsible for training and evaluating program staff to make sure interventions and assessments are being administered properly.[22](https://sciwheel.com/work/citation?ids=11913313&pre=&suf=&sa=0)

These methods of evaluation will make sure the program is effective and appropriate stakeholders are involved in the maintenance and improvement of the program based on the CDCs recommendations for program evaluation.[22](https://sciwheel.com/work/citation?ids=11913313&pre=&suf=&sa=0) Results of participant progress towards goals, synthesized feedback, new research available and ideas to be implemented will be written up in a report available to all stakeholders through newsletters to referral sources and posted in the UNC Wellness Center.[22](https://sciwheel.com/work/citation?ids=11913313&pre=&suf=&sa=0)

**Conclusion**

Due to the high incidence and prevalence of cardiovascular disease (CVD) in the United States and the known associated disability and detriments to function and quality of life, the proposed community program will provide much needed resources to this population to improve their health and well-being.[26,27](https://sciwheel.com/work/citation?ids=3386451,8970360&pre=&pre=&suf=&suf=&sa=0,0) The program itself is accessible due to its low cost and central location to many cities in the Triangle area of North Carolina. HIIT, MCT and the educational interventions are all evidence-based methods to improve functional capacity and health-related quality of life in individuals with CVD.[5,8,11,17](https://sciwheel.com/work/citation?ids=11691088,5309011,10144064,11863484&pre=&pre=&pre=&pre=&suf=&suf=&suf=&suf=&sa=0,0,0,0) This will allow individuals to better participate in daily activities they enjoy and help them take an active role in their health. The Health Belief Model will help participants identify benefits and barriers to change while increasing their health literacy on topics related to CVD.[1,3](https://sciwheel.com/work/citation?ids=11749069,4571060&pre=&pre=&suf=&suf=&sa=0,0) The program will equip participants with the self-efficacy and concrete skills needed to adopt health behaviors such as appropriate exercise, dietary habits and smoking cessation as well as promote autonomy and intrinsic motivation moving forward beyond the end of the program

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