

**Strength and Agility with Brynn:  
A Senior Fitness Research Project**

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### **Abstract:**

Senior fitness is a vital component to examine within a community to assess the physical health of the older generations. Awareness of physical health is increasingly important as we age; furthermore, fitness levels will typically decline with age. To test senior citizens' physical fitness, a fitness-test-based group class was implemented at The Worthington Independent Living Center. A total of 10 weeks of fitness classes were implemented in which fitness-test data was collected. During the first three weeks class was held once a week, then during the last seven weeks class was held twice a week. The first three weeks of class consisted of solely subjective survey data. The objective survey for new participants asked medical health history questions and current fitness levels of each participant. For the next 10 weeks an existing participant survey was given once every two weeks. For this survey the seniors self-analyzed their improvement in six specific physical health factors since coming to class, balance, upper body strength, lower body strength, ability to stand from a chair, flexibility and ease of walking up stairs. During the last seven weeks of class objective data was collected. This included the numerical values from each participant's performance on the national fitness tests. Each class consisted of the same six fitness-battery tests geared towards seniors and acts of daily living (ADLs). These tests assessed lower and upper body strength, lower and upper body flexibility, endurance, and agility. In respective order the class was set up with a chair sit to stand test, an 8-foot agility get up and go test, chair sit and reach, 2-minute step test, bicep curl test, and finally a back scratch test. After data collection, the average values from the fitness tests of participants at The Worthington Independent Living Center were compared to the national normative values for seniors. Participant's average values were separated by age and sex. We found that both age groups and sexes of seniors at The Worthington were above the national average for upper and lower body strength, and endurance. The 85-94 age group in both sexes was below average for the lower body flexibility test. All groups were below average

for the upper body flexibility test besides women ages 85-94, and all groups for the agility test were below average. Regular participants saw improvements in four out of the six fitness tests over 10 weeks. This project met its goals of increasing fitness levels in senior participants, evaluating how they measure up in comparison with the national normative values, and what areas they can improve in, which would consequently be flexibility and agility.

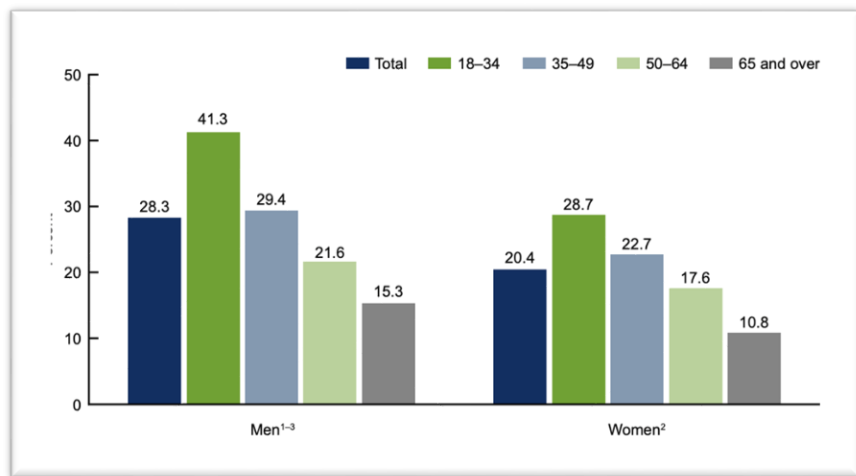
## **Introduction:**

### **I. The Senior Population**

The population of senior citizens has been increasing over recent years. As populations age, many changes will happen; muscle mass decreases, muscle power decreases, and flexibility decreases which can contribute to seniors having a lesser quality of life and longevity. On a global level, projections indicate that the number of elderly individuals will exceed two billion people by 2050, representing 22% of the world's population (Geremia 2015). This increase in population should be accompanied by increased public health attention directed towards the aging populations, this can start on a local level. When it comes to the fitness industry, adult and senior fitness is often overlooked, especially in a college town like Fort Collins, Colorado where the focus can lean towards youth and college athletes. Physical activity is a vital component that directly contributes to seniors' health and enjoyment. Fitness and activity levels decline greatly after age 44 and keep decreasing with later life (Rhoades, 2005). This decline in physical activity levels is demonstrated by a paper in 2020 that assessed the percentages of senior citizens (ages 65+) who met the CDC physical activity guidelines for both anaerobic strength and aerobic fitness was 15.3% for men and only 10.8% for women. (Elgaddal et al, 2022). The guidelines for older adults for cardiorespiratory fitness are defined as 150 min (2.5 hours) of moderate aerobic activity a week or 75 minutes of vigorous activity. For aerobic fitness the guidelines are two or more days a week of muscle-strengthening activity at moderate or vigorous intensity involving

all major muscle groups (Liguori et al, 2022). The lowered fitness levels accompanied by the natural changes in the body have significant effects on seniors' functional capacity, increased risk for falls, decreased performance of activities of daily living (ADLs), and a reduced quality of life. Thus, it is vitally important to monitor, examine, and be aware of the fitness levels of elderly populations.

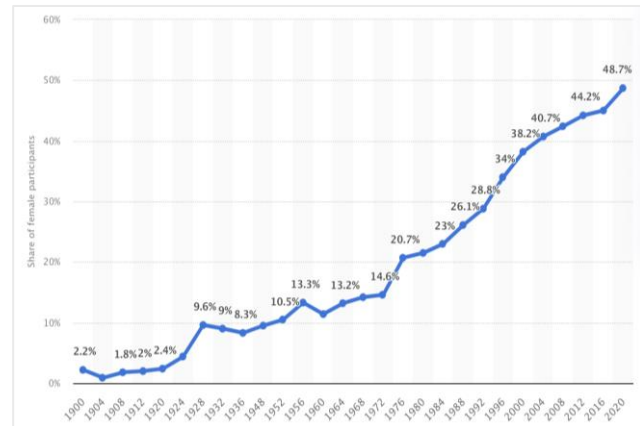
National percentages of adults meeting physical activity guidelines: See age 65+ in gray and each age group before with a larger percentage than age 65+. (Elgaddal et al, 2022)



The decline in physical

activity levels as we age can be due to a wide variety of life factors. These may include a decrease in ease of movement, less knowledge about physical activity, less access to workout facilities, or lack of motivation (Rhoades, 2005). Specifically, less knowledge about physical activity in the older generations can stem from their youth. Health is a field that is always progressing and finding new information. When seniors grew up there was considerably less knowledge about fitness and exercise. Additionally, older generations of women often did not or could not participate in organized sports in their youth. During the 1950's, when many current 80 to 90-year-old women were young, there was little room for women in sports because it was an activity traditionally left for men (Nelson, 2023).

Specifically, female participation in the summer Olympics of 1956 was 13.3%, whereas in 2020 it was 48.7% (Statista Research Department, 2023). (see right) Senior age women did not have a youth that was grounded in organized sports, so it may be more difficult for them to participate in regular exercise later in life.



For all these reasons, many seniors do not have as much background knowledge of physical activity as younger generations do today. Fitness should be supported and made accessible to every age and every gender.

## II. Chronic disease

Another key importance of exercise, especially with respect to older populations, is the immense health benefits. In 2016, 72% total of deaths in the world were caused by a chronic illness (Anderson, 2019). Chronic illnesses can be extremely fatal if untreated, and the risk for developing these diseases increases as we age. Although, the risk for chronic disease declines with any amount of physical activity, this is especially important in older adult populations because they naturally have an age-associated risk of chronic illness (Anderson, 2019). Also, exercise lessens risk and can reduce the effects of an existing chronic disease. A comprehensive study done to examine effects of exercise with cardiovascular disease (CVD) found that exercising “30 minutes per day 5 times a week can greatly reduce effects of existing CVD” (Tian, 2019). It is important to note that exercise can reduce the harmful effects of CVD. In the United States CVD has been the leading cause of death for decades and has dramatically increased in number of deaths since 2011. (Rana, 2021). Cardiovascular disease includes heart disease, hypertension, peripheral arterial disease, stroke, and diseases of the veins, which are all common chronic diseases among senior citizens in the United States. Furthermore, in the United

States in 2016 the adult prevalence of CVD was 48% (Benjamin, 2019). So almost half of adults in the United States have at least one form of cardiovascular disease. Managing and lessening the risk for CVD is vital for quality of life and longevity. One of the goals of this research is to increase fitness levels and physical activity among the senior populations. Increasing fitness levels will help with lessening risk and effects of chronic diseases.

### **III. Group fitness**

This research could have been constructed as a strict research study structure rather than a group fitness class. However, it is primarily a community service project, and the fitness class structure allows for both studying physical activity of seniors at The Worthington and promoting fitness and healthy habits. Having a repeated group fitness class increases the levels of physical activity in seniors more than an intensive single day of data collection. Moreover, the effects of group exercise have repeatedly been tested and there is “value in fitness classes feeling like authentic groups” (Graupensperger, 2019). Group fitness can provide additional community and motivation that individuals like seniors often lack when it comes to exercise. It has also notably been found that the more positive an individuals’ emotional evaluations of group fitness are, the more enjoyment and exertion they experienced, and they improve more from the exercise (Graupensperger, 2019). Group fitness classes have been seen to increase adherence to exercise, enjoyment, and motivation among participants, thus increasing their levels of physical activity, all of which are important factors for this research-based community service project.

### **IV. Fitness tests**

Not only is it important to ensure healthy fitness habits in seniors for their physical health, but also to gain knowledge of how seniors’ fitness levels compare to the general population. Senior fitness battery tests are a prime example of comparative fitness because these tests have been collected into a set national normative averages. Some examples of the tests

include chair sit to stand, bicep curls, 2-minute step test, and the sit and reach test (Langhammer, 2015). The goal of each test is to assess strength, endurance, flexibility, or agility. These tests have been performed extensively, with the national normative values comprising the average results from over 7,000 participants between ages 60-94. They found on average that men performed better in cardiorespiratory exercise, strength, and agility, whereas women only performed better in flexibility (Rikli, 1999). Senior fitness battery tests have been used for decades to assess the fitness of older adults. One study found that when assessing quality of life, physical fitness is a bigger factor for women than for men, indicating that women place more health importance on their fitness level. Moreover, the same study found that after age 50 women focus more on how they are performing on strength and flexibility, whereas men tend to focus on their performance with cardiorespiratory activities (Slawińska, 2018). The recommendation for fitness plans based on this was to focus on older adults' performance in cardiorespiratory fitness, strength, and flexibility. For my honors thesis project I decided to perform a fitness battery test like the ones explained above because there is a need for physical activity awareness in the older adult community. To make the Strength and Agility class research-based my goal was to compare the fitness levels of the class participants at The Worthington Independent Living Center to the national standardized norms. Fitness test data was collected two days a week. These classes consist of six standardized fitness tests. Within this project I aimed to provide an aspect of self-competition to exercise which can hopefully increase the levels and adherence of fitness and physical activity in senior adults in the community. The main goal of this project includes identifying how seniors at The Worthington compare to the national standardized values which will demonstrate which aspects of physical fitness the participants at The Worthington can improve upon versus what they are already proficient in. Additionally, the improvements on fitness tests of the regular participants will be analyzed. Moreover, this data can be used to help

senior homes and independent living centers like The Worthington improve resident fitness. In a broader sense, anyone who works with the adult population in any capacity or has older relatives in need of a fitness plan could benefit from this research. The main goal of the research is to show the participants how they can be more active, what aspects of physical fitness they can improve upon to get to the standardized norms, and what they are already sufficient in.

## **V. Getting Started:**

Some examples of fitness tests that are beneficial for older adults were sit-to-stand, bicep curl burnout, a 2-minute step endurance test, and various flexibility tests (Langhammer, 2015). There are papers that have tested seniors' fitness on these tests and used the results to compute national standardized values of the "normal" set points for each age group. Normative values are crucial for this project because they allow us to test seniors' fitness levels and compare them to these national values to conclude if they are meeting physical fitness parameters based on their age and gender group. I compared the fitness test results from Strength and Agility class to the normative values created by Rikli and Jones in a 1999 paper titled [Functional Fitness Normative Scores for Community-Residing Older Adults, Ages 60-94](#). The residents at The Worthington have an average age of 85, so having groups of normative values for older seniors was crucial for me to be able to analyze the data. The next steps after finding normative data and making the Strength and Agility class plan were obtaining professional liability insurance and writing up waivers for participants to sign. Many months were also spent making and perfecting the subjective surveys; the first survey was based off the form used in Adult Fitness at CSU and on the recommendations in The ACSM Guidelines for Exercise Testing and prescription book written by Liguori and team in 2022. The first part of the subjective survey is a risk assessment of the participants' health and medical history. The second part asked questions related to the frequency, intensity, and duration participants were exercising before starting their first class.

Lastly a follow-up survey was created to see how participants think they are improving, as well as including some open-ended questions for feedback. In all these surveys provided additional subjective data related to participant satisfaction and provided vital background health and exercise information.

### **Methodology:**

The class was set up as a routine of the six exercises chosen from the research. Before the fitness tests we did a warmup for five to ten minutes consisting of dynamic exercises to get the joints warm. This consisted of neck tilts, arm circles, calf raises, and more. Each warmup exercise was performed for 15 to 45 seconds. Next, the following procedures were found and explained in the Senior Fitness Test Manual that Rikli & Jones published in 2013. The order of exercises and some procedures were changed or modified to fit the fitness classes' goals. The first test was a sit to stand. During this test the participants were instructed to stand up from a seat with their arms crossed over their chest, then to sit back down and stand up again while keeping their arms over their chest. If participants needed to, they could use the chair to push off or hold onto a walker. They counted their repetitions for 30 seconds, and the number of repetitions was recorded. All tests were consecutive, and the participants performed the tests all at the same time together except for the flexibility measurements and the 8-foot agility test. During the 8-foot agility test each participant performed the test one at a time while under supervision to make sure everyone was safely monitored. They took turns starting seated in a chair that had a cone eight feet away from it. A timer started as they stood up, walked around the cone and sat back down. Time to complete was recorded. Participants could use a walker if needed. Lower body flexibility was next with the sit and reach test. While seated they were positioned at the front end of the chair, then extended their legs in front of them with toes pointed up. First, they warmed up the stretch with four reaches down to the feet, holding each for

10 to 15 seconds. From here, the distance in inches from the participants fingertips to their toes was measured one at a time. Positive inches indicate that the individual went past their toes. Negative inches indicate that the individual did not reach their toes, thus defining the number of inches they have left to touch their toes. A value of zero inches indicated they are touching their toes. The 2-minute step test was next. Participants were instructed to stand up, they could have one or two hands on a chair or walker if they needed extra support as they stepped repeatedly to mid-thigh height. So, if a line was drawn out midway between the greater trochanter of the femur and the patella that would indicate how high the knee was supposed to reach. They counted their steps, counting each right leg as one step, for two minutes, and then they sat back down, and the number of steps was recorded. The last two tests were upper body focused. For the biceps curl test participants self-selected a dumbbell weight, one in each hand. They started seated with elbows extended and palms forward in anatomical position. A timer went for 30 seconds and participants were instructed to begin curling the weight up by bending their elbows and keeping the elbow joint axis in place and counting how many full range repetitions they could do. A full range repetition is described as from the elbows completely extended at the sides to bent at the top of the curl, and then back to the bottom while keeping the elbow joint in the same position. The participants were allowed to select their own weight; however, they were instructed to be aware that the national data was comprised of women who were lifting five pounds and men who were lifting eight pounds. The number of repetitions were recorded. The final test was a back scratch test. Participants were instructed to have one arm reach up overhead and bend at the elbow, so the palm touches the back, and the other to reach behind the back inferiorly, with the backside of the hand on the back. They were instructed to try to touch their fingers together. Each participant's distance between their middle fingers was measured in inches. Similarly to the sit and reach, fingers touching is recorded as zero inches, overlapping fingers is positive inches,

and not touching fingers is recorded as negative inches. This was the final test that objective data was collected from (Rikli, 2013). If time allowed, we finished off class with some balance tests that were not measured, these were added for extra stability with walking and ADLs so participants could more easily move about and have less risk of falling. For balance we did 30 seconds side to side standing, 30 second tandem and 30 seconds with one foot propped up in a kickstand fashion for each leg. Their options were to have both hands on the chair, one hand, no hands, close their eyes, or in the kickstand to lift the toe off the ground turning it into one leg stance. Finally, we always did a cool down for five to ten minutes to lower the heart rate. The cool down contained similar exercises as the warmup with more static stretches incorporated like a seated piriformis stretch, cat-cows, and static triceps stretch.

### Results:

Results are split into three sections, the results from the objective data fitness tests, the improvements in the fitness tests, and subjective data from the in-class surveys.

#### I. Objective

Tables 1 and 2: All fitness test averages for female and male participants vs national averages

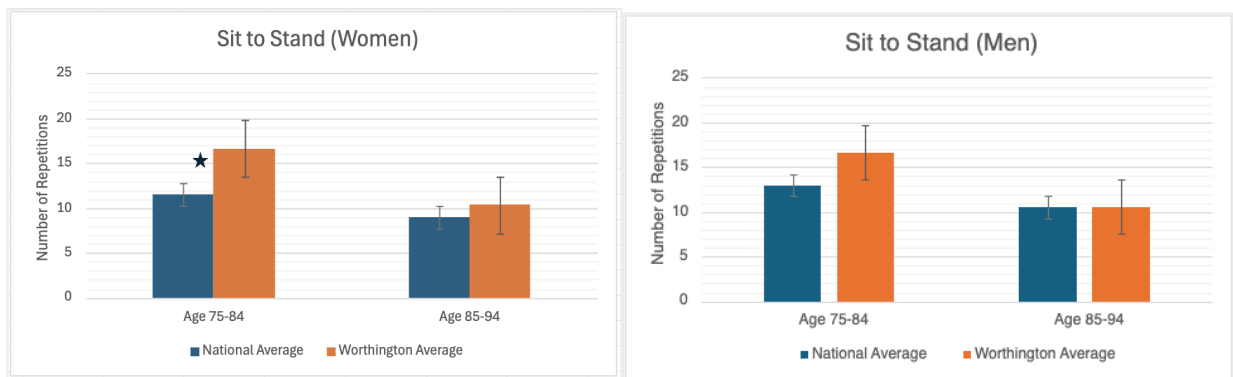
WOMEN	Age Grouping:	
	75-84	85-94
Sit to Stand	75-84	85-94
National Average	11.5	9
Worthington Average	16.63	10.34
Agility 8-foot get up and go	75-84	85-94
National Average	6.75	8.65
Worthington Average	7.66	12.61
Sit and Reach	75-84	85-94
National Average	0.75	-1.25
Worthington Average	0.85	-3.77
Step Test - 2 mins	75-84	85-94
National Average	79.5	64
Worthington Average	99.54	85.84
Bicep Curl	75-84	85-94
National Average	13.5	11.5
Worthington Average	23.53	16.5
Back scratch test	75-84	85-94
National Average	-2.25	-4.25
Worthington Average	-2.91	-2.85

MEN	Age Grouping:	
	75-84	85-94
Sit to Stand	75-84	85-94
National Average	13	10.5
Worthington Average	16.67	10.6
Agility 8-foot get up and go	75-84	85-94
National Average	6.75	8.65
Worthington Average	10.02	9.17
Sit and Reach	75-84	85-94
National Average	0.75	-1.25
Worthington Average	0.94	-3.8
Step Test - 2 mins	75-84	85-94
National Average	89	72
Worthington Average	177.78	91.30
Bicep Curl	75-84	85-94
National Average	16	13
Worthington Average	26.78	17.30
Back Scratch Stretch	75-84	85-94
National Average	-2.25	-4.25
Worthington Average	-6.56	-16.50

- ◆ These tables are an accumulation of all the average data generated from the fitness tests.
- ◆ All 12 graphs below are comprised from the data tables above.

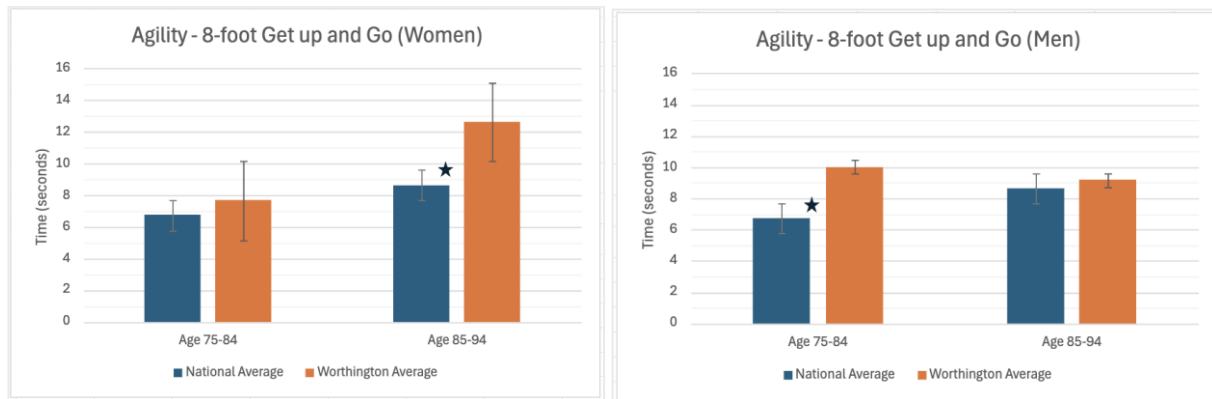
The graphs below demonstrate a comparison between the national normative averages in dark blue and the Worthington participants averages in orange. They are separated into men and women, and further into age groups. The dark blue star indicates statistically significant data.

### Graphs 1 and 2: Sit to Stand



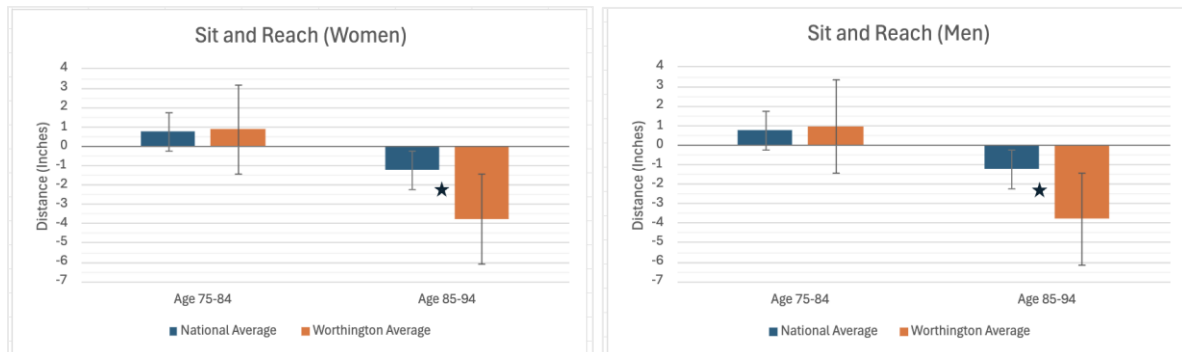
- ◆ The sit to stand test produced above national-average results across the board in all age and gender groupings.
  - Women ages 75-84 at the Worthington performed an average of 16.63 sit to stands whereas the national average is 11.5.
  - Women ages 85-94 at The Worthington performed an average of 10.34 sit to stands and the national average was 9 sit to stands.
  - Men ages 75-84 at The Worthington performed an average of 16.67 sit to stands and the national average for that age grouping was 13 repetitions.
  - Lastly men ages 85-94 at The Worthington performed 10.6 repetitions on average, and the national average for that age group was 10.5 repetitions.

## Graphs 3 and 4: Agility Test



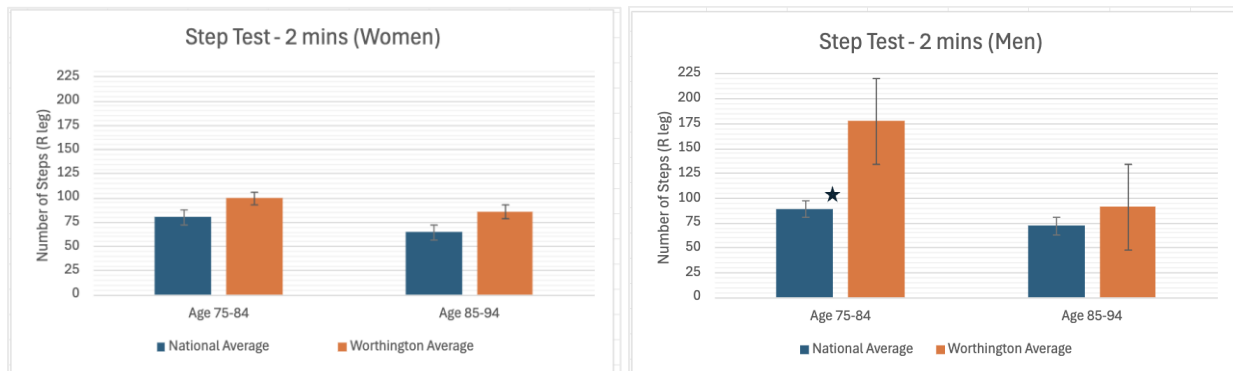
- ◆ The Agility fitness tests produced results in The Worthington participants that were below the national average values.
  - Women ages 75-84 at the Worthington took an average of 7.66 seconds for the agility test and the national average is 6.75.
  - Women ages 85-94 did the test in an average of 12.61 seconds and the national average for this age group is 8.65 seconds.
  - Men ages 75-84 did the agility test in an average of 10.02 seconds and the national average is 6.75.
  - Lastly men ages 85-94 performed the test in an average of 9.17 seconds at the Worthington and the national average for that age group is 8.65 seconds.

## Graphs 5 and 6: Sit and Reach Test



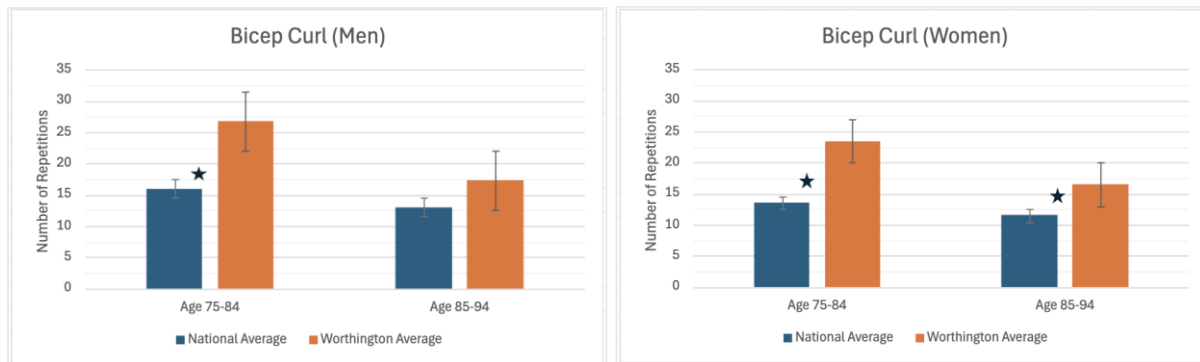
- ◆ Women and men that were ages 75-84 were above the national averages for the sit and reach test.
- ◆ Men and women ages 85-94 were below the national averages.
  - Women ages 75-84 at the Worthington had an average of +0.85 inches and the national average is +0.75 inches.
  - Women ages 85-94 at The Worthington had an average of -3.77 inches and the national average for this age group is -1.25 inches.
  - Men ages 75-84 at The Worthington had an average of +0.94 and the national average is +0.75 inches.
  - Men ages 85-94 at the Worthington had an average of -3.80 inches and the national average for that age group is -1.25 inches.

## Graphs 7 and 8: Step Test 2-Minutes



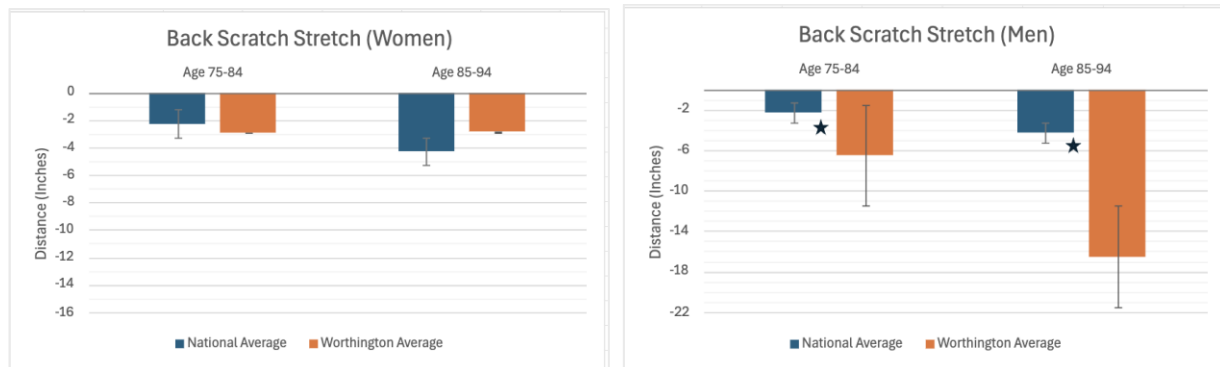
- ◆ The step test produced results that were above average in all age and gender groupings.
  - Women ages 75-84 at the Worthington had an average of 99.54 steps and the national average is 79.5 steps.
  - Women ages 85-94 at The Worthington had an average of 85.84 steps and the national average for this age group is 64 steps.
  - Men ages 75-84 at the Worthington had an average of 177.78 steps and the national average is 91.3 steps.
  - Men ages 85-94 at The Worthington had an average of 91.3 steps and the national average for that age group is 72 steps.

## Graphs 9 and 10: Bicep Curl



- ◆ The Bicep curl test produced results at the Worthington that were above the national averages in all age and gender groupings.
  - Women ages 75-84 at the Worthington performed an average of 23.53 curls, whereas the national average is 13.5 curls.
  - Women ages 85-94 at The Worthington performed an average of 16.5 curls and the national average is 11.5 curls.
  - Men ages 75-84 at The Worthington did 26.78 curls and the national average for that age grouping was 16 repetitions.
  - Men ages 85-94 at The Worthington performed 17.3 curls, and the national average for that age group was 13 curls.

## Graphs 11 and 12: Back Scratch test



- ◆ Women ages 75-84 and both male age groups of participants at The Worthington performed below the national average for the back scratch test.
- ◆ The only group above the national average was women ages 85-94.
  - Women ages 75-84 at the Worthington had an average of -2.91 inches and the national average is -2.25 inches.
  - Women ages 85-94 at The Worthington had an average of -2.85 inches and the national average for this age group is -4.25 inches.
  - Men ages 75-84 at The Worthington had an average of -6.56 inches and the national average is -2.25 inches.
  - Men ages 85-94 at the Worthington had an average of -16.5 inches and the national average for that age group is -4.25 inches.

## II. Improvements

We tested five participants data that were going to class consistently over the 10 weeks of objective data collection. Their first set of values for the fitness tests from the first week were compared to the last set of values in the last week of class to determine how much they improved. There were significant improvements in four out of the six fitness tests.

Table 3: Improvements from first to last week: five regular-participants data averaged

<b>Fitness test:</b>	<b>First week average</b>	<b>Last week average</b>	<b>Statistical Significance</b>
Sit to stand	13.2 reps	13.6 reps	0.477
Agility	10.57 s	9.02 s	0.014
Sit and reach	-2.9 in	0 in	0.006
Step test	68.1 steps	111.9 steps	0.010
Bicep curl	17.2 reps	21.2 reps	0.292
Back Scratch	-6.9 in	-4.9 in	0.025

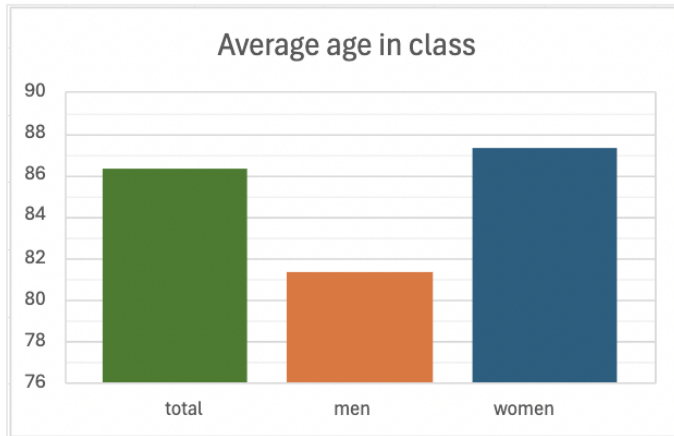
- ◆ Statistically significant improvements data is highlighted in orange.
  - The agility, sit and reach, step test and back scratch saw significant improvements.
  - The sit to stand and biceps curl tests did not have significant improvements.

### III. Subjective:

#### a. Age and Gender:

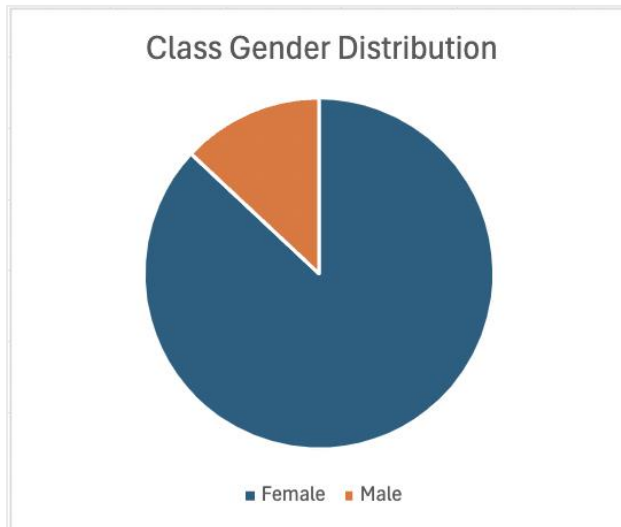
The subjective surveys produced results related to the demographics of the class participants and their exercise levels before their first class.

Graph 13: Age distribution



Rounding to whole numbers the average ages are as follows. The total age of all class participants was 86 years old. Average male age was 81 years old, and the average female age was 87 years old.

Graph 14: Gender distribution

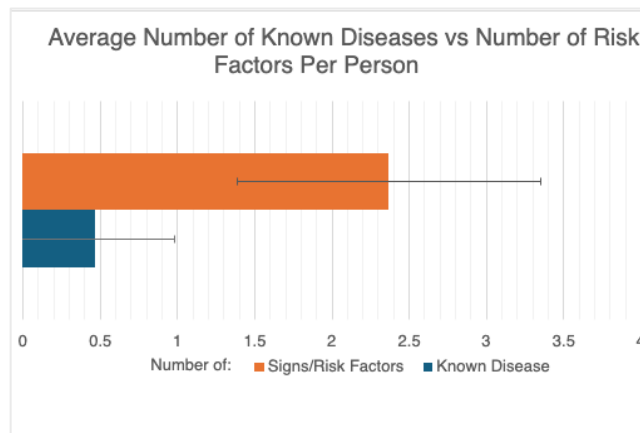


Over the entire span of classes at The Worthington 87% of the participants were female and 13% were male.

## b. Health History:

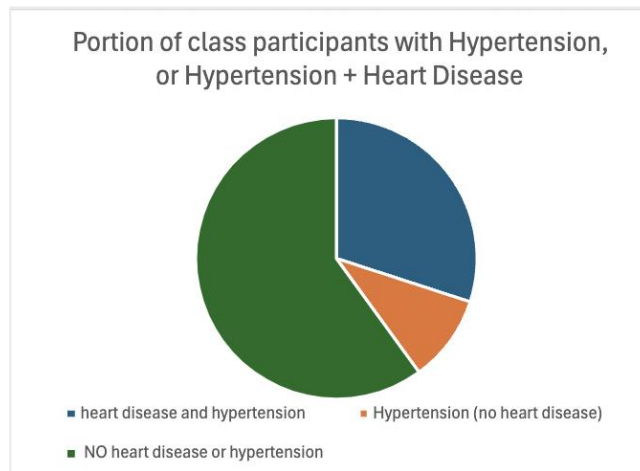
The first two questions on the survey were designed after the recommendations in ACSM's Guidelines for Exercise Testing and Prescription (Liguori, 2022). The number of risk factors was also quantified from the first subjective survey given to participants. The risk factors included smoking, not physically active, age, high cholesterol or blood glucose levels, hypertension, and more. We also received data on any known diseases (CVD, pulmonary disease, heart disease, etc.) the participants have.

Graph 18: Average number of known diseases and number of risk factors for disease per person



- ◆ The average number of risk factors in each participant was an average of 2.38 and ranged anywhere from zero risk factors to four.
- ◆ The number of known diseases in participants ranged from zero to one with the average being 0.47.
- ◆ About half of the participants had one known disease and none of them reported more than one.

Graph 19: Percentage of Class Participants with Heart Disease, Hypertension, or Both

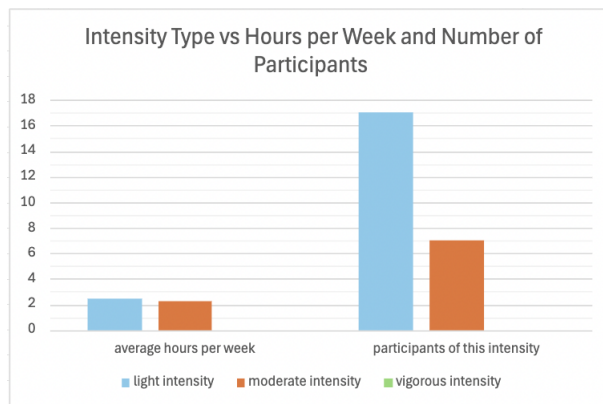


- ◆ A total of 40% of participants in class have hypertension and are taking medication for it,  $\frac{3}{4}$  (30% of the total participants) of which also have a heart disease diagnosis.
- ◆ 10% of all participants have hypertension with no heart disease.
- ◆ Heart disease was the only reported known disease among participants and made up almost half of the responses.

**c. Exercise Levels:**

During the subjective survey for new participants, we collected data on their current exercise levels to gain knowledge of the intensity, frequency and time that they were habitually exercising every week before attending their first class. This allows for a sense of their fitness level before taking the fitness tests.

Graph 15 and Table 3: Intensity Type vs Hours per Week and Number of Participants



Intensity:	Average hours per week	Participants of this intensity
Light	2.46	17
Moderate:	2.29	7
Vigorous:	0	0

- ◆ This table and graph reflect the exercise habits of participants before participating in any of the fitness tests at the Strength and Agility class.
- ◆ There was a total of 17 participants at a light intensity, seven participants at a moderate intensity, and zero participants for vigorous intensity.
- ◆ The light intensity participants do an average of 2.46 hours a week of light intensity exercise, and the individuals who do moderate intensity exercise do an average of 2.29 hours a week at this intensity.
- ◆ There is some overlap because participants could choose more than one intensity so some individual participants will have values on both moderate intensity and light intensity.

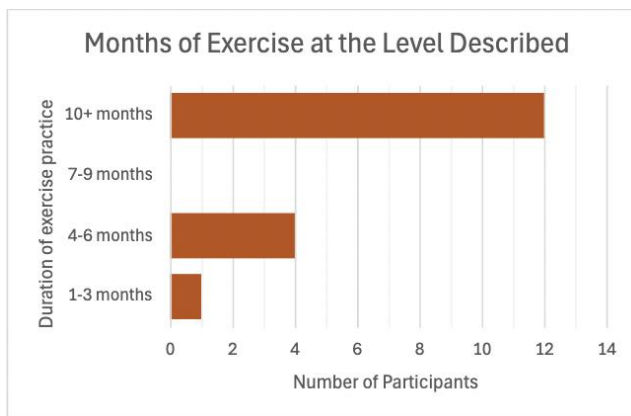
Graph 16: Days Per Week of Exercise



On the subjective survey, question number three asked “How many days a week do you exercise?”. The answer choices are on the Y axis and the number of participants who answered each option is represented by the light blue bars. Overall, eight out of 19 participants who answered this survey question were in each of the

categories of three to four days a week and five to seven days a week. Three out of the 19 participants were in the zero to two days a week category.

Graph 17: Months of Exercise at the Indicated Intensity and Frequency



After participants had answered their intensity and days per week of exercise, question 5 on the subjective survey asked, “For how many months have you been exercising as you have indicated above?”. 12 out of 17 participants who answered this

question chose the category of 10+ months. Four participants chose four to six months, and the remaining one participant chose one to three months.

## **Discussion:**

### **I. Objective**

The participants at The Worthington need to improve in flexibility and agility, and they are already proficient in strength and endurance. The objective data displays that the residents at The Worthington that came to class were above average for all muscle strength-based tests, the biceps curl and sit to stand, as well as endurance during the step test. Yet they were below average in upper and lower body flexibility and agility tests. All age groups performed above average for the lower body strength, yet all age groups performed below average for agility. Strength and agility was the name of the class, yet these two categories of physical fitness did not go hand in hand. The discrepancy here may be due to less muscle power and initial velocity among the older adults. For the bicep curl test the participants at the Worthington scored an average of 7.5 more repetitions than the national average. With men and women ages 75-84 leading this average at 10 repetitions above their respective national normative averages. These values indicate that strength is a forte of participants at The Worthington, possibly because their other fitness classes tend to focus on upper and lower body strength. Participants at The Worthington averaged below the national average for the 8-foot agility test, and most of the groups were below average for the flexibility tests. The female and male participants ages 75-84 at the Worthington were the only groups above average for lower body flexibility in the sit and reach test. Men and women ages 85-94 were below the national average for the sit and reach test. Therefore, lower body flexibility among participants at The Worthington decreases with older age. For upper body flexibility, the back scratch test, the participants were below average for all groups besides women ages 85-94, who placed above average. This indicates that older female participants at The Worthington tend to have more flexible upper bodies. All groups of participants at The Worthington were below average on agility, and most groups were below

average for the flexibility tests indicating that The Worthington seniors need to focus more on flexibility and agility components of physical fitness.

## **II. Improvements:**

For participants that came to class regularly, their data was assessed to quantify the improvements in the fitness tests values. Every test except for the sit-to-stand and biceps curl test saw statistically significant improvements in numbers from week one to week 10. This finding is inconsistent with the data concerning whether participants were above or below average for the fitness tests. The tests that the Worthington participants scored above average, the sit-to-stand and the bicep curl, were the tests that the regular participants also did not significantly improve in. For the below-average scoring tests, namely agility and flexibility, the regular participants saw significant improvements. This finding may be due to the participants being well versed in upper and lower body strength and thus already being well above average on those tests would indicate that they cannot improve much further and may be on a plateau phase of strength. However, with flexibility and agility, the participants do not have as much practice with these tests since they scored below average, yet it is important to note the values were still significantly improving over the course of the fitness classes.

## **III. Subjective**

### **a. Age and Gender:**

Upon talking with the administration, data was received on the average age and gender demographics at The Worthington. The average age at The Worthington is 85 years old, which is consistent with the average age in the fitness classes of 86 years old. The female participants were older, at an average age of 87 years old, and males in class had an average age of 81 years old. The gender distribution at The Worthington is 75% female and 25% male. Gender distribution in class was somewhat consistent with The Worthington as a whole, with even more

female participants in the fitness classes. Overall, 87% of the total class participants were female and 13% were male. I believe that this gender gap is in part due to smaller communities at The Worthington that tend to do things together, there were friend groups of women that would come to class together. It could also be caused by a stronger tendency for female populations to enjoy group fitness classes or placing more importance on fitness. A study by Dr. Slawińska found that physical fitness is a more important factor for women than for men when they self-assess quality of life (2018). Since women place more importance on their health related to physical fitness that may be a reason that women made up a vast majority of the class. These women grew up in the 50s and 60s when there were not many, if any, women that were allowed in sports. Recall that only about 13% of the Olympic athletes were women in 1956 (Statista Research Department, 2023). This gender gap is the opposite of what was seen in the Worthington fitness classes, most likely because the women rarely had a youth experience of organized sports. Many of the women in class would rave to me about how much they enjoyed the community aspect to group fitness and the motivation it provides. These statements are consistent with Graupensperger's research in 2019 on the effects of group exercise in 2019 showing that the more positive an individual's associations are with group fitness, the more enjoyment, exertion and improvements are seen. From these data and feedback, I believe that more women attended class than men because they didn't get access to a group exercising environment as much when younger and this community aspect is something many people are drawn to. It is interesting to compare to the nationwide data that men over the age of 65 are meeting the physical activity (PA) guidelines 15.3% of the time whereas the women over age 65 are meeting the PA guidelines 10% of the time. However participants in Strength and Agility were mainly women, which would indicate another possible data discrepancy. Explanations for this discrepancy could be that participants in Strength and Agility averaged at 86 years old so the

data is slightly different with age, or because while less men are going to fitness class, they could be getting the physical activity guidelines met in other ways other than group fitness.

**b. Health History:**

The health and medical history section of the subjective survey indicated that 40% of participants had hypertension, and 75% of this group also had heart disease. These numbers are fairly consistent with 48% of the United States having some form of cardiovascular disease (Benjamin, 2019). Heart disease was the only chronic illness that any of the participants listed on the form. The high rate of heart disease among the class participants is important to note because exercise can provide numerous benefits. Exercise can greatly reduce the cardiovascular effects of heart disease in someone who already has it and even lessen the risk for developing heart disease. Exercise lowers blood pressure and blood sugar, reduces inflammation, promotes healthy muscle and bone health, and lowers cholesterol, all of which can help lessen the risk for chronic disease, especially CVD (Tian, 2019). The goal is to have participants exercise 5 times per week for at least 30 minutes each time to see even more benefits. Promoting consistent exercise habits is something that Strength and Agility was aiming to do.

**c. Exercise Levels:**

The exercise levels showed that participants of the fitness classes at the Worthington are an active population, with the average choice for days week split between three to four days and five to six days, participates of the fitness class are going to many other fitness classes a week. Most of the participants exercise at least three days a week. Most participants were exercising at moderate intensity or light intensity, with the majority of participants at light intensity for an average of 2.46 hours a week. Technically this does not meet the physical activity guidelines since it is light intensity and less than 150 minutes per week; however, they are physically active if they exercise 3 days a week for 30 minutes for three months. It is also hard to know what

intensity participants are at without measuring their heart rate or rate of perceived exhaustion. This indicates that Strength and Agility is by far not the only exercise the participants will do in a week. On average, most participants had also been exercising at the intensity and frequency they indicated for at least 10 months. Most had even said they had been exercising at that level for years or even as long as they can remember. One participant even started that throughout her 80s she was participating in hundreds of jazzercise classes. Building sustainable exercise habits is a main barrier that will stop people from exercising, so the fact that most participants have this habit built is indicative of their performance and improvements on the fitness tests.

### **Conclusion:**

#### **I. Difficulties:**

Group fitness classes in their nature provide modifications for everyone, and because of this the parameters of the tests were more relaxed. For example, for sit-to-stands the procedure says they are supposed to have their hands crossed over their chest, but some of the participants must use a walker for support or use a chair to push off during sit to stands. Moreover, a few of my participants also used their walker for the get-up-and-go 8-foot agility test throughout the duration of the walk. For the biceps the normalized values said to use 5 and 8 lb. dumbbells for women and men respectively but we only had access to multiple one, two, and three pound sets, and one and a single five pound set of weights so only a couple of the female participants used five pounds for bicep curls and one male worked his way up to using both a three pound weight and a five pound weight in the same hand (by choice), and achieved eight pounds for biceps curls that way. However, the rest of the participants were using less weight than the normative values had demonstrated. Overall, since the fitness tests were in the format of a group fitness class the procedures for the fitness tests all had modifications, which could have produced some data errors in the fitness test results.

## **II. Revisions:**

I would change a few aspects in the future to this research. I would test the participants RPE testing or heart rate and have a more controlled and diverse group of participants. With more time, personnel, and funding, I believe that this could be more of a structured study and thus could be easier applied to a wider variety of senior citizens. In this case the data would be from seniors at more varied levels of physical fitness and varied ages and backgrounds. However, if I were to keep the format as a fitness class, not a strict research study, I would have participants participate in regular exercise at the beginning of class or supplementally in addition to the fitness tests because the tests are not strengthening the participants fitness as much as a variety of exercises could. This could better prepare them for the fitness tests instead of relying on the other fitness classes that the participants take to increase their fitness levels even more.

## **III. Reflection:**

From this project I learned that physical fitness in itself is very multidimensional. An individual or a population can excel in one area of physical fitness and fall short in another area. Being self-proclaimed “fit” or “active” doesn't necessarily mean a person automatically excels in all areas of physical fitness. A lot of the participants in the Worthington classes were exercising often, and they were above average in the strength areas but below average on flexibility and agility. I think that flexibility is always seen as an “extra” component to fitness and not necessary. However, it is a vital component to fitness, and it can hinder performance and the ease of movement, especially with increased age. I also learned that group fitness classes for older populations will draw in a lot more women than men, which could be due to the facility I was at, but nevertheless interesting that women tend to prefer a fitness class more than men. Lastly, I grew to appreciate the time, effort and meticulous behind the scenes work that goes into a research project. This research-based community service project opened my eyes to the extent of

preparation and daily effort that goes into research, yet the process is still rewarding and enjoyable. The ability to work through kinks and issues to produce valuable data takes hours of dedication and pays off in the end. It was wonderful to see how many lives one can affect just by providing exercise. Talking with the seniors at the Worthington was always a highlight of my week and they mentioned loving the young presence. They enjoyed the consistency of the workout classes and asked for me to print out copies of the class plan so they can work on the fitness tests at home. I even saw the effects among the people in my own life because my grandparents, who are not very active, asked me for the workout plan that I provided for the seniors so they can do it themselves. Friends and peers also seemed intrigued with my community service project; I could see their gears turning about senior fitness for the first time.

#### **IV. Future Applications:**

This honors thesis project is just the tip of the iceberg of learning, it will assist me in patient care and client interactions in my future career as a Physical Therapist. The results from these tests will be used starting on the 10<sup>th</sup> of January 2025 in phase two of my fitness classes at The Worthington. Instead of being called Strength and Agility the classes will be called Flexibility and Agility with Brynn since those were the two fitness areas that the participants at The Worthington were below average in. The fitness classes will incorporate more agility and power building skills, balance exercises to increase stability while standing and walking, and a wide variety of fun flexibility exercises for both lower and upper body. I aim to do these same fitness tests on participants about once a month in order to assess how they are progressing. Since this phase two is not for a school research project I will not be collecting as much data. The data that I collected over the past few months could be used to improve fitness classes anywhere, not just at The Worthington. Anyone who works with a senior population or knows seniors can use the same fitness tests to test their population or use the findings of this project to

focus fitness classes more on flexibility and agility. Physical activity is a vital part of daily life and lessens risk for chronic disease, so staying physically active later in life is essential for health, therefore it is important to be aware of the detriments and the proficiencies in physical fitness among both individuals and whole populations of seniors.

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