MURRAY STATE UNIVERSITY

Murray State's Digital Commons

Integrated Studies

Student Works

Fall 2022

The Benefits of Strength and Resistance Training

Rebecca Burke
rburke5@murraystate.edu

Follow this and additional works at: https://digitalcommons.murraystate.edu/bis437

Recommended Citation

Burke, Rebecca, "The Benefits of Strength and Resistance Training" (2022). *Integrated Studies*. 459.
https://digitalcommons.murraystate.edu/bis437/459

This Thesis is brought to you for free and open access by the Student Works at Murray State's Digital Commons. It has been accepted for inclusion in Integrated Studies by an authorized administrator of Murray State's Digital Commons. For more information, please contact msu.digitalcommons@murraystate.edu.

The Benefits of Strength and Resistance Training

By

Rebecca Burke

Project submitted in partial fulfillment of the

Requirements for the

Bachelor of Integrated Studies Degree

Continuing Education and Academic Outreach

Murray State University

October 26, 2022

Abstract

Strength training is proven to prevent many chronic diseases and improve the overall health and well-being of people of any age, race, or gender. Not only can it prevent disease, but it can also slow the progression of existing diseases and disabilities. There has always been a stigma around strength training, however, anyone can benefit from this type of training. Social media and mainstream media often make strength training seem very intimidating. If you spend any time on social media, you will see videos of highly muscled men lifting super heavy weights in fancy gyms. It is often portrayed that unless you are lifting heavy you may as well not lift at all. Many people believe that they must be at a higher athletic level to begin training but this is not true. Strength training is readily available to everyone and can be done with several types of weights/equipment. Resistance training exercises can easily be scaled for anyone who would like to start. Kettlebells, dumbbells, barbells, and resistance bands are types of equipment that can be used. These items are often easily found in any large retail store. It is proven that strength training is effective for all ages and genders from children all the way to senior citizens. This paper will discuss the many ways that strength training can benefit anyone with a concentration on how it can specifically benefit women. Women especially can benefit from resistance training and prevent osteopenia/osteoporosis by strengthening their bone density. Increasing bone density also reduces the risk of fractures as women age. Strength training can also reduce the risk of chronic diseases like high blood pressure, high cholesterol, and the rising illness of type 2 diabetes. It reduces the amount of visceral fat which is associated with cardiovascular disease (CVD). Lowering visceral fat can also be linked to reducing the risk of cancer. Strength training is proven to increase energy levels and enhance mood which can lead to the lessening of mental

health symptoms. Strength training also helps joints stay flexible and reduces symptoms of arthritis. It also improves balance which reduces the risk of falling. This is especially important for elderly persons. Mental health issues are also on the rise and strength training can improve symptoms of depression and anxiety. Exercise-triggered endorphins play a role, but it also provides an opportunity to overcome obstacles in a controlled environment. This type of training also increases a longer life by improving one's overall health and well-being. A well-maintained exercise routine including resistance training is one of the most efficient ways to not only prolong life expectancy but also to maintain wellness into old age.

Table of Contents

INTRODUCTION

As time evolves, society continues to research and learn ways to increase life expectancy and improve the quality of life. Industrialization has increased both and humans have been left to play catch up on learning how to live a healthy life for the increased number of years they are alive. Resistance training is a proven way to increase the quality of life and longevity of life. Research on the benefits of strength training or resistance training is increasing and we are learning more about the many ways strength training can benefit a person when committing to a routine featuring this type of exercise. Strength training involves someone completing static physical exercise movements using either body weight or additional weight and can be done in various ways and in several environments. It is not always easy or convenient for someone to make time for training or to find a coach that can show them the correct way to begin their training program. It can be very intimidating to take the first step of entering the gym for the first time unless you have a solid plan. There are ways to overcome these barriers and resources are available to help people get started safely. Many local gyms offer programs to help someone get started. If you are not able to access a local gym you can train with weights or resistance bands inside your home, or outside. There are many different instructional videos available on the internet or for purchase in stores for those wanting to train at home that offer the feel of a coach being in the room with you. There are also several group programs you could join like CrossFit. In these group programs, you not only have a coach you also have other people who are following the same exercise routines so they can help you stay on track. Resistance training can

be done with the person's body weight, resistance bands, kettlebells, free weights, and machines. All genders and all ages can participate in this type of training because the workout can be scaled to meet the individual's needs and abilities. This is especially beneficial to those recovering from surgery, those with health problems, those transitioning from a completely sedentary lifestyle and the elderly. In the past there have been many barriers that have been specific to women and have caused them to struggle when it comes to increasing muscle, however, more studies are showing the importance of increasing strength and muscle mass to help women reduce the risk of osteopenia and osteoporosis. Both men and women, young and old, can reap the benefits of long-term strength training. This can reduce the risk for many chronic diseases like type 2 diabetes, high blood pressure, high cholesterol, and cardiovascular disease, and even lowers the risk of cancer by reducing visceral fat. Strength training has also been shown to have benefits on mental health. You can help relieve the symptoms of many mental illnesses by sticking to a workout routine. Strength training is proven to reduce anxiety and depression and improve a person's mood by releasing endorphins. Overall, this type of training can benefit anyone and help to increase overall health and well-being without using medication.

HISTORY OF STRENGTH TRAINING

Historically strength training has existed in many forms. The ancient Greeks practiced forms of strength training in their palaestra and the first gym dating back to the XI century was found in India. (Nenad Stojiljkovie). Subtotal rising is a form of strength training that was done by the Indian people using a log that was crafted with handles for easier lifting and was used to increase strength and endurance. This same kind of weight is now still used in the World Strongman Competition during many exercises. During the Middle Ages exercise was not

performed as often because it was looked down upon or even banned in some places. This is because it was associated with the battles fought by Gladiators which often ended in death. It was seen as inhumane or scandalous. (Nenad Stojiljkovie) Even though exercise programs were not performed the lifestyle of the people tended to be much more active than the average lifestyle today which means that although people were not intentionally performing resistance training, they were engaging in functional fitness that mirrors resistance training in many ways without even realizing it. Much later in the late XIX century, the first professional strongman appears, and a form of strength training known as "lifting" gains popularity. (SI, SM, &M) During this time feats of strength used to be performed for entertainment purposes and people were fascinated with large muscles. Many of the early “strong man” performers were paid to lift impossibly heavy weights for the entertainment of a crowd. Resistance training or lifting was still seen as a sideshow type of exercise. Most early experts on strength training were gym owners or professional strong men who entertained crowds with their ability to do things many people could not. It wasn’t until much later that medical professionals or educators began to become knowledgeable on the subject or to even acknowledge that resistance training had benefits beyond entertainment value. (Kraemer) Even though it took years for the medical community to get on board, Americans have been training with weights since the founding of the country. Even earlier than that athletes were known to have used strength training to perfect their sport. This type of training to be better able to engage in sports has continued throughout the years. In New York, gym owner William Wood would develop the first known strength training program for a school sports team. He developed a resistance training program that allowed rowers from Yale to train and improve their stamina and beat their archrival, Harvard. Despite this long history of strength training little research was performed on the benefits until the mid-

XX century. During a series of studies conducted between 1945 and 1952, Thomas L. DeLorme developed a protocol known as progressive resistance exercise. DeLorme believed that his patients would benefit from adapted weight training. He developed a plan that included multiple repetitions with varying weights. This plan was based on a model of three sets of ten which is still used to this day in the fitness world. Today three sets of ten is believed to be what all people should strive to work up to when implementing resistance training into their exercise routine. (Kraemer) The 1970s is often considered the most important decade in the world of strength training. This time saw the rise of strength coaching as a profession and the creation of the first association focused on research in the field. Since that time there have been numerous advances in the field and many studies conducted proving that resistance training is beneficial to health in many ways. Resistance training is slowly being recognized as the type of exercise that is most beneficial to both physical and mental health.

WHAT IS STRENGTH TRAINING

Strength training involves the performance of physical exercise specializing in the use of resistance to induce muscular contraction which builds the strength, endurance, and size of the muscles involved. (definitions.net) It both stops the loss of muscle mass and builds new muscle. It is a general term referring to requiring one to exert force against resistance and has been demonstrated to be a superior modality for increasing muscle strength, local muscular endurance, power, hypertrophy, and motor performance. (Kraemer, 2017). Modern-day strength training shares many similarities with the programs and exercises of the past; however, it has benefited from the things that have been learned from research in the field. We now know that strength training doesn't have to look the same for everybody. Programs can be individually tailored to meet each person's needs. Exercises can be scaled to fit everyone's fitness level and

goals. Sometimes people engage in resistance training without even realizing that it could be considered strength training. This could be referred to as functional fitness. Functional fitness is a way of doing exercise movements that mirror the same movements that we use in our everyday lives. For example, we squat several times a day whether it be sitting in a chair or when using the restroom. Reaching overhead and putting things on the top shelf is often the same movement we perform doing a military press during a gym routine. Lifting something off the ground and carrying it to a different place uses the same muscles that are used in a farmer's carry at the gym. Lifting bags of groceries out of your trunk uses the same muscles used in a deadlift. Resistance training can be found in many of the movements we perform every day in our normal routines. Therefore, this type of exercise best helps to improve the quality of life. Strength training can also be powerlifting with barbells and weights. These exercises can be performed in a gym, a home gym, or simply at home with many different types of equipment. Any exercise or movement that repeatedly uses resistance to gain strength can be considered strength training. Performing any number of these ways can lead to achieving results. Whether a person trains in a gym with high-end equipment or at home with gallons of milk it would still be considered strength training. Although modern technology has greatly reduced the need for strength in our everyday lives and daily activities it is still critical to maintaining health and fitness and extending our life and improving our quality of life. (Kraemer, 2017)

EQUIPMENT AND ENVIRONMENT

Over the years resistance training has been performed in many different environments using many different forms of equipment. During the ancient Greek era, people used rocks to lift to practice strength training. They eventually changed to using halteres which is the precursor to one of today's most used pieces of equipment, the dumbbell. (Huovinen) Today dumbbells can be found in many different weights and are one of the most widely available pieces of equipment that modern man can use. They are available anywhere from the local Dollar General to high-end stores dedicated to exercise equipment. The environments that ancient Greeks performed strength training in were known as gymnasiums, which were gathering places for all citizens of Athens, and palaestras which were rectangular spaces lined with buildings used for practice. (Nenad Stojiljkovie) These spaces were the precursor to modern-day gyms and practice arenas. During the late 1800's Benjamin Franklin was using dumbbells for resistance training and even wrote about the superiority of dumbbell swinging as an exercise. (Science of Resistance Training). During the early 1900s formal training in gyms using dumbbells and barbells with varying weights gained popularity and was often used by school and professional sports teams. (Kraemer, 2017). Today resistance training is performed in many different environments using a multitude of equipment types. Some people go to gyms full of expensive equipment that is geared toward one exercise while many others work out at home using cans of soup or resistance bands hooked to their doors. Some people train in gyms that are open access where you can enter any time of the day or night with a key card and others prefer to go to scheduled sessions with personal trainers or coaches that can help them safely and correctly perform the strength training

exercises. Beginners often see better results and continue to stick with the program longer if they choose to work out at a gym with a trained coach. Working out in a gym also offers the person the chance to be surrounded by other people who are motivated in the same ways they are. These people often lift each other up and encourage each other while performing the exercises. A coach just adds another layer to this support system. A gym also often has much more expensive and dedicated equipment than the average person can afford for their home gym. While it is true that resistance training can be done anywhere with minimal equipment it's just like every other exercise program in the fact that it's easier to do with dedicated equipment that is geared towards the movements you want to do. Working out with a coach allows the person to receive one on one assistance in using this equipment. A dedicated coach also acts as a spotter while you lift weights to make sure that you're lifting safely and to help you if you were to get in a bind with your weight. Also, while most people wouldn't think so, gyms can be a much more convenient place to work out than at home. There are few distractions and gyms often offer other programs like healthy shakes, workout items, and recovery equipment. (Topic Of The Week July 29) In the past 30 years, there have been many advances in the equipment that is available for strength training. You can even order your exercise equipment on the home shopping network. There are many options out there for people who choose to work out at home. You can purchase DVDs that help teach you techniques, or you can buy machines that help you perform specific moves. Many advancements have been made in providing equipment for home training that helps people to feel immersed in the experience and less like they are exercising alone in their homes. These include anything from online workouts performed over a video call to virtual reality workout programs that allow people to feel that they are in a gym while they are at home. People who are using virtual reality to work out from home have found great benefits from adding weighted

vests, ankle and wrist weights, and weighted gloves to their routine as a way to incorporate resistance training into their virtual reality routine. Another place where many advances have been made is in the area of adaptive gym equipment. The resistance training field is becoming more inclusive of everyone who wants to work out. Modern exercise equipment also consists of the Polar H10 Heartrate Sensor, A Fitbit, Garmin heart rate monitors, or even your apple watch that can perform an EKG to monitor heart health while exercising. These products are considered exercise equipment because they are essential in allowing people with previous cardiovascular issues to participate in exercise while watching their hearts. The Oura Ring is a medical device in the form of a ring that checks your sleep pattern and measures your blood oxygen levels while you sleep to determine if you're in the prime condition to work out the next day. All the advances in medical exercise equipment have allowed people to work out to their top performance.

BARRIERS TO STRENGTH TRAINING

Not long ago, weight training was considered something that only men who competed in sports such as powerlifting, bodybuilding, and Olympic lifting did. Most people saw no reason to start this type of training. Some athletes even thought that it would hinder their athletic performance by bulking them up with large muscles. It was especially rare to see women performing resistance training routines because they did not want to be perceived as "manly". Now it is slowly becoming more common to see women hitting the weights in the gym. The beauty standard for women is gradually changing to include a more muscular body type. Muscles are no longer seen as only attractive to men. The media portrays more fit women in movie roles, and even beauty competitions such as Miss America, have a fitness routine in their events. Even with these changes, however, there are many gender disparities still today when it comes to weight

training. According to (the International Journal of Exercise Science) men engage in this activity approximately 30% more frequently than women. The study showed that for every 27 men using the weight section of the gym, there would only be one woman. Velika and Kumar (28) and Wachs, suggested that females may be socialized at a young age to avoid perceived “masculine” areas and are more likely to participate in feminine programs like dance and aerobics. As a fitness trainer, I have heard women say that they don’t want to “bulk up” or “look manly.”

Another barrier that keeps people from strength training is the lack of time. Most young adults would say it is hard to find time for themselves. Especially those with full-time jobs and children at home. In 2021 89% of families with children had at least one parent employed full-time. In families that consisted of a married couple with children, 96% included at least one full-time employed parent and in 62% of these families, both parents were employed. (bls.gov) In today's world, many adults are working more than one job, making it even harder to find time to work out. Even people who only have one assignment or do not have children often struggle to find the time to commit to an exercise routine due to other commitments and just life in general. During the pandemic, this barrier did the lesson. In 2021 at least 38% of the workforce was working from home, so they could better find the time to work out. On an average day, 86% of people over the age of 15 participated in some leisure or enjoyable activity. (bls.gov) The average person spent half an hour performing exercise activities. Unfortunately, due to the pandemic, many gyms were shut down during this time, so those who did work out had to perform the actions at home.

Money can also be a hurdle for some people. Gym memberships are not free and are often one of the first things people would cut when budgeting expenses. Many people feel they need a coach or a personal trainer to show them the safe way to perform the movements and write out a

program that fits those individual needs. This is an added expense to the initial cost of the gym membership. Special shoes and clothing can also be seen as an additional expense required to work out in a gym. CNBC reports that the average gym membership cost is $40 - $50 a month but once you add sign-up fees and other sometimes hidden fees it could be as much as $800 a year. (Dellaverson) The areas in which people live have been shown to greatly affect their ability to exercise. Access to parks, recreational facilities, and safe crime-free areas are important factors. A study in the UK showed that access to free public transportation led to an increase in physical activity because people felt they could more safely reach their gym or another exercise area. A study of older adults showed that their most common reasons for not participating in the physical exercise were ill health, pain, and injury. (Taylor).

Any time people participate in an exercise routine, the fear of physical injury might be considered. If a person does not have proper coaching, which often requires additional resources, they are more likely to injure themselves due to a lack of good form or technique. Often the media portrays strength training as something large men do to the extent of lifting cars or extreme amounts of weight. This can lead people to believe that they need to lift heavy to achieve any type of result, which can lead to injury. Once someone is injured, they often will not return to a regular strength training program.

MODIFICATIONS THAT ALLOW INCLUSIVITY

Advanced age or medical issues, including prior cardiovascular events, obesity, or physical impairments, can be obvious barriers to resistance training. However, it is often the people who are not easily able to perform the exercises that need them most. Many people who suffer from medical issues feel that they cannot safely work out; however, resistance training is one of the safest forms of exercise they can perform. Resistance training is safe for people suffering from medical issues because it is an exercise routine that is easily scaled to fit the needs of the individual person. If a person is sick or has a medical issue or disability, they are still able to perform resistance training in many different forms. Resistance training is beneficial at all levels even when scaled down to accommodate a patient who is weak from surgery or a patient who cannot stand or balance on their own. Everyone can benefit from resistance training. Because this is well known, there have been many advancements in modifications to the activities performed in resistance training.

Modifications for people of advanced age include changes made to the basic exercise program and the weights and equipment used. One example would be allowing someone to use the indoor rowing machine instead of running to warm up during their exercise routine. Another example might be modifying the total weight or the number of sets and reps someone has to perform compared to someone younger. Using a balance bar to help maintain balance during exercises that use body weight, so they don't fall. Another essential modification might be making sure a trainer is present. They can help provide support in performing the exercises correctly and safely

and help them decide when to increase their program time or raise their weight load. Special Strong, a training center dedicated solely to training individuals with special needs has a list of suggested criteria that should be looked at when selecting a trainer to work with a person with special needs. Does the trainer have experience working with special needs individuals? Many people feel they can help those they think are less fortunate but it's important to select a trainer that has actual experience. Is the trainer familiar with the person's specific disability? Special needs are a blanket term but it's helpful if the trainer is well versed in the person's specific needs. Does the trainer have experience in rehabilitation? This is especially important if a person is recovering from an accident or facing a new life with limited mobility. Is the trainer certified? Is the trainer encouraging? No amount of education, experience or certification can turn someone into a caring empathetic person if they aren't and these are important qualities to have in a trainer. (Masterdaniel, 2020)

Modifications for someone who is obese or has previous heart issues might include monitoring their heart rate with the equipment mentioned above and making sure they do not over excerpt themselves during the workout. Even though the movement may need to be modified or the amount of weight scaled to ensure it isn't too much for the individuals challenging themselves and elevating their heart rate to a safe level is still healthy and increases heart health. Also, it is important to monitor other body vitals, such as a person's oxygen rate and blood pressure during the workout. This is another example of where modern exercise equipment can be used to allow someone with a health issue to work out safely. If a person struggles with obesity, it is often essential to remove the impact portion of the workout so that their body weight doesn't cause harm to their muscles or joints. This allows them to perform the training more comfortably and with less likelihood of injury, which means they are more likely to return and continue the

program. Once a person commits to a resistance training routine and is able to maintain it for a length of time, they often are able to lose weight which can lead to them being able to perform the exercise without as many modifications.

BENEFITS FOR OSTEOPOROSIS/OSTEOPENIA

Osteoporosis is a degenerative disease that is gaining more attention due to today's increase in technology which has led to great advances in testing for degenerative disease. Because medical professionals can perform more in-depth scans, we can better tell when people are suffering from this disease that causes loss of bone density. Because more people are being diagnosed and are diagnosed at a younger age, people are better able to focus more on prevention. Osteoporosis and osteopenia are the most prevalent metabolic bone diseases in developed countries of the world. (The effects of weight training article) Osteoporosis is a systemic skeletal disease characterized by low bone mass and micro-architectural deterioration of bone tissue that results in increased fragility and risk of fracture. Osteopenia is when the bones have a decreased mineral content, with a bone mineral density (BMD) lower than normal but less than the threshold for osteoporosis. (effect of weighted exercises article) In 2004, an estimated 10.1 million people aged 50 and older in the US had osteoporosis, and 33.6 million people had osteopenic low bone mass. This accounted for almost 50% of Americans over 50. The Surgeon General's office created a national health initiative and predicted that by 2020, there would be 13.9 million individuals with osteoporosis, with 75% of these being women. The New York State Department of Health reports that osteoporosis is a major public health threat for over 44 million Americans. Nearly one of every two Caucasian or Asian women in the United States will experience a bone break due to osteoporosis. (The Facts About Osteoporosis NY state) Postmenopausal or type 1 osteoporosis develops when estrogen levels begin to drop after

menopause. This imbalance of hormones leads to a faster rate of bone resorption. The imbalance of hormones speeds up the process of bone loss. Type II osteoporosis is seen in both males and females. It is a gradual decrease in BMD that affects both cortical (dense outer layer of a bone) and trabecular (bone tissue arranged in a framework of mesh or beams) types of bone. (Effect of weighted exercises) The most common fractures that occur from either type of osteoporosis are in the distal forearm, thoracic and lumbar vertebrae, and the proximal femur, with a proximal femur (hip) fracture at the top of that list. Approximately 300,000 hip fractures occur each year in the United States. These fractures cost the healthcare system an estimated cost of over 9 billion dollars. They also cost hundreds of thousands of older Americans their independence and sometimes lead to death due to comorbidities that occur with the bed rest needed to recover from the injury. It is well known that the best defense against any sort of health care issue is always prevention, and the best prevention method against osteoporosis in both genders is the prevention of bone loss. Many different methods of preventing bone loss are available in the United States. One might try therapies prescribed by physicians, including estrogen replacement therapy. The supplementation of calcium and phosphorus via oral medication, shots, or IV treatments is also an option. Last but certainly not least is a carefully performed exercise routine. There have been several recent studies on how following a resistance training program can successfully prevent bone loss. One such study was conducted from 1990 through 2005, which was a computerized search of the MEDLINE, CINAHL, EMBASE, PEDro, and Science Citation databases. (Carol Hamilton Zehnacker, PT, DPT, MS) The review revealed evidence to support the effectiveness of weight training exercises in increasing BMD in postmenopausal women. The increases were site-specific and required high loading with a training intensity of 70% to 90% of 1 rep maxes for high repetitions. This study concluded that weighted exercises could help maintain BMD and

increase the spine and hip in women with osteopenia and osteoporosis. This study showed that resistance training can prevent bone loss and actively fight it by increasing bone mass density. Smith and Gilligan concluded that increased cellular activity found in cell and organ culture research presented the likelihood of proportional reactions of bone to loading. If a load is detected as being greater than the load threshold, an increase in internal strain and bone formation will occur. To show an impact on bone density, the exercise intensity must be higher than the minimum effective strain threshold of bone. (pg 85 carol Hamilton zehnacker) Older adults tolerated high-intensity weight training well. This type of exercise program must be made into a long-term lifestyle change due to aging women's chronic bone loss. Once the exercise program is stopped, the bone mass gained will be lost again. Specific exercises are proven to help include the first of four types, weighted squats, hack squats, hip extensions, knee extensions, and hamstring curls. Also, stair-climbing or box step-ups with a weight or a weighted vest and power cleans. Military press, lat pulldowns, seated rowing, and torso rotation were also successful. Lifts like bench presses, curls, tricep extensions, forearm pronation, and supination are also included. These exercises could theoretically be done at home if the patient did not have access to a gym. This means that using resistance training to fight the loss of bone density and build back bone density could potentially be more readily available to patients than other medical treatments that require visits to a doctor's office or hospital and the purchase of potentially expensive medications.

Resistance training also provides an efficient way to load the sites most likely to suffer from loss of bone density at the spine, hip, and wrist, which in turn leads to the benefits of improving muscular strength and balance. Improving these will reduce the risk of falls which is important to patient health as maintaining bone density. Patients are better able to perform everyday tasks and

lead a less sedentary lifestyle if they can move freely without the fear of falling or losing their balance. This freedom not only leads to a healthy lifestyle but also less chance of depression or anxiety since they can do more for themselves and maintain a sense of independence.

BENEFITS FOR WOMEN: REPRODUCTIVE SYSTEM

Polycystic ovary system is one of the most common disorders affecting reproductive health in women. Among women with insulin resistance and obesity it is the most common disorder found during reproductive age. (toloee et al.) Symptoms commonly associated with this disorder are infertility, weight gain, changes in lipid profile and unbalanced hormones. (Aqdas et al.) There are four phenotypes of PCOS. The four phenotypes according to Lara Briden MD are as follows: (Nielsen)

1. Insulin Resistance - elevated insulin, glucose levels, abnormal glucose tests
2. Pill-Induced PCOS - Ovulation is suppressed due to birth control however after stopping the pill ovulation usually resumes but can take months or years.
3. Inflammatory PCOS - results from chronic autoimmune activation caused by stress, environmental toxins, leaky gut syndrome, and an inflammatory diet.
4. Hidden Cause PCOS - results from an underlying disease, deficiency, or diet problem that isn't well known at the time. Often consumption of soy is a major contributor.

Resistance training is known to reduce the symptoms of PCOS so often incorporating it into a patient's daily lifestyle is a form of first-line treatment in their health plan. As mentioned previously resistance training is a well-known way to reduce body weight and improve fat to muscle ratio while lowering a person's BMI. Because of this it also helps to regulate a woman's

monthly menstrual cycle. (Aqdas et al.) Resistance training has also been shown to have a positive impact on ovary morphology and the glycemic levels of women with PCOS who participated in an 8-week training cycle. (toloee et al.). This can benefit all four types of PCOS but it is especially helpful to those who have phenotype 1 Insulin Resistant PCOS. This is because women with Type 1 PCOS often have high in It can be used as a safe and effective form of treatment for these women. While genes and environment do have their place in the cause of PCOS it is well known that poor diet and sedentary lifestyle are also known to contribute. Resistance training can help with bringing people to a more active lifestyle and often when people are more active, they choose to make better dietary choices so they can see the maximum benefit of their training.

Endometriosis is another common reproductive disorder affecting women. It affects up to 10% of women in the United States between the ages of 25 - 40. Endometriosis occurs when the lining of the uterus known as the endometrium grows in the body outside of the uterus. This lining doesn't shed during a menstrual period like the healthy lining inside the uterus does, so it leads to inflammation, scarring, and cysts. Sometimes even causing a build-up of tissue between organs that can cause them to fuse together. Symptoms include excessive menstrual cramps, heavy flow, and pain during intercourse. Infertility is a well-known complication of the disease. Doctors are unaware of the exact cause of the disease, but the current theories are as follows:

1. Blood or lymph symptom transport - The tissue is transported to other areas of the body via the blood or lymphatic system in the same way that cancer cells are transported.
2. Direct transplantation - This occurs when cells can directly transplant to other areas of the body due to surgery such as a c-section.

3. Genetics - this disease seems to run in some families more than others so the potential for a genetic link is possible.
4. Reverse menstruation - Endometrial tissue flows up into a woman's fallopian tube and abdomen instead of exiting her body through the normal period.
5. Transformation - other cells in the body may transform into endometrial cells and start growing outside the uterus. (*Endometriosis*)

The most common treatments for endometriosis are hormones and surgery however these forms of treatment are not able to treat all the symptoms that occur with the disease. Physical activity and a sustained exercise program have been suggested as a good alternative treatment to help with the symptoms that the former treatments don't help. Two individual studies of 109 participants that included women who had previously been diagnosed with endometriosis showed that there were improvements in both pain intensity and stress levels in those women who performed resistance training exercises habitually. (Tennfjord et al.) Because endometriosis is a disease of chronic inflammation and it is known that recurring resistance training coupled with a healthy diet lowers the body's inflammation markers, more and more doctors are willing to try exercise as a non-pharmaceutical treatment option for their patients.

MENTAL HEALTH

There have been many studies that prove that exercise and movement of the body play an important role in mental health and the improvement of symptoms that occur with mental illness. It is estimated that 12% of the global population suffers from a mental disorder (ncbi.nlm.gov) and that number is probably a huge underestimate as many people, especially those in lower-income countries don't see treatment for mental disorders. Those who suffer from mental health

disorders often have comorbid somatic disorders that lead to a life expectancy 15 to 20 years shorter than the average population. Poor mental health often leads to a variety of physical symptoms that can lead to people not taking care of themselves physically. Substance abuse, lack of sleep, poor personal hygiene and long periods of a sedentary lifestyle are often contributing factors. People with severe mental disorders such as psychotic disorders, bipolar disorder, and depression spend an average of 7.8 hours in the day being sedentary. This is significantly more time than age and gender-matched control subjects who do not suffer from mental illness of any type. Treatment of mental health disorders has become more prevalent but rates of common disorders such as anxiety and depression continue to increase at a rapid rate. Currently, the most common treatment includes pharmacological treatments which include antidepressants and antipsychotics. These medications are considered front-line treatment when dealing with almost any mental disorder (ncbi.nlm.gov) but they often come with a host of side effects that can cause physical symptoms of their own. Psychotropic medication is known to increase weight gain, elevate blood glucose levels, cause a loss of sexual interest, and have other negative physical impacts that occur long-term if the person is taking the medicine. Sometimes these side effects result in the discontinuation of the medication because the person cannot deal with them. When patients are not taking their medication, they are left to deal with mental illness which cycles back to the physical symptoms discussed above. The other main line of treatment for mental illness is talk or behavior modification therapy. This treatment does have fewer physical side effects but is often not as beneficial without being combined with medicine. Therapy is known to have one major physical side effect that can negatively influence people's lives. That side effect is known as post-trauma therapy syndrome. Intense therapy sessions can lead to an increased sense of self-autonomy. This increases your stress and anxiety levels which in turn can lead to an

increase in pain and tiredness after therapy sessions. Patients have been reported to experience excessive tiredness, migraines, and even symptoms of physical illness after sessions. (shape.com). The brain-body connection so it makes sense that the more emotionally intense the work, the more the body physically reacts to it. Therapy often magnifies the bad feelings a person has and that they have repressed. When we unpack stored trauma to process and heal from it our physical body can feel beaten up. This can often lead to someone not continuing with the therapy they need or to them not living a healthy lifestyle during intense therapy sessions because of the physical symptoms they are feeling. Another third option for improving mental health that has been proven in many studies is exercise. In the third century, Hippocrates quoted that "Walking is man's best medicine" (ncbi.nlm.gov). Today we know that physical activity or any bodily movement produced by the muscles that result in energy expended and especially exercise which is structured and repetitive has preventative and therapeutic effects on our mental health. Many studies have proven that exercise is medicine and new research points toward the fact that exercise is medicine for the brain as well as the body. Evidence from a meta-analysis of 49 studies of more than 260,000 participants demonstrates that people with higher physical activity levels are less likely to develop depression. That relationship remained significant regardless of the age group, sex, and geographic location of the participants. Even adjustments for confounders like smoking, weight, and the presence of physical disease or impairments did not change these findings. (ncbi.nlm.nih.gov) A large-scale genome-wide association study using data from participants in the UK Biobank that assessed physical activity using objective measures has shown that physical activity has casual protective effects against depression. That outcome has been corroborated by numerous other studies. These studies seemed to focus more on more common mental disorders such as depression and anxiety but there is limited evidence

on the protective effects of physical activity against bipolar disorder and schizophrenia. These types of mental disorders most likely require multiple forms of treatment to be successfully treated. Guidelines for treating mental disorders have begun to incorporate the available scientific evidence and propose that physical activity and exercise should be integrated into mental health care for all disorders. For example, the Royal Australian and New Zealand College of Psychiatrist's clinical practice guidelines propose that exercise should be incorporated as a routine care treatment before medicine and talk therapy is tried. (ncbi.nlm.nih.gov) The studies have shown that strength training benefits extend beyond the diagnostic symptoms and include improving cognitive symptoms and actual quality of life. Previously it was thought that aerobic exercise needed to be included in an exercise program to see benefits to mental health. However, A recent review has demonstrated that strength training alone effectively reduces depressive symptoms with a moderate effect size. Age and sex do not seem to alter these benefits received from strength training. The study also showed that strength training improved cognitive abilities such as memory and visual learning ability. In another study, researchers found that exercise reduced anxiety symptoms with a moderate effect size. Exercise has also been shown to be beneficial in reducing anxiety and depression symptoms in children who have been diagnosed with attention deficit hyperactivity disorder. Thought problems, social problems, and aggressive behaviors all improved following physical activity. Even though the benefits of exercise for mental health have been well proven, many professionals working in the industry and mental health centers have been slow to incorporate it into their treatment programs. In one study done in Brazil only 35% of study participants usually or always recommended exercise to their patients. The most common barrier to implementing exercise into the treatment of mental illness is that most mental health providers believe that exercise doesn’t fall under their area of expertise

and believe that an exercise regimen should be prescribed by a primary care physician. This is not a surprising belief since exercise has long been considered a task for physical educators and those in the exercise industry. Patient-level barriers also include poor physical health and fatigue that is caused by the very mental illnesses they are trying to treat. Patients can be motivated to perform the exercise routine by being educated on the benefits that it would provide to them both mentally and physically. Lack of access to an appropriate facility is also a major barrier in many socio-economic populations which is why strength training is such a good routine to recommend since it can be performed anywhere, even at home, without specialized equipment. It would also be beneficial if exercise professionals were included in the teams that treat patients with mental illness. It is known that patients who suffer from mental illness are often also those who have other physical health disparities. This is why a strength training routine is such an important thing to incorporate into treatment for mental illness. To help facilitate this, all mental health professionals should receive basic training in the principles of physical activity prescription. It would also be helpful if experts in physical activity would receive training in how their expertise could not only benefit people's physical health but also their mental health.

DIABETES

Type 2 diabetes is rapidly increasing worldwide. In 2017, approximately 425 million people had diabetes, projected to reach as high as 629 million people by 2045. (Prev of type 2) The numbers are lower for European countries and many low- and middle-income countries. This is primarily due to diet and lifestyle choices. However due to rapid socioeconomic growth and changes towards a more sedentary lifestyle the number of people diagnosed with diabetes is expected to double by 2045. Socioeconomic growth in countries is often tied to a diet leaning more towards

fast foods and larger consumption of sugar due to more spending money and a lack of time at home for cooking. (D;) There are two types of diabetes, type 1, and type 2. Type 1 diabetes is caused by an autoimmune reaction where the body attacks itself by mistake. The reaction destroys the cells in the pancreas that makes insulin, called beta cells. When the body doesn't have sufficient insulin, the cells do not get the nutrients needed to function. This process can go on for a while without showing other symptoms and the symptoms of Type 1 diabetes often onsets suddenly and sometimes after a viral illness. (CDC) This is not caused by diet or lifestyle choices but is an autoimmune disorder that people are born with. As mentioned before, insulin acts like a key to letting blood sugar into the cells in your body for use as energy. In Type 2 diabetes cells don't respond normally to insulin. Therefore, your pancreas makes more insulin trying to get a response and eventually can't keep up. Then the person's blood sugar rises, and prediabetes begins. This is also known as insulin resistance. High blood sugar is damaging to the body in many ways and can cause many serious health problems. Having diabetes increases the risk of cardiovascular diseases, blindness, renal failure, and lower limb amputation. It can also lead to obesity and decrease the overall quality and duration of life. It leads to more doctor appointments, more hospital stays, more missed days of work and more financial burden on the patients. Type 2 diabetes symptoms take several years to develop. Some people won't notice symptoms for a long time. It usually doesn't start to become an issue until you are an adult, but more children and teens are starting to develop it. Before developing type 2 diabetes, most people have prediabetes or insulin resistance. This is when your blood sugar is higher than the normal range but not high enough for a diabetes diagnosis. (CDC) The CDC reported that 96 million US adults have prediabetes and more than 80% of them do not even know they do. Reports also show that one-third of American youth are overweight which is related to the

increase in kids who have type 2 diabetes. American youth have easier access to food that is unhealthy and lead a more sedentary lifestyle due to the rise in popularity of video games and other forms of online entertainment that are often engaged in while sitting still. There are children as young as 10 years old that have been diagnosed with type 2 diabetes. In years passed it was almost unheard of for children to be diagnosed with type 2 as they were often found to have type 1. This is changing due to lifestyle changes. The burden of diabetes is not only a public health issue but has caused economic consequences. It is expensive to treat diabetes and prices are increasing due to the long-term complications that patients have and newer drug treatment options. Bariatric surgery is becoming more popular for obese patients with type 2 diabetes since it is effective in causing weight loss which effectively treats type 2 diabetes. It wasn't until around the 1980s that the prevention of diabetes, instead of just treatment, began to get attention in the medical field. High blood sugar is damaging to the body in many ways and can cause many serious health problems. Having diabetes increases the risk of cardiovascular diseases, blindness, renal failure, and lower limb amputation. It can also lead to obesity and decrease the overall quality and duration of life. It leads to more doctor appointments, more hospital stays, more missed days of work, and more financial burdens on the patients. Not only is it a financial burden on both patients and on the medical system it is a burden of time on both as well.

The good news is that prediabetes can be reversed, and we are learning more about prevention. Exercise is one of the first management strategies given to patients that have just been diagnosed with type 2 diabetes. Exercise is an essential component of all diabetes and obesity prevention and lifestyle intervention programs. Hippocrates, the father of scientific medicines, was the first physician on record to recognize the value of exercise for a patient with "consumption." (Kirwan, Sacks, & Nieuwoudt, The essential role of exercise in the management of type 2

diabetes, 2017) Adults who maintain a physically active lifestyle can reduce their risk of developing impaired glucose tolerance, insulin resistance, and type 2 diabetes. (ESS. Role) It has also been shown that low cardiovascular fitness is a strong and independent predictor of mortality in patients with type 2 diabetes. Elevated hemoglobin levels are predictive of vascular complications in patients with diabetes, and regular exercise has been shown to reduce HbA1c levels. There was a meta-analysis of 9 randomized trials comprising 266 adults with type 2 diabetes, with patients randomized to 20 weeks of regular exercise at 50% to 75% of the maximal aerobic capacity. They showed improvements in HbA1c and cardiorespiratory fitness. Larger reductions in HbA1c were observed with more intense exercise, reflecting greater improvements in blood glucose control with increasing intensity. (Kirwan, Sacks, & Nieuwoudt, The essential role of exercise in the management of type 2 diabetes, 2017) Exercise also boosts insulin action through short-term effects. Seven days of vigorous aerobic exercise training in adults with type 2 diabetes resulted in improved glycemic control, even without weight changes. In the last 2 decades, resistance training has gained a lot of recognition as a viable exercise training option for patients with type 2 diabetes. Studies showing the effects of resistance training in type 2 diabetes have found improvements that range from 10% to 15% in strength, bone mineral density, blood pressure, lipid profiles, cardiovascular health, insulin sensitivity, and muscle mass. (Kirwan, The Essential Role of Exercise in the Management of Type 2 Diabetes, 2017)Dunstan reported a threefold greater reduction in HbA1c in patients with type 2 diabetes ages 60 to 80 compared with non-exercising patients in a control group. They noted an increase in lean body mass in the resistance training group, while those in the non-exercising control group lost lean mass after 6 months. Weight training also showed to improve glucose and insulin responses during an oral glucose tolerance test. These findings support the use of resistance

training as part of the diabetes management plan. The ADA and ACSM recently updated their exercise guidelines for the treatment and prevention of type 2 diabetes to include resistance training.

Educating people on the prevention of type 2 diabetes will not only help save lives but will increase the quality of life. Increased quality of life leads to many benefits like increasing the workforce. Decreasing cases of type 2 diabetes would mean fewer missed days in both work and school. It would also mean fewer doctor appointments and few hospital visits for people. Chronic conditions like type 2 diabetes, are a major contributor to the costs of health insurance premiums and employee medical claims. (CDC) Often a disease like these costs much less to prevent than it does to treat. If the money spent on treatments for type 2 diabetes was spent instead on education on prevention including exercise and diet the money would be much more suitably invested. The CDC reports that US employers spend 36.4 billion a year because of employees missing days of work. Workplaces can promote and provide programs that protect the health of employees.

CARDIOVASCULAR HEALTH

The leading cause of death in the United States for both men and women is heart disease, and recently regular exercise was promoted as beneficial for attaining physical fitness, desirable body weight, and cardiorespiratory health. (Resistance 209)

As many as 250,000 deaths per year in the United States are attributable to a lack of regular physical activity. There is a higher death rate in those individuals with low levels of physical fitness. In a Copenhagan Male Study conducted between 1970-2001, it was determined that

resting heart rate is both an indicator of physical fitness and an independent risk factor for death. Scientists discovered that a high resting heart rate was indicative of a higher death rate no matter the level of physical fitness. Every 10 - 20 heart beats per minute resting resulted in a 16% increased chance of death. While researchers say more studies need to be conducted on the link between heart rate and death, they maintain that an exercise routine should be a top priority for everyone. (CBS Resting Heart Rate). A moderate exercise routine is beneficial in strengthening the heart muscle and lowering heart rate and blood pressure. This exercise doesn't have to be high impact. Even midlife increases in physical activity, through a change in job or recreational activities, are associated with a decrease in mortality. Despite the information, most adults in the United States remain effectively sedentary. Less than one-third of Americans meet the minimal recommendations for activity. (ahajournals.org) There have been many scientific reports over the last few decades examining the relationships between physical activity, physical fitness, and cardiovascular health. Expert panels from organizations such as the Center for Disease Control and Prevention, the American College of Sports Medicine, the American Heart Association, and the US Surgeon General's Report on Physical Activity and Health, reinforced scientific evidence linking regular physical activity to various measures of cardiovascular health. It was evident in these reports that more active or fit individuals tend to develop less coronary heart disease (CHD).

A sedentary lifestyle is one of the 5 major risk factors for cardiovascular disease. Reducing these risk factors decreases the chance of having a heart attack or experiencing another cardiac event, such as a stroke, and reduces the possibility of needing bypass surgery. Regular exercise has a favorable effect on many of the risk factors for cardiovascular disease. Exercise promotes weight reduction and can help reduce blood pressure. Exercise can also reduce bad cholesterol levels in

the blood as well as total cholesterol and can raise the good cholesterol. Many of the other risk factors such as age, race, and family history cannot be controlled or changed by a person. Sedentary lifestyle is one that can be easily changed with minor changes to one's daily routine. Resistance training fits into these changes easily as it can be performed at home or at a gym. With anywhere from the simplest of equipment up to the most expensive machine at the gym. Even small changes such as lifting dumbbells when you wake up in the morning can significantly lower your risk factors. Exercise can also lower blood pressure by 5 - 8 mm Hg. Resistance training can help prevent elevated blood pressure from turning into hypertension and can lower hypertension to safer levels. Mayo Clinic recommends including strength training into your routine at least two days a week to help maintain or lower blood pressure. (Mayo Clinic 10 Ways to Control Blood Pressure).

There are many physiological benefits of exercise, and two examples are improvements in muscular function and strength and improvement in the body's ability to take in and use oxygen. As one's ability to transport and use oxygen improves, regular daily activities can be performed with less fatigue. This is especially important for patients with cardiovascular disease, whose exercise capacity is typically lower than that of the healthy person. Therefore, starting with a strength training program that is easy to maintain is important for those looking to improve their cardiovascular health. Starting with lighter weights and less reps can help the person work up to their max weight and reps slowly and safely while not tiring them so much that they give up on the routine. The general advice is to start with a single set of eight to twelve repetitions and build up to three sets over time. (Health.Harvard.Edu) This is important for seniors who are working with trainers either on their own or in coordination with their medical team. There is also evidence that exercise training improves the capacity of the blood vessels to dilate in response to

exercise or hormones, consistent with better vascular wall function and an improved ability to provide oxygen to the muscles during exercise. (ahajournals.org) Patients that are newly diagnosed with heart disease and who start an exercise program report an earlier return to work and improvements in other measures of quality of life. The death rate is reduced by 20% in people that have had heart attacks when they begin an exercise regimen. The Surgeon General's Report and a National Institute of Health report agreed that the benefits will occur if the individual participates in at least 30 minutes of modest activity on most days of the week. Modest activity is defined as any activity that is similar in intensity to brisk walking at a rate of 3 to 4 miles per hour. A study of 4000 adults concluded that static strength training had stronger links to reduced risks of cardiovascular disease than dynamic activities such as brisk walking. (Medical News Today).

A person does not need to be an Olympian or a marathon runner to derive significant benefits from resistance training. The greatest gains in terms of mortality are achieved when an individual goes from being sedentary to becoming moderately active. Guidelines recommend that adults should be active for 150 minutes a week with the greatest benefits seen with 300 minutes of activity a week (Medical News Today). However, even a slight change in lifestyle that leads to a person no longer being sedentary can have significant health benefits. Adults who simply choose to sit less can improve their health. Strength training is especially beneficial to women of menopausal age. Menopause and aging may lead to a loss in fitness, a decrease in muscle strength and bone mineral density, and a gain in weight all of which can increase the risk for cardiovascular disease. A study conducted by Shaw et al. concluded that resistance training can be beneficial for cardiovascular health and the prevention of the loss of muscle mass and other physical changes often seen with menopause. The authors demonstrated that 8 weeks of

resistance training only twice per week for approximately 40 minutes at 67% to 85% of a 1-RM could lead to cardiovascular health benefits in postmenopausal women. (Duck Chu Lee) It is imperative that women in this age range not get discouraged and stop their resistance training program because they don't see weight loss on the scale as often weight loss is very hard to achieve at this age due to hormonal changes. Muscle mass declines between 3% and 8% each decade after age 30 and with a proper strength training routine gaining muscle mass could also mean gaining weight. The randomized 6-week intervention study conducted by Shaw using resistance training vs control group showed that participants had substantial improvements with performing resistance training only two times per week for 40 minutes at 67% to 85% of their 1 repetition max. On completion of the 6-week program, the individuals in the resistance training group saw improvements in resting heart rate, both systolic and diastolic blood pressure, waist circumference, muscle mass, and body fat percentage. (Duck Chu Lee) Resistance training isn't only beneficial for older women though it is beneficial for the cardiovascular health of seniors of any gender. Aging is associated with a decline in the cardiovascular system, therefore, leading to a decline in cardiovascular health. Heart failure is a common condition that can come with a decline in the cardiovascular system. Studies have shown that resistance training can improve muscle strength and physical function in patients with heart failure. Resistance exercise training represents an ideal intervention to redress these deficits since its effects on skeletal muscle are thought to be imparted through modulation of myofilament protein metabolism (Hasten et al. 2000; Balagopal et al. 2001).

STRENGTH TRAINING AND HYPERTENSION

Hypertension is otherwise known as high blood pressure. This means that the arteries (blood vessels that carry blood away from the heart) have elevated blood pressure through them. When pressure is higher in the arteries it requires the heart to work harder to circulate blood throughout the body. The WHO/ISH recommended guidelines for a normal blood pressure reading is below 120/80. (GPickering) Hypertension is a chronic disease that affects a large section of the population and is one of the leading causes of death worldwide. Hypertension is a risk factor for many other diseases such as stroke, heart attacks, heart failure, atherosclerosis, and renal failure. In the United States about 33% of the general population is considered hypertensive. Because hypertension is often without symptoms this number is probably vastly under the actual amount. As we age our chances of becoming hypertensive increase but due to a sedentary lifestyle, obesity, and genetics hypertension is not just a problem for the elderly it can also affect young adults and even sometimes children. Childhood obesity is the number one indicator of hypertension in childhood and adolescence. As we age hypertension also becomes harder to treat and more resistant to standard pharmacological treatments. Often a person must take a combination of two or more drugs that each have side effects to maintain healthy blood pressure when they are elderly. (Cheung et al.) These drugs often come with side effects that can be so bothersome that people simply stop taking their medications. This is especially true with blood pressure because often the side effects of the drugs are worse than the nonexistent symptoms of high blood pressure.

In 1986 the WHO put out a tentative statement that said that exercise was beneficial to mild hypertensives. In 1991 the World Hypertension League published a paper stating that the inclusion of exercise programs was beneficial in preventing hypertension. In 1992 the WHO recommended regular mild exercise to prevent hypertension. In 1993 this was followed by a memorandum that read "it appears reasonable to advise that efforts to lower blood pressure by lifestyle modifications, including exercise, should normally proceed any decision about the necessity of drug treatment of mild hypertension" (Baak) The US National Committee on the Detection, Evaluation, and Treatment of High Blood pressure as well as the American College of Sports Medicine both recommend exercise as a means to reduce the incidence. (Baak) Resistance training is a way to help treat hypertension with no ill side effects. Blood pressure is much easier to control while a person is young so it serves to realize that diet and lifestyle changes including a steady program of resistance training can and should be used to prevent or reverse hypertension as soon as it's diagnosed. Because hypertension is part of the metabolic system it is important to recognize that in many people obesity is the underlying cause. In young people 30 and under it is now recommended by some doctors that lifestyle changes be implemented before any drugs are tried to treat hypertension. This is very important because it not only allows the person to be in control of their own treatment it is often much less cost-restrictive than pharmaceutical treatments. Resistance training included as a habitual exercise program has been shown to reduce blood pressure in hypertensive patients. This was found to be true in both obese and not obese patients.

ELDERLY PATIENTS

Worldwide about 3.2 million deaths a year can be attributed to inactivity according to the WHO. However, studies show a strong inverse relationship between physical activity and mortality. Even with this knowledge, over 60% of Americans over 50 fail to perform the needed amount of exercise. (Taylor) Despite advances in medicine and social conditions, longer life expectancy has not been matched with increased health. (Lorito). The disuse of skeletal muscle is often a primary cause of decreasing physical health in the elderly. This loss of muscle mass often leads to lower functional ability in everyday life and high rates of falls, doctor's visits, outpatient surgeries, and even hospital admissions in senior citizens. Because loss of muscle mass equals a loss of strength, many elderly people lack the ability to complete everyday tasks like carrying groceries, doing yard work, or sometimes even caring for themselves properly. This can lead to a lack of freedom and an increased dependency on others which can greatly impact mental health. Many times, this loss of muscle mass is caused by a sedentary lifestyle. Sometimes the person leads this type of lifestyle due to a simple lack of motivation or feeling like they no longer have anything to contribute to the world. Other times this lifestyle is forced upon the patient because of other health conditions that make them tired or unable to be as active as they would like to be. Either way resistance training can be very beneficial. If it's the former, resistance training can help improve mental health as mentioned in the above paragraphs and if it's the latter it has been noted that resistance training can help improve many different health issues that occur later in life. Studies have shown that for older adults participating in an exercise program can decrease functional limitations as well as functional disability by as much as 30% - 50%. Not only does resistance training decrease limitations but it also slows the progression of functional decline. (Taylor). As previously mentioned, resistance training can be done in many different settings with many different types of tools, so it is often the easiest form of exercise for elderly

patients to perform. In previous years resistance training often was not recommended by doctors for elderly patients because of the implied danger of a rise in blood pressure that was associated with lifting heavy weights. The main concern was that isolated incidents of raised blood pressure could cause more ischemic events in the elderly who may already have other conditions that make them more predisposed to these events. However, recent studies have shown that resistance training is less hazardous in this area than was once presumed. Tests performed on 37 Italian women measured both blood pressure responses and electrocardiographic responses during single arm curls and single and double leg lifts at different percentages of one repetition max did not reveal any clinically significant results that showed a raise in blood pressure or an occurrence of any other heart-related events. Only when subjects were asked to do multiple reps at max weight did the results show any alarming rise in blood pressure. Therefore, it has been shown that resistance exercise done at light to moderate levels is safe for elderly patients and presents them with no greater risk of ischemic events than any other exercise. (Sagiv)

Not only has resistance training shown to be beneficial in the elderly to help prevent the loss of skeletal muscle, but it has also been shown to provide benefits of improving mental health and cognitive skills. A study conducted on 36 elderly people with a mean age of 73 years showed that resistance training both lessened anxiety and improved memory recall of the study participants. The study group performed exercises once a week which included a 10-minute warm-up and 8 different resistance exercises on machines. Participants in the group showed a considerable amount of less self-attentive thoughts after the process which led to a lower amount of anxiety. These participants seemed to be less concerned about their future and more open to enjoying new experiences. The researchers also found significant changes in pre-test and post-test free recall and recognition in the training group. It is not known if the experience of the

exercises doing themselves lead to these changes or if the positive physical changes that resulted from the exercises caused the group to have positive mental changes but either way resistance training did show to have a beneficial mental result when done by the elderly training group. (Krings)

The primary care physician plays a huge role in incorporating resistance training into the everyday routine of elderly patients. Because older adults have higher rates of disease and disabilities, they tend to have a relatively higher rate of attendance in their physician's office. Because they are seeing their physicians more often it is important for those physicians to understand the role that resistance training can have in improving their patients' lives. Older adults who receive physical activity advice from their primary care providers participated in more and higher intensity exercise programs than those who did not receive any advice. One study showed that 95% of elderly participants had seen their physicians in the past year but only 62% had received advice about resistance training or any other exercise from their physicians. (Taylor).

Because populations in industrialized countries are increasing in average age, many governments around the world are facing the problem of how to keep an aging population healthy. Over the past 50 years, the number of adults aged 65 and over has tripled. By 2050 it is estimated that senior citizens will represent 25% of the world's population. (Lorito) Many have begun to issue guidelines on maintaining health and physical activity at an advanced age. The big challenge is not only finding ways to incorporate exercise, specifically resistance training into their daily routines but also how to provide the support and education needed so that they can successfully maintain the routine so that they can continue to benefit from it. Some governments are finding

that the challenge cannot lie solely on the shoulders of primary care physicians and have started incorporating exercise specialists or physiotherapists into the general care team. (Taylor).

CANCER

Cancer is a disease in which some of the body's cells grow uncontrollably and spread to other parts of the body. The disease can almost start anywhere in the human body. There are more than 100 types of cancer, and they are usually named after the organs.

Exercise is proven to have many benefits and another one of them is that by engaging in regular exercise, you can lower your risk of getting cancer. According to the American Cancer Society, getting more physical activity is associated with a lower risk for several types of cancer, including breast, prostate, colon, endometrium, and possibly pancreatic cancer. (Cancer.org) The physical activity guidelines for the U.S. Department of Health and Human Services (USDHHS) recommend that adults perform muscle-strengthening activities at least 2 days per week for health benefits. Strength training can help regulate some hormones that contribute to the development of cancer and keep the immune system healthy. Being overweight or obese is a factor in an estimated 14% to 20% of cancer deaths in the US. (Cancer.org) By losing weight through resistance training or any exercise you reduce the risk.

A study examined weight training in relation to the risk of the 10 most common cancer types in the National Institutes of Health (NIH)-American Association of Retired Persons (AARP) Diet and Health Study. The goal was to determine the cancers associated with weightlifting and if they varied by age, sex, and body mass index. The hypothesis was that weightlifting would be associated with lower risks of at least some types of cancer. During up to 10 years of follow-up, they ascertained 23,346 cases of total cancer. 1715 was colon cancer. 851 were kidney cancer,

1836 were bladder cancer, 3288 were breast cancer, 3480 were lung cancer, 1187 were Non-Hodgkin's Lymphoma, 795 were pancreas cancer, 7213 were prostate cancer, 527 were rectum cancer, and 2454 were melanoma. Approximately 25% of participants reported weightlifting. In multivariable models, weightlifting was associated with lowering the risk of colon cancer and kidney cancer. Strength training promotes greater muscle gain and is important for maintaining glucose homeostasis, an important contributor to increased colon cancer. At the molecular level, strength training is an activator of mTOR, a known regulator of cell growth and metabolism often dysregulated during cancer progression. (Bottaro)

In a study performed in Colorado of 20 females ranging in age from 40 - 70 who were newly diagnosed with breast cancer researchers attempted to determine if strength training is beneficial to helping breast cancer patients fight fatigue. The research focused on resistance training instead of aerobic training because resistance training is the type of exercise that promotes the most changes in muscular strength. The women performed 8-12 different exercises at 40% - 60% of their max weight and reps. At the end of the study the exercise group had experienced a 10% increase in muscle mass while a slight decrease was indicated in the control group who performed no set exercise routine. A significant decrease of fatigue was noted in the exercise group. This is important because fatigue is the most reported symptom of cancer treatment. (Battaglini et al., 2006)

HEALTH CARE COST SAVINGS

It is well known that preventing disease and disability saves cost over treating them. As mentioned previously in the paper, strength training can benefit people by lowering their risks of many long-term diseases and disabilities. In the United States along physical activity levels below the current recommended guidelines are associated with approximately $117 billion dollars of healthcare expenditures. (Coughlan, Saint-Maurice, Carlson, Fulton, & Matthews, 2021) The rising cost of healthcare, especially for the treatment of chronic illness, means that we must evaluate whether strength training can benefit people by lowering their long-term healthcare costs. Previously it was noted that the average gym membership is $600 a year, however it was also noted that strength training is a program that can easily be done at home with items that can be purchased at a very economical cost.

One area that strength training can be established as a money saving program is in the workplace. Many companies have discovered the benefit of having onsite gyms or providing their employees with discounted rates to local gyms. The workplace is often an ideal setting for engaging in a long-term strength training regimen as it is easier to incorporate a new routine into an already existing routine such as getting dressed and going to work each day. People are more apt to participate once they are already at a location and don't have to go out of their way to visit the gym. A study performed in Mexico on a group of 425 university employees showed that if sedentary employees participated in some type of exercise program it not only reduced their rates of hypertension and diabetes but also reduced the cost of their healthcare total by $138,000 annually. The study showed that for every dollar invested in the program by the company they

saved 5.3 dollars on healthcare costs. (Mendex-Hernandez, Dosamentes-Carrasco, Siani, Yvonne).

Another area that could be explored is government programs that include gym membership or some form of strength training exercise funding. A study on a large sample of United States citizens on Medicare found that physical activity during early and middle age was associated with lower late life healthcare costs. This study proved that adults who had maintained a high-level physical activity program had healthcare costs that were 15.9% lower. Adults who maintained a moderate-level physical activity program had costs that were 14.1% lower. Adults who increased physical activity levels in early adulthood and maintained it throughout life had a cost reduction of 22.5% and even adults who didn't increase activity until late middle age had a cost reduction of 9.7%. Adults who increased their physical activity in later years still showed a reduction of 2.4%. These statistics are compared with adults who were consistently inactive. A 14 - 22% reduction in health care costs across the board for Medicare (Coughlan, Saint-Maurice, Carlson, Fulton, & Matthews, 2021) Medicare spending grew 3.5% in 2020 to total of $829.5 billion. (*Nhe fact sheet*) Cutting this spending by 22% across the board would mean a savings of $182.4 billion. This money saved by Medicare could be used by the government to fund more broad preventative measures including strength training programs. It is safe to assume that prescription drug spending would also be lowered, contributing even more funds to the government's ability to support strength training programs as preventative medicine.

CONCLUSION

As we are learning more and more about how movement is important to health and longevity of life it is important to understand how strength training has been proven to not only prevent many chronic diseases but also slow the progression and reduce symptoms of these same conditions. It is beneficial to all people no matter their age, race, or gender. Resistance training has been used by people since the beginning of recorded history to not only make their daily lives easier but also as a form of entertainment. From early man to current day resistance training has remained an easily modified and achievable form of exercise. As we have discussed, strength training can be done in the privacy of one's own home or in a gym space solely dedicated to exercise. Many different pieces of equipment are used from simple dumbbells to intricate expensive pieces of machinery. Although there are many noted barriers to resistance training including: time, money, knowledge, and the perception of beauty it has proven to be beneficial time and time again. There are modifications that can be used to help to overcome those barriers.

It is clear that a long-term program of resistance training has many health benefits. It is beneficial to people, especially women with osteoporosis. Studies showed that not only can it prevent further bone loss, but it can actively fight it by increasing bone mass density in some areas. This not only lowers the medical bills of patients fighting this disease but also allows them to live life more fully and be more independent.

Resistance training is also beneficial to women dealing with reproductive issues. A program including strength training has been shown to lower glycemic index and relieve other symptoms of PCOS which is one of the most common reproductive issues affecting women in America. Therefore, it is an effective first line treatment for the syndrome. Endometriosis patients can also benefit from resistance training. Resistance training has shown to help lower the pain of women

suffering from this disease and helps to lower inflammation markers. Therefore, more doctors are starting to recommend an exercise program heavy on resistance training to their patients suffering from endometriosis.

It is clearer than ever that resistance training is beneficial for improving mental health symptoms and helping patients to fight depression and anxiety. It has long been known that movement helps mental health, even from the time of Hippocrates when he said “walking is man’s best medicine” until now when studies have shown that people who perform a small amount of resistance training weekly have a lower rate of depression and anxiety. It is also beneficial to children who have been diagnosed as neurodivergent and helps to improve their quality of life. Because of these findings many mental health care providers are starting to push for a reform that includes physical exercise to be implemented even before talk therapy.

Diabetes is a disease that can be drastically improved by implementing and maintaining a resistance training program. The number of diagnosed patients with Type 2 diabetes has drastically risen in the past 10 years with one of the greatest increases being noticed in people under 20 years of age. Resistance training has been shown to lower blood sugar levels and glycemic index in patients diagnosed with diabetes and also to do the same for those only diagnosed with pre-diabetes and prevent the disease from progressing even if the patient doesn’t show substantial weight loss.

Hypertension, also known as the silent killer, is an epidemic in the United States. Hypertension is a risk factor in many other heart-related issues including heart attack, stroke, and heart failure as well as kidney failure. Unfortunately, approximately 33% of adults in the United States are estimated to be hypertensive. In many people, (Nenad Stojiljkovie) obesity is the underlying

cause of hypertension. For this reason, resistance training is beneficial to lowering blood pressure. When patients can lower their blood pressure with simple exercise this saves them from having to take what is often a combination of expensive medications to try to treat the disease.

Elderly is the group that could possibly reap the largest benefit from resistance training. As the WHO has released studies that correlate inactivity with mortality it is known that remaining active is imperative for a long life. Often aerobic exercise is too strenuous on elderly people so they turn to resistance training because the program can be modified to fit their ability. Not only has resistance training been shown to increase the physical aspect of life for the elderly population it has also been shown to improve mental clarity, improve recall and lessen anxiety. It allows them to remain independent longer which leads to greater quality of life. Because the elderly has a higher rate of seeing their primary care physicians it would be helpful if these physicians could educate them about the benefits of resistance training.

Cancer is another disease that can not only be prevented but also managed with resistance training. The American Cancer Society has reported that a more active lifestyle is associated with lower risk of many common cancers. Weightlifting specifically has been reported to be associated with lower risks of colon and kidney cancers. Resistance training has also been proven to lower fatigue levels in patients with breast cancer.

Not only has resistance training proven to be beneficial in preventing, treating, and improving symptoms of many common diseases, it also is beneficial in saving money for individuals, companies, and the government. One study at a Mexican university showed that for every dollar invested in exercise programs for their employees they saved 5.3 dollars in healthcare. Another study conducted on Medicare recipients showed that adults who started resistance training in

early life and maintained it throughout their lifetime had 22% lower health care costs than sedentary adults. This could potentially equal billions of dollars saved by the government on health care that could be invested in preventative care measures.

All research points to a clear conclusion that implementing and maintaining a resistance training program is not only beneficial to the individual performing the exercise, but also to society as a whole. Moving forward, the medical community and the government should focus more on funding the education of physicians and mental health providers as well as the average citizen on how resistance training can be beneficial. Further research should be done on how resistance training benefits other common diseases that plague society and on how the lives of everyone can benefit from participating in a resistance training program.

References

"Lifestyle Change Program Details." *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 27 May 2022, https://www.cdc.gov/diabetes/prevention/lcp-details.html.

D;, Al Busaidi N;Shanmugam P;Manoharan. "Diabetes in the Middle East: Government Health Care Policies and Strategies That Address the Growing Diabetes Prevalence in the Middle East." *Current Diabetes Reports*, U.S. National Library of Medicine, https://pubmed.ncbi.nlm.nih.gov/30715611/.

Uusitupa, Matti, et al. "Prevention of Type 2 Diabetes by Lifestyle Changes: A Systematic Review and Meta-Analysis." *Nutrients*, vol. 11, no. 11, 2019, p. 2611., https://doi.org/10.3390/nu11112611.

Galaviz, Karla I., et al. "Lifestyle and the Prevention of Type 2 Diabetes: A Status Report." *American Journal of Lifestyle Medicine*, vol. 12, no. 1, 2015, pp. 4–20., https://doi.org/10.1177/1559827615619159.

Kraemer, William J., et al. "Understanding the Science of Resistance Training: An Evolutionary Perspective." *Sports Medicine*, vol. 47, no. 12, 2017, pp. 2415–2435., https://doi.org/10.1007/s40279-017-0779-y.

Kirwan, John P., et al. "The Essential Role of Exercise in the Management of Type 2 Diabetes." *Cleveland Clinic Journal of Medicine*, vol. 84, no. 7 suppl 1, 2017, https://doi.org/10.3949/ccjm.84.s1.03.

Westcott, Wayne L. "Resistance Training Is Medicine." *Current Sports Medicine Reports*, vol. 11, no. 4, 2012, pp. 209–216., https://doi.org/10.1249/jsr.0b013e31825dabb8.

Huovinen, Ville, et al. "Bone Mineral Density Is Increased after a 16-Week Resistance Training Intervention in Elderly Women with Decreased Muscle Strength." *European Journal of Endocrinology*, vol. 175, no. 6, 2016, pp. 571–582., https://doi.org/10.1530/eje-16-0521.

Kerr, Deborah, et al. "Resistance Training over 2 Years Increases Bone Mass in Calcium-Replete Postmenopausal Women." *Journal of Bone and Mineral Research*, vol. 16, no. 1, 2001, pp. 175–181., https://doi.org/10.1359/jbmr.2001.16.1.175.

Petranick, Kimberly, and Kris Berg. "The Effects of Weight Training on Bone Density of Premenopausal, Postmenopausal, and Elderly Women." *Journal of Strength and Conditioning Research*, vol. 11, no. 3, 1997, pp. 200–208., https://doi.org/10.1519/00124278-199708000-00012.

Zehnacker, Carol Hamilton, and Anita Bemis-Dougherty. “Effect of Weighted Exercises on Bone Mineral Density in Post Menopausal Women a Systematic Review.” *Journal of Geriatric Physical Therapy*, vol. 30, no. 2, 2007, pp. 79–88., https://doi.org/10.1519/00139143-200708000-00007.

“Department of Health.” *The Facts About Osteoporosis*, https://www.health.ny.gov/publications/2047/index.htm#:~:text=Osteoporosis%20is%20a%20major%20public%20health%20threat%20for,and%20women%20have%20osteoporosis%20or%20low%20bone%20mass.

Coughlan D;Saint-Maurice PF;Carlson SA;Fulton J;Matthews CE; “Leisure Time Physical Activity throughout Adulthood Is Associated with Lower Medicare Costs: Evidence from the Linked NIH-AARP Diet and Health Study Cohort.” *BMJ Open Sport & Exercise Medicine*, U.S. National Library of Medicine, https://pubmed.ncbi.nlm.nih.gov/33768963/.

Physical Activity and Reduced Risk of Depression Results of a ... https://www.researchgate.net/profile/Pablo-Mendez-Hernandez/publication/230795568_Physical_Activity_and_Reduced_Risk_of_Depression_Results_of_a_Longitudinal_Study_of_Mexican_Adults/links/583d155308ae3cb6365616f9/Physical-Activity-and-Reduced-Risk-of-Depression-Results-of-a-Longitudinal-Study-of-Mexican-Adults.pdf.

Masterdaniel. “Personal Trainer for the Disabled - How to Find One with the Right Certification.” *Special Strong*, Special Strong, 11 Dec. 2020, https://www.specialstrong.com/personal-trainer-for-the-disabled-how-to-find-one-with-the-right-certification/.

Bottaro, M., et al. “The Effects of Physical Exercise on Cancer: A Review: Semantic Scholar.” *Undefined*, 1 Jan. 1970, https://www.semanticscholar.org/paper/The-effects-of-physical-exercise-on-cancer%3A-a-Bottaro-Battaglini/dbb8a767a0437df1e8b607d6dff4a9e9ab1711c7.

Unit, 1Bone Metabolism. “The Effects of Weight Training on Bone Density of... : The Journal of Strength & Conditioning Research.” *LWW*, https://journals.lww.com/nsca-jscr/Abstract/1997/08000/The_Effects_of_Weight_Training_on_Bone_Density_of.12.aspx.

“Latest Releases.” *U.S. Bureau of Labor Statistics*, U.S. Bureau of Labor Statistics, 11 Aug. 2022, https://www.bls.gov/bls/newsrels.htm.