Exercise From Afar: Progressing At-Risk Adults to Independent Exercise for Dementia Risk Reduction

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NCT #: TBD

SPECIFIC AIMS

Aim 1. Determine the impact of a technology-driven exercise program on exercise adherence, exercise efficacy and exercise enjoyment. Providing a personalized exercise program via a smart phone application reduces the need for personal trainer or group exercise class. Providing memberships at local fitness facilities provides the opportunity for participants to choose to exercise at home or at a fitness facility. Together, these delivery characteristics may reduce barriers to exercise for Rural adults. We hypothesize that Rural adults will report high exercise adherence, efficacy and enjoyment following this program.

Aim 2. Determine the impact of a technology-driven exercise program on biomarkers associated with dementia risk. Exercise is associated with disease risk reduction. Cardiovascular exercise is known to reduce biomarkers associated with disease risk (LDL, cholesterol, blood glucose, etc.). We hypothesize that participants with high exercise adherence will see the greatest improvements in biomarkers associated with reduced dementia risk.

RESEARCH STRATEGY

Significance

Alzheimer’s disease (AD) affects more than 6.1 million Americans and costs our national economy nearly $400 billion per year (1). Advancing age is the single greatest risk factor. Alzheimer’s is estimated to affect one in every eight Americans over 65, and more than half of those past the age of 85 either have AD or show signs of developing the disease. For Latino individuals, the risk of AD is even higher; twice that of Caucasian older adults. Alzheimer's disease has reached the status of being a public health crisis with a diagnosis every 66 seconds. Kansas has an estimated 53,000 residents over 65 diagnosed with AD. Research suggests if we can push back the onset of AD by 5 years, we could reduce the prevalence of AD in the state of Kansas by 50%.

Rural Americans (RA) report significantly higher percentages of obesity and chronic disease than their urban counterparts (4, 13). However, rural individuals face different barriers to physical activity and exercise than urban-dwelling individuals (3, 7). Six key lifestyle behaviors have been identified as AD risk reducing behaviors; physical activity and exercise, nutrition, social engagement, cognitive engagement, socialization, sleep and stress management (5). Research suggests that individuals who regularly participate in these behaviors are at a lower risk of developing cognitive impairment than those who do not (11, 16, 20, 25, 27, 30, 32, 45). Rural Americans report lower attainment of education, less daily physical activity (both by choice and due to chronic health conditions), higher all cause death rates and greater use of tobacco products among all ages (3, 4, 8, 10, 12, 14). Risk reduction education and programming is essential to address and preclude further health disparities in these underserved communities. Cultural differences may also play a significant role in both AD risk and perception of barriers and benefits (of healthy lifestyle practices) (3, 7, 9, 14).

Given that nearly 50% of all individuals are likely to experience some form of cognitive decline by age 85, it is imperative that preventative measures be integrated into communities. Rural Americans require such programs to be tailored to their specific needs and address their unique barriers.

Innovation

Health disparity research exists and tells us that Rural Americans experience different and more numerous barriers to healthy lifestyle behaviors (specifically exercise) than do their urban-dwelling counterparts (2-4, 6-13). Exercise trials have investigated the impact of structured, supervised exercise on cognition and markers related to cognitive decline risk (26-31, 33-36, 44, 45, 51, 63, 72, 74, 79, 81, 83). Exercise seems to be effective at reducing risk for cognitive decline, as well as a myriad of other chronic diseases. However, most exercise trials are conducted within a very controlled setting, often lacking what would be deemed a ‘real-world’ feel to them. They also don’t address financial and geographic constraints. Our goal is to provide a more ‘real-world’ exercise experience for Rural adults that lends itself to disease risk reduction and overall health improvement. The purpose of this study is to investigate the efficacy of a technology-driven independent exercise program on health outcomes associated with dementia risk in underactive rural adults. Our goal is to create a safe, effective means of delivering personalized exercise programming to rural adults that reduces barriers to exercise, improves physical fitness and biomarkers associated with dementia risk and lends itself to exercise adherence in a population that is at an increased risk for cognitive decline.

Approach

This is a randomized controlled exercise trial. Participants will be recruited from pre-determined rural locations across Kansas. Recruitment will be conducted via radio, newspaper, traditional recruitment flyers at specific locations and other methods as deemed necessary. Underactive adults (n=50), ages 40-70 years, from federally designated rural and frontier Kansas counties will be recruited to participate in this study. Middle aged adults will be included in the study as they are at an age when successful behavior change is more probable (than older, institutionalized adults); older adults will be included as they are in the high-risk category for dementia. The inclusionary and exclusionary criteria for participation is detailed in Table 1.

Table 1. Inclusion and Exclusion Criteria	
Inclusion criteria	- Age 40 to 70 years - Characterized as underactive by the TAPA. - Able to read and converse in English - Willing and able to install an application on their smart phone (with assistance)
Exclusion criteria	-Myocardial infarction or symptoms of coronary artery disease in the last 2yrs -Uncontrolled hypertension within the last 6 months -Cancer in the last 2yrs (except non-metastatic basal or squamous cell carcinoma) -Significant pain or musculoskeletal disorder that would prohibit participation in an exercise program -Possible/probably dementia or mild cognitive impairment (MCI) base on adjudication -Physician concern regarding safety or completion of the study

Potential participants will be screened using the TAPA (1). Following screening, participants will complete baseline physical fitness and health assessments, supervised by the research team. This will require travel by the research team to various rural Kansas locations. The assessments will be those considered reliable, validated 'field tests' and can be easily administered with minimal exercise equipment. Blood glucose and cholesterol levels will be measured as well, using a device commonly used in the field (total, LDL, HDL and triglycerides). Additional baseline assessments may include, but are not limited to: cognitive assessments, quality of life (QOL), perceived stress, and perceived stress. Following completion of baseline assessments, participants will be randomized to one of two groups:

1) Exercise (EX); This group will be given structured exercise programming for 16 weeks.
2) Control (CON); This group will serve as the underactive control for this study. At the end of 16 weeks, they will be offered the same 16-week structured exercise program as the exercise group.

A personal training/fitness app will be installed on each participant's smart phone or tablet. The application used will be a highly-rated, commonly used fitness app and will be used in this study to design and deliver exercise programming and track exercise participation, adherence and progression over the course of the study. The study team will record exercise instruction videos that can be accessed by all participants at any time throughout the study. The particular app used will allow the research team to organize exercise videos into structured training sessions, allowing participants to exercise on their own, at the location of their choice, with ample instruction. The app will also allow participants to record themselves performing various exercises and send them to the research team for analysis of technique and safety. Communication between study personnel and participants will be delivered via the app. Phone calls and/or Zoom sessions will be offered as an alternative if necessary. During the initial project period (16 weeks), only the EX group will be given access to the structured exercise plan.

Exercise Intervention

The exercise intervention will consist of 3-5 exercise evidence-based exercise sessions weekly for a total of 16 weeks. The target goal for all participants will be 75-150 minutes of aerobic exercise and 2-3 strength training sessions weekly. Exercise will be progressive in nature and participants will be encouraged to achieve the target goal for exercise by week 8 of the study and maintain the target goal for weeks 8-16. All prescribed exercise will follow national governing body recommendations and include specific exercises found in previous work to be beneficial for physical health and brain plasticity. Following the exercise intervention, all baseline assessments will be repeated. Data will be compared to determine the impact of the exercise program on each variable (i.e. dementia risk biomarkers, QOL, physical fitness, etc.).

Data Analysis

Data collected from this study will be analyzed using statistical analysis software (SPSS) to determine differences, if any, between groups for each measure. We plan to collaborate with a qualitative statistician who will assist with the qualitative statistical analyses.

Outcomes

Findings from this study will be presented at a state or regional conference, in addition to the K-INBRE Annual Symposium. The undergraduate research assistants and faculty mentor will work collaboratively to submit at least one manuscript for publication. Data from this study will be considered pilot data and used to apply for an R15/R16 award to further investigate effective means of exercise delivery for underserved and at-risk populations across Kansas and beyond.

Alternative Strategies

There is the possibility that some older adults will not have access to a smart phone or feel comfortable using the fitness app on their phone or tablet. In this case, printed materials and exercise logs will be provided to these participants. All videos recorded will also be kept on a Google drive and the link to that drive will be offered to those participants. While data from these participants would not be relevant to the efficacy of technology-driven exercise delivery, it would be relevant to unsupervised exercise from afar. This would still provide valuable information about exercise adherence, motivation and associated physiological adaptations.

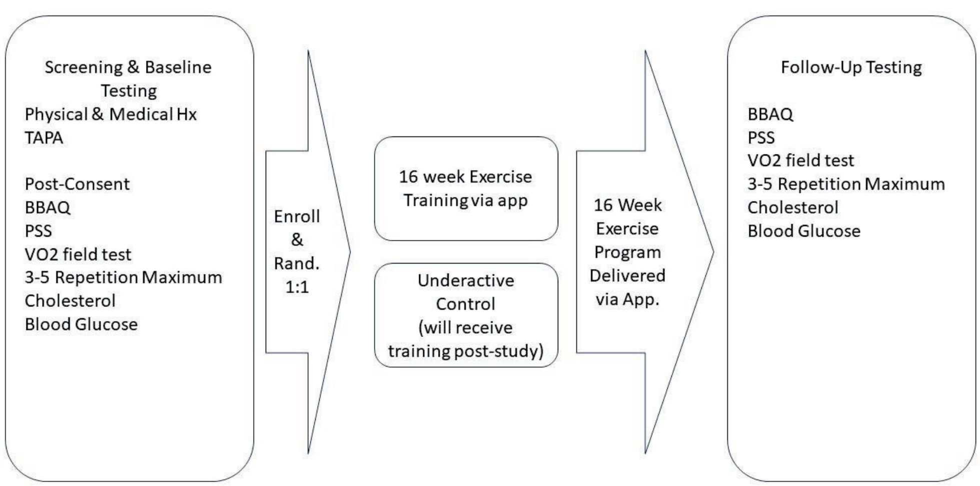
Timeline

A detailed study timeline is presented in Figure 1.

STUDENT MENTORING

The undergraduate research assistants (UGRAs) and PI (faculty mentor) will meet weekly throughout the course of the entirety of this project (SU24-SP25). In addition, the PI will supervise all program design, exercise video creation and dissemination. The UGRAs will be allowed more independence as their skills and confidence increase throughout the study period. As the students become increasingly competent using the fitness app and communicating with participants, they will gain greater responsibility and independence. Exercise program design and progression will continue to be overseen by the PI, with ample input from the UGRAs. This project will be a truly collaborative effort and provide great professional development and skill development opportunities for the UGRAs. UGRAs will be responsible for assisting in the data analysis and manuscript writing following completion of the study.

Figure 1. Study timeline.



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