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Effect of Exercise on Blood Pressure and Body Mass Index in At-Risk Populations

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Author Note

This paper is in partial fulfillment of maintaining Honors status in the Williams Honors College and School of Nursing.

Abstract

Higher blood pressure and basal metabolic rate (BMI) are health problems in the United States (U.S.), but particularly in high risk minority populations, in part because of limited access to adequate resources to help themselves become healthier. This Honors Paper aimed to examine the effect of an exercise intervention on blood pressure and BMI in high risk minority populations. The honors project is a part of the Finding A Better You (FABU) project by College of Health Profession faculty Dr. Murrock, Dr. MacCracken, and Dr. Juvancic-Heltzel. The FABU project assessed at risk individuals (lower income older adults) in Summit County and determined the outcomes of intervention classes about proper exercise and nutrition. Using a non-experimental design and convenience sampling, this honors project was guided by Bandura's Social Cognition Theory, which describes behavior change in group settings. The project initially aimed to generate preliminary findings about whether or not exercise affects blood pressure and BMI in at risk populations. However, the coronavirus disrupted the delivery of the intervention and resulted in revising the research question to examine the effect of exercise classes over 12 weeks on blood pressure and BMI in a sample of minority adults.

Keywords: Exercise, blood pressure, body mass index, BMI, vulnerable populations, at-risk, minority

In minority populations, there is often an increased risk of developing cardiovascular disease and type 2 diabetes (Osei & Gaillard, 2017). The term cardiovascular disease describes various conditions that impact the heart, such as coronary artery disease, arrhythmias, cardiomyopathy, and valvular disease. High blood pressure, or hypertension, is a leading cause of heart disease, which then may cause heart failure, myocardial infarction, stroke, and chronic kidney disease (Fuchs & Whelton, 2019). According to The Centers for Disease Control and Prevention (CDC, 2019), non-Hispanic black adults aged 20 and over were most likely to have hypertension in 2015-2016, compared with the rest of the population, with a prevalence of 42.1%. Overall, nearly 50% of Americans have heart or blood vessel disease. Type 2 diabetes occurs when the cells of the body resist the normal effects of insulin, resulting in uncontrolled blood glucose levels. Uncontrolled diabetes may lead to macrovascular complications, such as coronary artery disease and stroke; microvascular complications, such as neuropathy and retinopathy; and chronic kidney disease (Cannon et al, 2018). According to the CDC (2019), Hispanic and non-Hispanic black adults aged 20 and over were most likely to have diabetes in 2015-2016, compared with the larger population, with respective prevalence rates of 21.5% and 19.6%. Approximately 10% of Americans have a diagnosis of Type 2 diabetes.

Exercise and nutrition are two factors known to increase positive outcomes in patients with heart disease and diabetes. Okura et al. (2012) examined the effects of diet and exercise on risks of coronary heart disease and found that aerobic exercise and diet reduced low density lipoprotein, cholesterol, and fasting glucose in a group of ninety obese women. The results showed that high intensity exercise coupled with a nutrition program were effective in reducing the risk of coronary heart disease. In this honors research project, the variables of blood pressure

and body mass index were chosen because they are risk factors associated with heart disease and diabetes. Being overweight is a risk factor for type 2 diabetes (Mayo Clinic, 2018), and high blood pressure is a major risk factor for heart disease (CDC, 2019). Thus, this honors research team focused on two major risk factors for both diseases, which can be measured by blood pressure and body mass index.

This honors research project was a small arm of the “Finding a Better U!” (FABU) project, organized by College of Health Professions faculty Dr. Carolyn J. Murrock and others, which aimed to examine the effect of nutrition education along with exercise intervention on risk factors associated with heart disease and type 2 diabetes. In the larger study, nutrition education classes were held one day per week, and exercise classes were held on a separate day per week. The clinical measures of risk factors were identified as weight, blood pressure, body mass index, waist circumference, cholesterol, and A1C. Physical activity was measured using the Godin Leisure-Time Exercise Questionnaire (GLETQ), diabetes awareness was measured using the Risk Perception Survey for Developing Diabetes survey (RPS-DD), and nutrition knowledge was measured using the Nutrition Literacy Assessment Instrument (NLit). The purpose of this honors research project was to specifically examine the effects of exercise on blood pressure and body mass index in vulnerable populations. The project used a one-group, pretest/posttest design for each outcome measure and analyzed quarterly data from the larger study. The sample was subjects from eight apartment complexes located in an urban setting in a Midwest state in the United States. The following research questions were initially advanced:

1. In a minority sample, what is the effect of a weekly exercise intervention on blood pressure over a period of 3 months?

2. In a minority sample, what is the effect of weekly exercise intervention on body mass index over a period of three months?

This honors project aimed to examine the effects of an exercise intervention on blood pressure and BMI in high risk minority populations. Higher blood pressure and body mass index (BMI) are health problems in the United States (U.S.), but particularly in minority populations because of limited access to adequate resources to help themselves become healthier. This project is important to nursing because the leading cause of death in the United States is heart disease.

Integrated Review of Literature

Ten studies are described in this integrated review of the literature. Researchers of the studies used several different designs and methods: quasi experimental, nonexperimental and 2-group comparisons, meta-analysis, retrospective data collection, secondary data analysis, as well as cross-sectional and longitudinal data collection. Data were collected using surveys, observation, and questionnaires. Main variables included independent variables of exercise and dependent/outcomes variables of body mass index (BMI) and blood pressure (BP). Samples included 45 overweight or obese adults (Westcott et al., 2019), 25 healthy male individuals (Goeder et al., 2019), 146 individuals with intellectual disability (Walsh et al., 2018), 61 women and 34 men living in nursing homes (Kortajarena et al., 2019), 2,585 youth ages 8-18 (Betz et al., 2018), 1,223 children age 9 (MacDonald-Wallis et al., 2017), and 4,832 minority women (LaMonte et al., 2017), to name a few. The Jackson et al (2019) study included a sample of African-American adolescents.

Not all studies were done in the U.S. For example, Walsh et al. (2018) conducted their study in Ireland, McGeechan et al., (2018) and Macdonalds-Wallis et al., (2017) performed their

studies in the UK, and Kortajaren et al. (2019) performed their study in Spain. Westcott et al. (2019) completed their study in the United States. The sites varied across the studies and included Dublin City University, Ireland (Walsh et al., 2018), a primary school in Bristol, UK (Macdonald-Wallis et al., 2017), and a college fitness research facility (Westcott et al., 2019). Betz et al. (2018) used cross-sectional data from 2003-2006 National Health and Nutrition Examination Survey.

Intervention intervals differed from study to study as well. Walsh et al., (2018) conducted an exercise-only intervention. Interventions by Westcott et al. (2019) included twice monthly nutrition lectures and Monday-Wednesday or Tuesday-Thursday aerobic activity sessions for 40 minutes each. McGeechan et al. (2018) did not describe the specific interventions, but noted that all participants took part in a “structured exercise program”. Some researchers did pre and post data collection, whereas others did not, such as Walsh et al. (2018), who did only post data collection. Westcott et al. (2019) collected pre and post data over a six month period, similar with McGeechan et al. (2018) who performed a 6-month follow up on all participants in their study. Thus, as stated above, the intervention intervals differed with each study.

Overall, the results consistently indicated that exercise has a positive effect on hypertension (Kelley & Kelley, 2018; Westcott et al, 2019) and BMI (Kortajaren et al, 2019; McGeechan et al, 2018; Westcott et al, 2019), regardless of varied samples, as mentioned above. For example Kelly and Kelly (2018) found that when participants were a part of regular aerobic exercise and resistance training, statistically significant decreases in the resting systolic and diastolic blood pressure were found. Kortajaren et al., (2019) found that regular physical activity decreased BMI in both men and women participating in the study, although men had more significant decreases in BMI than women did. McGeechan et al., (2018) found that there were

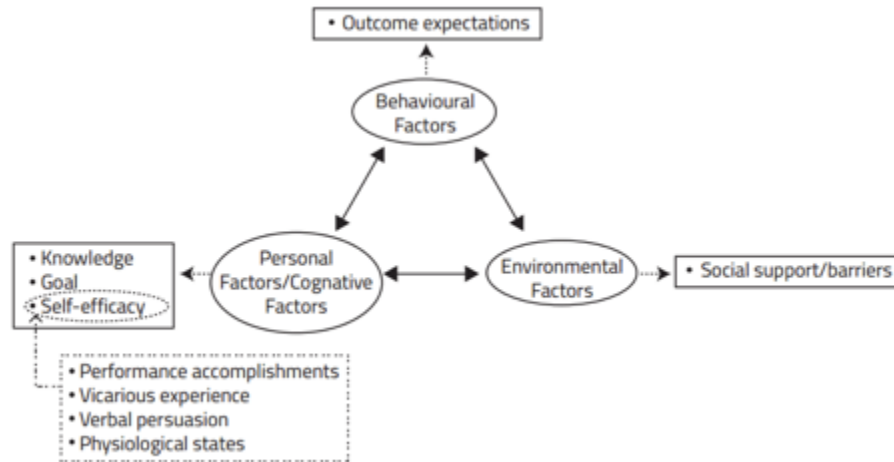
significant decreases in BMI at the end of their 12 week study, but in a follow up assessment 6 months after the end of the study, there were increases in BMI. Therefore, BMI decreases were not sustained. Westcott et al., (2019) found that regular aerobic exercise, when paired with appropriate nutrition, was successful in reducing both BMI and resting systolic blood pressure in adults. A few of the researchers had inconsistent findings (Macdonald-Wallis et al, 2017; Walsh et al, 2018). For example, Macdonald-Wallis et al (2017) found no significant changes in BMI or blood pressure when in children, studied at ages 6 and 9, regardless of how much exercise they reported. Walsh et al (2018) also found that there were no significant differences in BMI in adults aged 18-65 regardless of what level of physical activity was reported.

A common limitation across studies was smaller samples, and this can indicate that the results may not be statistically significant or accurate. For example, Kortajaren et al. (2019) stated that their sample size was limited due to budget constraints, but their findings were consistent with those of other studies. Walsh et al. (2018) cited that their limited sample size was due to issues during recruitment and a lack of volunteers. Kelley and Kelley (2018) listed a number of different limitations, several due to the design of the study and specifically a limitation called “Simpson’s Paradox”, where the relationship between two variables changes as one is manipulated. This means that when there are two variables that are being tested in a study, these variables are related in some way, as when one variable is manipulated the other will change with it regardless of what is being tested. This can skew the results of a study, because the changes that are observed in the second variable may be seen as a result of the experiment, when they are actually just the natural relationship response of the variables.

Theoretical Framework

The theoretical framework for this project was the Social Cognitive Theory (SCT, see Figure 1) developed by Albert Bandura (LaMorte 2019). The basic proposition of this theory is that learning, and particularly behavioral learning, is influenced by the social context surrounding the learner. The SCT focuses strongly on maintenance of learned behaviors.

Figure 1. Social Cognitive Theory: Factors Affecting Outcomes



The SCT focuses strongly on maintenance of learned behaviors, not just their initiation. The theory proposes that a person's unique set of learned experiences and skills are molded and shaped according to their environment and the way that they are perceived in the world. Also, the theory proposes that people may learn by studying and imitating what they see in others, and that their learning and self-efficacy can be altered based upon the expectations of others, verbal persuasion, vicarious experience, and performance. Imitating behaviors, otherwise known as modeling, is a way that people learn by copying what they see others do. Verbal persuasion is a

factor through which people learn by listening to the feedback and criticism of others, and vicarious experiences are when people learn by hearing or seeing the experiences of others. The theory has several limitations, and this is because everyone's learning is different based on their unique, personal experiences; therefore, it is difficult to determine the extent of the effects of social context.

This theory was relevant to this project because participants in the FABU study attended a weekly group, exercise classes, and the honors research team examined the effect of their exercise on BMI and blood pressure. According to the SCT, the honors project team anticipated that these participants who took classes and exercised together should have different outcomes compared with those who did not participate in classes or exercise. This could be observed in the physiological markers of BMI and blood pressure, as well as in the participants' habits and behaviors that they may develop and maintain outside of the study. One limitation of the FABU project is that data were not collected regarding the exercise habits of participants before the study, so it may be difficult to determine the exact effects that participation in the exercise classes have on these habits.

Methods

There was much work to be undertaken in this project. First, the honors team did an extensive search of background studies and a review of the literature on exercise and its effect on both BMI and blood pressure in vulnerable populations. After identifying a theoretical framework, they identified research methods.

Design

Originally, the honors project intended to use a nonexperimental design because the honors research team did not plan to conduct the exercise intervention, but would be collecting and using data from the larger study to analyze intervention effects on BP and BMI. The honors research team aimed to analyze data from the larger project to generate preliminary findings. When all of the honors project findings were interpreted, then the honors research team planned to discuss findings about how exercise affected both BMI and blood pressure in the sample of at-risk, minority populations. The FABU project obtained university IRB approval, and the members of this honors research project were listed as a part of the FABU project.

Site and Sample

This project focused on a vulnerable population of African Americans living in subsidized housing to increase understanding about intervention effects in this population and how FABU can add to the body of scientific nursing knowledge. FABU was conducted in several Metropolitan House Authority (AMHA) sites and Alpha Phi Alpha Homes, both are subsidized housing complexes in a Midwestern state. Subjects in the FABU project had to meet the following inclusion criteria: they must be over 18 years of age, they must be living in the five AMHA housing complexes or in the three Alpha Phi Alpha homes, and they must provide a signed medical waiver from their healthcare provider stating that they are able to engage in exercise programs. Exclusion criteria included: uncontrolled diabetes with an A1c of greater than 10%, unstable angina, uncontrolled hypertension, or a history of mental instability.

Sampling and Recruitment

The FABU study recruited subjects by placing information on flyers in the community rooms of the five AMHA housing complexes and the three Alpha Phi Alpha Homes as well as in the monthly newsletters at each site. Subjects were then enrolled in a private face-to-face meeting with a member of the FABU research team. In this meeting, the study was explained to the potential subject and the potential subject's questions were answered. Subjects were also informed that they were able to withdraw from the study at any time without penalty. Then, once the study was explained and all questions were collected, the team member obtained informed consent (see Appendix for consent form).

Data Collection

The honors research team partnered with the FABU team, which is funded by the Ohio Commission on Minority Health, a state funded interprofessional intervention research project to collect data. Data collection began in January 2020 and included measures of height, weight, BMI, blood pressure, and waist circumference. Data collection of A1c and cholesterol began in March 2020. Blood pressure was measured manually on the participant's left arm, unless there is a contraindication such as a left mastectomy. The participants were seated for five minutes prior to blood pressure being taken. Height was measured with a height rod attached to the scales used to measure body weight. Participants who were in a wheelchair and unable to stand on a scale or be measured for their height self-reported both height and weight. Subjects were assigned an identifying number so within-subject data could be compared.

The data used by this honors project was stored by the FABU team in secured on-campus locations and in password-protected computers. Data files were stored separately from a master

file describing the assignment of a number for each participant. Only the FABU research team had access to the data, and all data will be destroyed according to IRB regulations.

Measures

Blood pressure for participants was originally recorded via a self-report questionnaire, and reassessed quarterly with a manual blood pressure assessment (using a stethoscope and sphygmomanometer). Body mass index was measured by dividing weight in kilograms by height in meters squared (kg/m^2). Height and weight for participants was originally recorded via a self-report questionnaire, and weight was reassessed by weighing the participants quarterly while in their street clothes on and with their shoes off. Height was measured with a height rod attached to the scales used to measure body weight. All of these measurements were recorded and analyzed using a ratio variable measure.

Data Analysis Plan

Data were imported into a data analysis software program by a FABU research team member with outliers and missing data will be identified and addressed. Descriptive statistics were used to describe the sample, and inferential statistics were used to answer the research questions. Level of statistical significance was set at $p < .05$. The initial research questions were:

1. In a minority sample, what is the effect of a weekly exercise intervention on blood pressure over a period of 3 months?
2. In a minority sample, what is the effect of weekly exercise intervention on body mass index over a period of three months?

The statistical test that will be used to answer the above questions was a paired t-test. There was no comparison of groups, there is only a comparison of the subject data to previous subject data. Data for one subject was not compared with data from the rest of the group.

Results

Due to COVID-19, FABU and Honors researchers were unable to be onsite until further notice. The study was closed out due to Governor Mike DeWine's stay-at-home order. At that time it was not known when the intervention and data collection would resume. Therefore, no summer data collection occurred and only March 2020 baseline data was available for analysis. As a result, the research question was revised to be:

1. What is the effect of exercise classes over 12 weeks on blood pressure in a sample of minority adults?
2. What is the effect of exercise classes over 12 weeks on BMI in a sample of minority adults?

Both questions were answered using paired (dependent) t-tests to compare within the group (same subject at two different points).

Sample

The Honors researchers used data from a sample of 21 adults, although only 11 of the 21 submitted complete data to calculate BMI. Changes in the FABU faculty research team resulted in barriers to getting demographic data for this small subsample. Therefore, the FABU sample (N=54) is described in this Honors paper. Approximately 32% (n=16) of the sample was African American and 6% was White (n=6) with the remaining 57% (n=31) not reporting race. Approximately 91% (n=40) of the sample was female. Approximately 45% (n=24) reported non-Hispanic as ethnicity with the remaining preferring not to report. Regarding age, 30% (n=16)

were 65-75 years, 11% (n=6) were 55-64 years, 6% (n=3) were older than 75 years.

Approximately 17% (n=9) reported annual household incomes of less than \$9,000, less than 1% (n=4) reported annual household incomes of \$10,000-\$14,999, and remaining preferred not to say. Twenty-six percent (n=14) reported having public health insurance, with the remaining preferring not to say. Unfortunately, there is no way to compare the sample of 54 to the subsample in this Honors project analysis.

Findings

The first question was: What is the effect of exercise classes over 12 weeks on blood pressure in a sample of minority adults? For the subsample of 21, Quarter 2 baseline mean systolic blood pressure was 127 (SD 13.93). Quarter 3 baseline mean systolic blood pressure was 126.10 (SD 15.14). The paired t-test was used to determine mean difference, showing no significant difference in systolic blood pressure ($p = .68$). Further analysis showed no significant difference between Quarter 2 and 3 baseline mean diastolic blood pressure values either.

Therefore, there was no significant effect of exercise classes over 12 weeks on systolic BP $t(20) = .42, p = .68$. The blue indicates the degrees of freedom, which is the sample size -1. So 21-1=20. The yellow is the t value and the green is the p value, which determines significance. (C. Murrock, personal communication, August 10, 2020).

The second research question was: What is the effect of exercise classes over 12 weeks on BMI in a sample of minority adults? BMI data were available for a subsample of 11. Quarter 2 baseline mean BMI was 31.86 (SD 8.90), and Quarter 3 baseline mean BMI was 29.18 (SD 8.44). The paired t-test was used to determine mean difference, showing no significant difference in BMI ($p = .068$). Therefore, there was no significant effect of exercise classes over 12 weeks on BMI $t(10) = 2.07, p = .065$. The blue indicates the degrees of freedom, which is the

sample size -1. So $21-1=20$. The yellow is the t value and the green is the p value, which determines significance (C. Murrock, personal communication, August 10, 2020).

Discussion

Unfortunately due to the restrictions from COVID-19, the Honors Research Team was unable to collect information from the summer quarter, but the second and third quarters showed little significant change in either blood pressure or BMI. This could imply that regular exercise has little to no effect on the blood pressure and BMI in minority populations, or these results could have been affected by the COVID-19 pandemic and the shut-down in social interactions. Further, it is possible that exercise in this population needs to occur for a longer period of time for it to have an effect on blood pressure and BMI. It is also possible that exercise alone does not affect blood pressure and BMI in this population with diet also affecting these outcomes. The findings were not consistent with studies conducted by Kelley and Kelley (2018), Wescott et al., (2019), McGeechan et al., (2018) and Kortajaren et al., (2019), as all of those studies found evidence that regular exercise does have a significant impact on BMI and blood pressure. However, the findings of the Honors Research Team were consistent with studies by Macdonald-Wallis et al., (2017) and Walsh et al., (2018), who found that regular exercise had no significant impact on blood pressure or BMI. It is difficult to say what our findings mean regarding the Social Cognitive Theory since the COVID-19 restrictions may have limited participants in their options for exercising and being with others for the group learning, and this could have influenced the results of the study.

Internal validity is defined as the extent to which a study establishes a trustworthy cause and effect relationship between a treatment and outcome in the population studied. One factor that can jeopardize internal validity is the threat of history. This means that an event unrelated to

the study itself influences the results, as the COVID-19 pandemic influenced this study. Due to the governor's stay-at-home order, participants were not able to attend previously scheduled classes, participate in group exercise, and provide data past March of 2020. Therefore, the delivery of the intervention was interrupted, and the duration of data collection was decreased, threatening the internal validity of the study.

Conclusion

This project examined the effect of exercise on blood pressure and BMI in a vulnerable population, aiming initially to determine the effect of 3 months of exercise. Due to the coronavirus and the abrupt ending of intervention delivery, the Honors Research Team had to use baseline data and data collected at 12 weeks. In the sample studied by the Honors Research Team, exercise had no effect on blood pressure and BMI in the sample. The internal validity threat of history forced the ending of the intervention and study.

Limitations

There were limitations to the scope of the honors project. First, the Honors Research Team was limited to one of the ten sites where FABU was conducting the larger study, making this a single site study rather than a multi-site study. A second limitation was the small sample which may have affected the statistical conclusion validity. Further, self-report data for weight and height may have affected the validity of variables measures. Finally, the intervention delivery was disrupted due to the coronavirus and the Honors Research Team was not able to collect data during summer 2020, shortening the duration of intervention delivery and preventing longer-term examination of intervention effect. Due to the coronavirus, the FABU study was put on hold and the Ohio Commission did not allow FABU to resume by June 2020.

Implications for Practice and Research

In conclusion, the previous studies noted show that this population is at a high risk of health disparities such as hypertension and overweight. This high risk of health problems leads to an increased need for interventions such as balanced diet and exercise. Unfortunately, due to the COVID-19 pandemic, the ability of the Honors Research Team to assess and interpret the research findings was limited. In addition to the decrease in participation due to the COVID-19 pandemic, there may be lasting impacts from reluctance to participate in such studies. Future researchers dealing with these kinds of issues may want to prepare contingency plans in the event that similar problems arise.

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Appendix

FABU Project Consent form



Informed Consent for Participation in FABU

Title of Study: Finding A Better U (FABU)

Introduction: You are invited to participate in a research project being conducted by Carolyn J. Murrock, PhD, RN, Mary Jo MacCracken, PhD, and Judith A. Juvancic-Heltzel, PhD, faculty from the College of Health Professions in the School of Nursing and School of Sport Science and Wellness at The University of Akron.

Purpose: The purpose of the FABU project is to show that culturally competent exercise and nutrition programs can reduce risk factors for heart disease and diabetes in minority populations.

Procedures: The FABU project will consist of culturally competent exercise and nutrition education programs at two times per week for 8 weeks over 2 years, meaning that this study is a 2-year commitment. The exercise programs will be one day a week and nutrition programs another day the same week. A list of weekly activities for both exercise and nutrition classes has been included at the end of this consent form. The exercise classes will consist of line dancing, chair exercises, low-impact aerobics that will include a 5-minute warm-up, 30-minutes of exercise, and 10-minute cool-down. For those with physical limitations, such as pain, arthritis, or hip/knee discomfort, the exercise routines will be modified. For those in a wheelchair, exercise routines will be accommodated for sitting, including non-weight bearing lower leg movements, upper body movements, clapping, etc. For the nutrition classes, they will consist of nutrition information about reducing risk factors for heart disease, diabetes, obesity, and blood sugar management. Cooking demonstrations will also be part of the nutrition education classes and will also be held in the community room. Food for the cooking demonstrations will be prepared following sanitation guidelines of handwashing, clean utensils, and proper disposal of food waste products. Exercise and nutrition classes will be held in the community room that is large enough to accommodate group activities and has been inspected and approved by local governing boards for safety and sanitation.

Prior to participating in the study, you must provide a written medical clearance waiver from your healthcare provider to ensure you are safely able to participate in the exercise classes. If not able to provide written medical clearance from your healthcare provider, you will not be able to participate in the study. A member of the research team will give you the medical clearance waiver. After you have provided a written medical clearance waiver from your health care provider, you will meet with the research team members for data collection: (1) at the beginning of the study for weight, height, blood pressure (BP), body mass index (BMI), waist circumference, cholesterol, and hemoglobin A1c, physical activity levels, diabetes and nutrition awareness questionnaires, (2) quarterly for weight, height, BP, BMI, waist circumference, cholesterol and hemoglobin A1c, (3) and quarterly for physical activity levels, diabetes and nutrition awareness questionnaires. Attendance for all exercise and nutrition classes will be recorded.

All data collection throughout the study will occur in a private area of the community room. For the first data collection time point at the beginning of the study, you will complete paper and pencil questionnaires about: demographic information, medical history, physical activity levels, diabetes and nutrition awareness questionnaires. We will also collect your weight, height, BP, BMI, waist circumference, cholesterol and hemoglobin A1c. Your weight will be collected in light street clothes without shoes. If you are in a wheelchair and unable to stand safely on a scale, you will self-report your weight. Your cholesterol and hemoglobin A1c levels will be obtained via a fingerprick using a sterile fingerprick disposable lancet and will be disposed of.

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according to sanitation guidelines, in a sharps container. The cholesterol will take approximately 5-6 minutes and the hemoglobin A1c will take approximately 2-3 minutes. For all quarterly data collections, we will measure your weight, height, BP, BMI, waist circumference, cholesterol and hemoglobin A1c using the same procedures. In addition, we will measure physical activity levels, diabetes and nutrition awareness via questionnaires quarterly. By consenting to be in the study, you must participate in all data collection activities, including the fingerpricks for cholesterol and A1c levels. If you don't want your fingerpricked, then you cannot participate in the study. By signing this consent form, you agree that the research team members and the University of Akron are not responsible for any adverse events or other types of injuries.

Inclusion: (1) 35 years and older, (3) ability to read and write English, and (4) provide a written medical clearance waiver from your healthcare providers.

Exclusion: Exclusion criteria are: (1) unstable chronic health conditions (unstable angina, uncontrolled hypertension, etc.), (2) foot ulcers, (3) refusing to have a fingerprick during data collection, and (4) not able to provide a written medical clearance waiver from your healthcare provider.

Risks and Discomforts: For exercise classes, you will be informed of the potential risk of injury such as muscle strains, sprains, and other musculoskeletal injuries associated with exercising. Members of the research team and the exercise instructors are trained in first aid and will carry cell phones for immediate access to 911. Every effort will be made to reduce the risk for injury by incorporating a warm-up and cool-down segment in each exercise class as well as modifications when indicated. In addition, the participants will be encouraged to report any injury to the co-investigators who will record it on a safety-monitoring sheet and follow up to assure that the participants get medical treatment if needed. The data monitoring sheets will be reviewed on a regular basis. All adverse events will be immediately reported to the IRB. If other concerns or problems are noted, they also will be reported to the IRB according to policy. For nutrition classes, participants will be informed of any potential food allergens and participants will be asked to identify any food allergies at the beginning of class. Nut and wheat products will not be part of any cooking demonstrations. As a safety precaution, the food and products to be used for the cooking demonstrations will be posted and reviewed at the beginning of the class. If an adverse event is noted, research team members and the dietitian will carry cell phones for immediate access to 911. All adverse events will be immediately reported to the IRB. Research team members and the University of Akron are not responsible for any adverse events or other types of injuries.

Benefits: A possible benefit of attending the exercise and nutrition classes is to reduce risk factors for heart disease and diabetes. Exercising and healthy eating may also help manage chronic health conditions, such as diabetes, high blood pressure, and assist with weight management. You may also receive no direct benefit from your participation in this study, but your participation may give health professionals and others a better understanding of how exercise and nutrition influence heart disease, diabetes, obesity, and high blood pressure in older adults.

Payments to Participants: There is no direct financial reimbursement for participating in this study.

Right to refuse or withdraw: Participation in this study is voluntary and each person has the right to withdraw without any penalty at any time throughout the study. The decision to withdraw will not influence the quantity or quality of services you receive.

Anonymous and Confidential Data Collection: Data collection forms will be identified by sequential participant research numbers and no names will appear on the data collection forms. An index of participants' names and research identification numbers will be written in a log that will be kept in a locked file in Dr. Murrock's office. All data will remain confidential and will be kept in a locked file separate from the written log in Dr. Murrock's office. Only members of the research team will have access to the data and the log. Your signed consent form will be kept separate from your data, and nobody will be able to link your responses to you. Participants will not be individually identified in any publication or presentation of the research results. Only aggregate data will be used. At completion of the study, the log linking the participant's name and corresponding sequential number will be destroyed according to The University of Akron's policy.

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Confidentiality of records: The data files will be kept in a locked file cabinet in Dr. Murrock's research office. Only members of the research team will have access to this information and only Dr. Murrock will have the key to the locked file cabinet.

Who to contact with questions: If you have any questions about this study, you may call Carolyn J. Murrock, PhD, RN, at 330-972-8077 or Mary Jo MacCracken, PhD, at 330-972 6485. This project has been reviewed and approved by The University of Akron Institutional Review Board. If you have any questions about your rights as a research participant, you may call the IRB at (330) 972-7666.

Acceptance & signature: Your signature below means that you have read or been read the information regarding this study and have had an opportunity to ask questions and have them answered. Your signature also means that you have been told the requirements of the study and voluntarily consent to participate in it. Your consent is effective from this date to the end of the study unless you withdraw this consent earlier. If you want a signed copy of this consent, please ask and you will receive a copy.

I have read the information provided above and all of my questions have been answered. I voluntarily agree to participate in this study. I will receive a copy of this consent form for my information.

Participant Signature

Date

Consent for pictures: We are asking for your permission to take pictures during the exercise and nutrition classes. You may request a copy of the pictures. Your name will not be on the pictures and only the research team will be allowed to use it. The pictures will only be used when we present the study results at professional conferences to show that the exercise and nutrition classes were fun, enjoyable, and easy to do. If you agree to have your picture taken, please sign on the line provided below. If you do not want your picture taken, do not sign on the line below. You can still participate in the study even if you don't want your picture taken. Photos will be stored in a locked cabinet and identity protected in the same manner as the research data. All photographs will be destroyed according to the policy at the University of Akron.

Participant Signature

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