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The Effects of Exercise on Mental Health: A Research Review

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The majority of people know that exercise and physical activity are key parts in maintaining physical health, but what about mental health? Exercise can be defined as "bodily or mental exertion, especially for the sake of training or improvement on health" (Dictionry.com), while physical activity, according to the U.S. Department of Health & Human Services, is "any body movement that works your muscles and requires more energy than resting" (NIH). "Mental health, according to the U.S. Department of Health and Human Services, can be defined as "our emotional, psychological, and social well-being. It helps determine how we handle stress, relate to others, and make choices" (MentalHealth). However, discussing mental health publicly, is still something that is considered taboo. The Guardian, a British based publication, conducted a study with 2,000 people and found that 30% believed it would be "difficult to admit publicly to having a mental illness" and that "admitting to a mental health condition is harder than confessing to having a drinking problem, going bankrupt, or coming out as gay." The Guardian also reported that people are "four times more likely to break off a romantic relationship if their partner is diagnosed with severe depression than if they develop a physical disability" (O'Hara). This news is shocking and saddening because having a mental health condition is something that should not be shameful, especially when something as simple are physical activity can have a positive effect.

It is important to understand how exercise affects children, adults, and senior citizens, as well as those with certain medical conditions. Physical activity is extremely beneficial throughout the lifespan and has a positive impact on the entire human body, including the mind.

Millions of people in the United States of America have been diagnosed with some type of anxiety or depressive disorder, while millions more have some other type of mental illness.

The statistics in America according to the Anxiety and Depression Association of America are listed in Table 1.1.

Type of Anxiety Disorder	Number of People Affected
Generalized Anxiety Disorder (GAD)	6.8 million
Panic Disorder (PD)	6 million
Social Anxiety Disorder	15 million
Specific Phobias	19 million
Obsessive-Compulsive Disorder (OCD)	2.2 million
Posttraumatic Stress Disorder (PTSD)	7.7 million
Major Depressive Disorder	16.1 million
Persistent Depressive Disorder	3.3 million

Table 1.1

The statistics in America according to the National Institute of Mental Health for children and youth with mental illness are listed in Table 1.2.

Problem	Percentage of Children Affected
Mental health condition	20%
Behavior or Conduct Disorder	10%
Anxiety Disorder	8%
Mood Disorder	11%

Table 1.2

It should also be noted that “70% of children in state and local juvenile justice systems have a documented mental illness” (NAMI).

When it comes to other mental illness, it is more than just anxiety and depression. In the United States, approximately 1 in 5 adults experience mental illness each year. That would be 43.8 million Americans, or 18.5% of the country. 1.1% of adults in America have been diagnosed with schizophrenia, 2.6% of adults have bipolar disorder, and 4% of adults have a serious mental illness that “substantially interferes with or limits one or more major life activities.” In addition to that, it has been found that African-Americans and Hispanic Americans are less likely to seek out help from mental health services than Caucasians or Asian-Americans (NAMI).

When it comes to suicide, the numbers are shocking. Between 18 and 22 veterans commit suicide daily in the United States due to posttraumatic stress disorder, depression, or some other type of mental condition. For children, over 90% that commit suicide have been diagnosed with a mental health condition (NAMI).

Another unfortunate part of mental conditions is that all of the above listed disorders can be associated with a "co-occurring disorder or physical illness which can make their symptoms worse and recovery more difficult." Some of these illnesses are eating disorders, headaches, irritable bowel syndrome (IBS), sleep disorders, stress, body dysmorphic disorder (BDD), among others (ADAA). Body dysmorphic disorder will be discussed shortly. It has also been found that children who go untreated for their mental illness are "at higher risk to perform poorly in school, miss out on important social experiences, and engage in substance abuse" (ADAA).

A less thought about side effect of mental illness is the economic impact. In 2006, it was reported by the Agency for Health Care Research and Quality that mental health care costs in the United States totaled $57.5 billion. Also, in 2009, the Substance Abuse and Mental Health Administration "estimated that the U.S. national expenditure for mental health care was $147 billion. Lastly, when combining lost earnings/wages and "public disability insurance payments associated with mental illness", it was estimated that mental disorders totaled $467 billion in America in 2012 (Insel). Insel, a former employee of the Centers for Disease Control and Prevention (CDC), states that "most of the economic burden of mental illness is not the cost of care, but the loss of income due to unemployment, expenses for social supports, and a range of indirect costs due to a chronic disability that begins early in life." "According to the World Economic Forum, the costs for mental disorders were greater than the costs of diabetes, respiratory disorders and cancer combined" (Insel). The World Health Organization (the WHO),

estimated that the amount of money spent on mental health care internationally totaled $2.5 trillion in 2010 and is expected to cost over $6 by 2030 (Insel).

Mental disorders not only affect how a person acts or reacts in certain situations, but can unfortunately reduce years of living. Again, the WHO has found that “mental illnesses are the leading causes of disability adjusted life years (DALYs) worldwide, accounting for 37% of healthy years lost” (Insel). DALYs can be defined as “a measure of overall disease burden expressed as the number of years lost due to ill-health disability or early death” (Disabled World).

One of the co-occurring conditions mentioned previously was body dysmorphic disorder, also known as BDD. BDD, according to the Mayo Clinic, is “a mental disorder in which you can’t stop thinking about one or more perceived defects or flaws in your appearance, a flaw that, to others, is either minor or not observable.” Some symptoms of BDD include “intensely obsessing over your appearance and body image, repeatedly checking the mirror, and grooming or seeking reassurance.” This condition most often begins to develop in a person’s teenage years and affects both males and females equally. However, in males, it is more common that they have “an obsession that body build is too small or not muscular enough (muscle dysmorphia). As of now, there are no known causes of body dysmorphic disorder. Researchers believe it could be the result of a combination of factors, such as “abnormalities in brain structure or neurochemistry, genes, and life experiences.” When it comes to complications of BDD, they are pretty much the same as every other anxiety disorder. There is an increased chance that the sufferer could have suicidal thoughts or behavior, engage in substance abuse, have eating disorders, or a number of other problems (Mayo Clinic).

Recently, there has been a “new” compulsive, mental condition that is directly related to physical activity being researched, and that is exercise addiction. Exercise addiction can be defined as “the repetition of a behavior past the point where it becomes self-injurious; in exercise, refusing to stop or even limit your regime when you’ve got an injury; can also mean exercising at inappropriate times” (Allen). It has been found that 10% of high-performance runners can be classified as exercise addicts. While exercising has many incredible benefits, there is such a thing as too much. Too much exercise can lead to serious injuries, exhaustion, stress on the body, depression, and in some very serious cases, suicide. Perfectionists are the group of people that are most likely to become addicted because of their constant need to be the best at everything they do. It is a personality trait that can work in a person’s favor or against them. This, unfortunately, can cause long lasting physical harm to the body. A sport psychologist at the University of Birmingham in England, Ian Cockerill, explains that “healthy exercisers organize their exercise around their lives, whereas dependents organize their lives around their exercise.” There isn’t much known about exercise addiction, but there have been some treatment plans. Some suggestions to treat this condition are: “encouraging patients to take up more social forms of exercise such as yoga and cycling instead of the solitary pursuits of running and/or going to the gym” (Allen).

Something else that should be noted about exercise addiction is that is has some similarities to drug addiction. They both seem to affect mood, tolerance, and withdrawal the same way, according to Elizabeth Hartney, PhD. Research has shown that exercise addiction affects neurotransmitters and the brain’s “reward system”. It also has been shown that “regular, excessive exercise influences parts of the brain involving dopamine. Like other addictive

substances and behaviors, exercise is associated with pleasure, social, cultural, and sub-cultural desirability" (Hartney).

It could be said that everyone knows exercise helps you stay in shape and maintain or lose weight, but there are also some incredible mental benefits as well. In the article, "*7 Mind-Blowing Benefits of Exercises",* the authors go in to great detail on what exactly exercise can do for the mind and body. Engaging in regular physical activity can "reverse the effects of stress, lift depression, improve learning, build self-esteem and improve body image, leave you feeling euphoric, keep the brain fit, and it may even keep Alzheimer's from developing" (Haupt). On the topic of depression, research has shown that burning just 350 calories three times a week through "sustained, sweat-inducing activity" can reduce the symptoms that a person experiences. Scientists believe that this may be because physical activity can stimulate the growth of neurons in certain parts of the brain that have been affected, or damaged, by depression. In 2010, a yoga based study was conducted and concluded that participating in yoga three times per week increased the participants' level of gamma-Aminobutyric acid (GABA). GABA has the capability to improve someone's mood and decrease anxiety (Haupt).

Exercising can also help improve learning. It can help new brain cells and "establish new connections between brain cells to help us learn." A slightly surprising fact is that playing tennis or taking a dance class have the biggest and best effects on improving learning. This is thought to be because tennis and dance are challenging sports that force the participant to really concentrate on coordination and execution. German researchers did a study on high school students and found that those who participated in just ten minutes of a "complicated" fitness routine scored better on "high-attention tasks" than their counterparts who either participated in ten minutes of "regular" physical activity or didn't partake in any physical activity at all. Their study allowed

them to definitively say that “complicated activities also improve our capacity to learn by enhancing our attention and concentration skills” (Haupt). Something that goes hand-in-hand with improvements in learning is keeping the brain “fit” or “active”. In 2011, Canadian researchers conducted a study on physical activity and cognition. They found that “the most active participants, compared to their sedentary peers, scored significantly better on tests of cognitive function and they showed the least amount of cognitive decline.” This study was published in the Archives of Internal Medicine (Haupt).

Physical activity can also help deter Alzheimer’s disease. The Alzheimer’s Research Center has stated that “exercise appears to protect the hippocampus” which is a major part of the brain affected by the disease. There has been research published in the Archives of Neurology that found jogging, or even walking, every day can lower a person’s risk of developing Alzheimer’s disease. If someone does, unfortunately, become an Alzheimer’s patient, then this daily walk or jog can still help to lessen its impact (Haupt).

It is crucial that Americans know what the recommended amount of exercise is for every age group. According to the American Heart Association (AHA):

> All children age two and older should participate in at least 60 minutes of enjoyable, moderate-intensity physical activities every day that are developmentally appropriate and varied. If the child cannot exercise for a full 60 minutes, try to provide at least two, 30-minute periods, or four, 15-minute periods in which they can engage in vigorous activities appropriate to their age, gender, and stage of physical and emotional development.

The next age group to be considered is adults. According to the American College of Sports Medicine (ACSM):

> Adults should get at least 150 minutes of moderate-intensity cardiorespiratory exercise per week, which can be met through 30-60 minutes of moderate-intensity exercise five days per week, or 20-60 minutes of vigorous-intensity exercise three days a week. Adults also need resistance exercise by training each muscle group two or three days

> each week. Adults also need neuromotor exercise, also known as functional fitness training, which is recommended two or three days each week for 20-30 minutes per day.

Lastly, the older population, or those that are age 65 or older, should follow the same guidelines as adults as long as they are generally fit and have no limiting health conditions (CDC).

Unfortunately, citizens in the United States do not come close to meeting the specified guidelines for physical activity. According to the National Center for Health Statistics, 51.7% of adults over the age of 18 meet the guidelines for aerobic physical activity, while only 21.7% of adults of the age of 18 meet the guidelines for both aerobic and muscle-strengthening activity (CDC).

Starting at an early age, physical activity should be incorporated into children's daily routines. To date, however, there have not been many research studies done on the effects exercise can have on mental health in the younger population. According to the National Institute of Mental Health, 50% of lifetime mental illness cases begin by the early age of 14, and 75% by the age of 24. Also, 50% of students that are 14 and older, that have a mental illness, will drop out of high-school. Lastly, 90% of children that commit suicide had an underlying, undiagnosed mental illness (NAMI).

A previous meta-analysis on the topic showed that "doing physical exercise is an efficient means of boosting positive feelings children have about themselves, especially in children with low self-esteem, or those with a high potential for its development" (Tubic, et al). More results from that same meta-analysis showed that there was a medium-strong correlation between engaging in physical activity and the mental health of children. The three mental health factors that were most heavily impacted by physical activity were anxiety, tension, and

depression. It was also found that physical activity reduces the chances of children having neurotic behavior. This meta-analysis also showed that children between the ages of two and five "sit still, dangle their feet or simply stand for about 60% (36 minutes) of an hour, while moderate walking or fast running was present in 11% (or 7 minutes) of the 60-minute observation period (Tubic, et al).

The first of the two child-centered studies that will be discussed is *"Exercise Effects on Mental Health of Preschool Children"* by Tatjana Tubic and Visnja Dordic. This research was conducted at the University of Novi Sad in Serbia by faculty in the Sport and Physical Education department. The purpose of the research was to "identify effects of a 2.5-year movement program on mental health of preschool children, as measured by reduction in symptoms of externalizing and internalizing behavior by comparing the intervention and control groups." The researchers stated that their hypothesis was "that children from intervention group will express less externalizing and internalizing behavior in comparison to children from control group after the 2.5-year period was completed" (Tubic, et al). The research was conducted using a longitudinal study design, meaning that "repeated observations of the same variables over lengthy periods of time" were taken. There were 184 participants between the ages of five and seven, with 167 being randomly chosen and 17 being "continuously exposed to the intervention movement program." The 167 randomly selected children were not allowed to do any additional exercise outside of what was already included in their kindergarten curriculum. The 17 intervention children participated in "fundamental motor skills, different body shaping exercises, exercises for the correct posture, gymnastic exercises, games, martial arts, dance, outdoor activities, swimming, stretching, and relaxation." These exercises were designed to focus on the children's "discipline, obeying rules, independence, overcoming anxiety, mutual respect and

helping each other, as well as cooperation among all participants." Students in the exercise intervention group participated in the physical activity sessions for 60 minutes, three times a week in groups of 24-30, with three coaches that were supervised by one coordinator. All of the exercises were developmentally appropriate for preschool to kindergarten aged children. They were meant to improve the motor, biological and psycho-social development. All 184 participants were given the Abberant Behavior Questionnaire as a pre- and posttest. The questions from the questionnaire focused specifically on diagnosing whether a child was internalizing or externalizing behavior.

The nine externalizing behavior questions were:

> 1.The child sometimes behaves too aggressively, 2. The child is disobedient, 3. The child argues with other children, 4. The child sometimes fights with other children, 5. The child sometimes snatches other children's toys, 6. The child gets really angry if he/she does not get what he/she wants, 7. It has happened that the child has taken something without permission, 8. When the child is angry he/she yells and throws things around, 9. The child sometimes breaks or smashes his/her toys

The eight internalizing behavior questions were:

> 1.The child is too timid, 2. The child is very weepy, 3. The child is overly withdrawn, 4. The child is rather distrustful, 5. The child gets easily confused when he/she should do something, 6. The child is too shy, 7. The child is too sensitive

The results of this study supported information that was already shown to be true. Playing with children and interacting with them improves their cognitive, physical, social, and emotional well-being. Playing also helps kids "develop fair-play and the skills necessary for taking over leadership and willingness to take over responsibility." "Participating in physical activity also influences the development of cooperation among children, improvement of interaction among children, and reduction of behavioral problems in terms of relationship with others, as well as a decreased of aggressiveness in the interaction" (Tubic, et al). The 17 children in the exercise intervention program expressed feeling like they were more successful and that they felt more

appreciated and respected by their teachers and peers. They also believed being successful in their exercise program made them more popular amongst the other students. The experimental group of 17 also reported that there was a significant reduction in the externalizing behaviors from the Abberant Behavior Questionnaire, however, the exercise intervention did not have as much of an impact on the internalizing behaviors. The group of 167 students that did not participate in the intervention program showed no significant improvement with externalizing or internalizing behaviors from the pre- to the posttest. Regular physical activity and play that is developmentally appropriate could serve as a preventative measure when it comes to externalizing behaviors. There was a significant reduction of "problem behavior" once the children began the exercise intervention. The researchers concluded that "physical activity contributes to the development of prosocial behavior and the reduction of antisocial one" and that "planned and regular physical activity on mental health must not be overlooked" (Tubic, et al).

The second research study being discussed that focused solely on children is *"Depression and Body Image in Children: Is Physical Activity Beneficial and how it this Translated into Clinical Practice? Lifestyle of our Kids Study"* by I. Olive, D. Byrne, R. Cunningham, and R. Telford. The purpose of this study was "to examine longitudinal relationships of children's body image and depressive symptoms with physical activity, fitness and fatness to determine their effect of mental health in children" (Byrne, et al). It is known that depression and "dysfunctional body image" in child can induce anxiety, eating disorders, obesity, insulin resistance and metabolic syndrome. This study featured 723 children from Lifestyle of our Kids (LOOK). The children were given questionnaires about their perceived body image and perceived stress level. Their physical activity level was measured using pedometers, their fitness level was measured

using the shuttle run, and their body fat percentage was calculated using duel-energy x-ray absorptiometry (DEXA) scans. All this information was collected first at 8 years old, then again at the age of 12. The results from this research showed that in both boys and girls, any increase in body fat percentage, having a lower fitness level and a low physical activity level was associated with increased body dissatisfaction and depression (Byrne, et al). While physical activity is effective in reducing symptoms associated with depression, it had no significant effect on decreasing body dissatisfaction. Another finding was that the more cardiovascular fitness a participant had, the less likely they were to suffer from depression and/or body image problems. The participants' body composition was not relevant. These researchers concluded that "participation in regular physical activity may serve to protect against depression and body image disturbance" and "increased fitness and increased physical activity may be an affective target in the treatment of mild mental health disturbances among children" (Byrne, et al). Something additional to mention is that the researchers raised two questions towards the end of the study. They wondered if certain physical activities should be added to "traditional" psychological treatment. They also wondered if the organizations that determine recommended physical activity levels for every age group should become more "physically literate" since it has been proven that exercise can "protect against the development of mental health problems among children" (Byrne, et al). Both are valid points that should be addressed soon because mental health and physical activity are two important and prevalent issues in, not only, the United States, but also globally.

Mental health statistics for the adult population, ages 18-65, was previously stated in Table 1.1. There, again, will be two research topics focusing on this specific age group. The first, *"The Effect of Morning Exercise on Mental Health of Female Police Employees"*, was authored

by Mohammad Hassani, Mahmood Parham, Mohammad Mahdi Soltani, and Faezeh Vahid Moghaddam. “Evaluation and comparison of mental health status and its related factors in female employees who take part in morning exercise and who are exempt in one of the police units” was the purpose of this descriptive-analytic, cross-sectional study (Hassani, et al). There were 150 participants; 85 female police officers that took part in a morning group exercise class, and 65 female police officers that did not participate in any exercise due to illness. The researchers used the Goldberg and Hiller Questionnaire of Mental Health to evaluate all 150 participants. There were 28 questions asked before and after the completion of the study. The results completely supported the researchers’ original hypothesis that exercise would have a positive effect on the female police employees. Morning exercise had a significant impact on the mental health of these officers. It decreased their physical complaints, anxiety, social dysfunction and depression. Unfortunately, the 65 officers in the non-exercising group showed no improvement in physical complaint, anxiety, social dysfunction or depression. The researchers concluded that “active women are in better state in all dimensions of physical signs, anxiety signs, sleep disorders, social function signs and depression signs. The active group enjoys better mental health status than the inactive group. The effect of exercise and exercise activities on mental health cannot be denied” (Hassani, et al).

“Effect of Yogic Exercise and Physical Exercise on Physical Health and Mental Health” by K.S.S. Sarojini and M. Usha Rani focused on the Indian-created physical activity can have a positive effect on mental health in its practitioners. To begin, yoga, according to the authors, is defined as being “developed and perfected over the centuries by philosophers and mystics in India. It is a method by which we increase the body’s supply of energy and remove any interference to the transmission of energy throughout the body” (Rani, et al). This study used 60

"healthy volunteers" that were all randomly selected and randomly assigned to the "traditional" physical activity group or the yoga group. All the participants were between the ages of 30 and 45 years old and were required to participate for three months. The first group, the yoga group, was made up of 17 males and 13 males. The second group, the physical activity group, featured 20 males and 10 females. Both groups were tested with sphygmomanometers for blood pressure, a weight machine for body weight, the pulse was taken by way of the radial artery, and a general health was questionnaire. The 60 participants were also given a pre- and post- psychological test that focused on "somatic symptoms, anxiety, insomnia, social dysfunction and severe depression" (Rani, et al). Participants in the yoga group attended a yoga class on a regular basis that was taught by a "qualified yoga teacher" (Rani, et al). The subjects in the physical activity group began "brisk walking" on a regular basis in the morning. When the study came to an end after three months, the yoga group showed no significant difference in systolic blood pressure, diastolic blood pressure, reduction in body weight, or radial artery pulse rate. However, there were statistically significant reductions in somatic symptoms, anxiety, insomnia, social dysfunction and severe depression. On the other hand, the "traditional" physical activity group showed significant reductions in diastolic blood pressure, radial artery pulse rate, and body weight. The physical activity group also showed reductions in anxiety, insomnia, social dysfunctions, and severe depression (Rani, et al). Both experimental groups showed great reductions in the physical and mental aspects. This is important to note because it cannot be definitively said whether yoga or a more traditional approach to exercising, such as walking, is more beneficial. The researchers stated that "both are effective in improving psychological health of its practitioners" (Rani, et al).

When it comes to mental health problems and substance abuse, the elderly population is commonly overlooked and/or misdiagnosed. Health care professionals often attribute their depressive symptoms, anxiety, or substance abuse symptoms to side effects from medications or illnesses the older person is already suffering from. As of 2015, 12% of the world's population was over the age of 60. By the year 2050, that number will rise to approximately 22%. Currently, 20% of adults over the age of 60 suffer from some type of neurological disorder, excluding headaches and migraines (WHO). The older population is at an elevated risk for developing mental health issues because of "isolation, loss of independence, loneliness, psychological distress and illness" (WHO). Feelings of isolation, loneliness, and psychological distress can arise because of something known as elder abuse. Elder abuse can be physical, sexual, psychological, emotional, financial or material. Elderly people can have their money stolen, personal belongings stolen, face neglect and abandonment, and "loss of dignity and respect" (WHO). According to the World Health Organization, 1 in 10 older people experience elder abuse. The WHO also states that "elder abuse can lead not only to physical injuries, but also to serious, sometimes long-lasting psychological consequences, including depression and anxiety." Citizens over the age of 60 account for 25% of all deaths that are a result of self-harm (WHO). When compared to people with chronic illnesses such as lung disease, hypertension and diabetes, those with depressive symptoms have "poorer functioning" (WHO).

Another problem plaguing the elderly community is dementia. Dementia is "a syndrome in which there is deterioration in memory, thinking, behavior and the ability to perform everyday activities." As of 2016, there were 47.5 million people diagnosed with dementia. It is expected that by the year 2030, 75.6 million people will have dementia, and by the year 2050, 135.5 million people will suffer from this condition (WHO). These factors work against an older

person's mind and can cause long-lasting mental effects. It would be helpful to this specific population if they knew of a way to help combat these psychological effects.

There is one article, *"Effect of Tai Chi Exercise on the Physical and Mental Health of the Elder Patients Suffering from Anxiety Disorder",* that focused completely on how physical activity can benefit the older population. Yan-Hua Guo, Qing-Hua Song, Guo-Qing Shen, Rong-Mei Xu, Quan-Hai Zhang, Ming Ma, Xin-Ping Zhao, and Yu-Bing Han decided to "observe the effect of Tai Chi exercise on the rehabilitation of elder patients suffering from anxiety disorder" (Guo, et al). The researchers explain Tai Chi as "Chinese traditional martial arts that is based on the Chinese traditional philosophy, health preserving, health science, medicine, aesthetics, and many other disciplines. Its fitness effect has been generally recognized by the world and the exercise method lies in harmony between man and nature and internal" (Guo, et al). The study featured 32 elderly patients that had all been diagnosed with an anxiety disorder. They were divided evenly into two groups; 16 participants in each. The first group, the control group, received only drug therapy to treat their anxiety. The second group, the experimental group, was treated with both drug therapy and Tai Chi exercise for their anxiety. Both groups underwent their separate therapies for 45 days. The Tai Chi group exercised for 35 minutes in the morning and 35 minutes in the evening for the entire 45 days. The morning session of Tai Chi was the Chen Style Tai Chi, in which "the 18 essences are the core of Chen Style Tai Chi and it integrates 18 postures required by the modern fitness training" (Guo, et al). It should be noted that the Tai Chi group of participants continued exercising for two months after stopping the drug therapy.

The researchers determined that after 45 days, seven patients in the control (drug) group were "cured" of their anxiety disorder and eleven patients in the experimental (Tai Chi) group

were “cured”. Before and after their respective therapies, the participants were evaluated by the Hamilton Anxiety Scale and Generic Quality of Life Inventory-74. Results showed that the experimental and control group both had better posttest scores after completing therapy. However, the researchers measured the recurrence rate of anxiety disorders in all 32 patients following the therapies. In the drug therapy control group, 42.86% of the members had their anxiety disorder reappear, while only 9.09% in the experimental Tai Chi group had that experience. The end results of the study showed that there was a significant improvement in anxiety symptoms in the Tai Chi group when compared to the drug therapy group. The researchers concluded that:

> Walking and Tai Chi exercise can significantly improve the anxiety factor of the elderly people and suggests that Tai Chi exercise can improve the psychological and autonomic nervous functions of the elderly people. Relaxation practice has a synergistic effect of regulating spirit, body and pranayama, thus tranquilizing the mind. Combining motion and quietness is suitable for regulating body and mind. In the aspect of treatment of various psychosomatic diseases, relaxation practice in which Tai Chi is the main movement, there are obvious curative effect on neurosis patients (Guo, et al).

In the United States, approximately 1.5 million people suffer from rheumatoid arthritis (RA). RA is “an autoimmune disease in which the body’s immune system mistakenly attacks the joints. This creates inflammation that causes the tissue that lines the insides of joints (the synovium) to thicken, resulting in swelling and pain in and around the joints” (Arthritis Foundation). Other parts of the body can also be affected by RA, such as the lungs, vessels, and the hematopoietic system (Himena, et al). This form of arthritis is almost three times as likely to occur in women than men. The typical onset age for rheumatoid arthritis is between the ages of 30 and 60 in women, and even later in men (Arthritis Foundation). In *“Benefits of Exercise on Physical and Mental Health in Rheumatoid Arthritis Patients”*, authors Himena Zippenfening and Elena Sirbu discuss whether there are “benefits of moderate-intensity exercises” on RA

patients when compared to sedentary patients. They also studied the "correlation between physical activity and mental health variables, including depression" (Himena, et al). The researchers wanted to study this because depression and physical activity are highly common in rheumatoid arthritis patients (Himena, et al). Nearly 42% of RA patients have mild to severe depressive symptoms, which can be attributed to increased pain, fatigue, reduced health-related quality of life, duration of illness, functional deficit, socioeconomic factors, psychological factors, and increased levels of physical disability (Himena, et al). Those patients that are depressed can be scared to move due to pain, which causes them to become sedentary, "deconditions the body" makes them "lose natural endorphins" and ultimately increases their pain level (Himena, et al).

This study featured 22 patients that were categorized by age, sex, and physical fitness. They were divided into two groups; the first group featuring two men and eight women, and the second group with eleven women and one man. The first group contained the experimental exercising patients and the second group was the sedentary patients. All 22 participants were required to meet the American College of Rheumatology criteria for rheumatoid arthritis disease (Himena, et al). The participants in the both groups were given the Medical Outcomes Study Short Form-36 Health Survey as a pre- and posttest. This questionnaire measured "physical functioning, role limitations due to physical health, body pain, general health perceptions, vitality, social functioning, role limitations due to emotional health, and mental health" (Himena, et al). The experimental group exercised three to five times a week for six months in 45-minute intervals. They could partake in several types of approved physical activity exercises including the aqua gym, walking, cycling, or aerobic group fitness classes. To avoid an over- and underestimation of physical fitness, the ten exercise group patients were given a heart monitor.

Participants in both the control and experimental group also received drug therapy. They were either given biologic drugs or disease-modifying antirheumatic drugs (DMARDs). In the exercising group, 38% were given biologic drugs and the remaining 62% received DMARDs. For the sedentary group, 70% received biologic drugs and 30% received the DMARDs.

Results from the study indicated that the physically active group of participants had significant improvements in their mental and physical health after the six-month period. For rheumatoid arthritis patients to see benefits, the exercise that they engage in should be of moderate to hard intensity, which would be 60-85% of their maximal heart rate. They should be physically active at least three times a week for at least 30 to 60 minutes. These patients also reported a "better quality of life, more satisfaction, and a higher level of physical and social function." On the other hand, the sedentary group had no improvements in their physical health and it was revealed that there was a negative correlation between mental health variables and physical activity (Himena, et al). Thus, as the level of physical activity decreased, mental health symptoms increased. The authors summed up their research by stating:

> Aerobic exercise can result in improvements in pain control and overall quality of life for patients with RA. Resistance training may be particularly important because it has been shown to be useful in preventing bone loss. Regular exercise can be useful in managing many of the symptoms that affect people with RA including, fatigue, stiffness, and depression. Regular aerobic exercise such as walking, swimming, supervised aerobic classes and cycling has been shown to improve muscle function, the stability of joints, endurance and physical functioning and performance. Exercise training could be recommended as part of an overall treatment plan that may also include education and/or pharmacotherapy for adults with rheumatoid arthritis (Himena, et al).

As of 2013, in America, there are 1.2 million people living with HIV. Shockingly, one in eight, or 12.5% of these people do not know that they have the disease (Avert). 36.7 million people are infected across the planet and 2.1 million of those 36.7 were newly infected (Ciccolo, et al). It is known that mental illness is extremely common among HIV sufferers and that "poor

mental health is linked to HIV progression" (Ciccolo, et al). Sanaz Nosrat, James W. Whitworth, and Joseph T. Ciccolo, the authors of *"Exercise and Mental Health of People Living with HIV: A Systemic Review"*, wanted to "conduct a systemic literature review of the effects of exercise on mental health in people living with HIV" (Ciccolo, et al). Participants of this study were given the Satisfaction with Life Scale, Physical Self-Efficacy Scale, and the Quality of Life Questionnaire as a pre- and posttest. These questionnaires combined were used to measure whether physical activity increased, decreased, or had no significant effect on the mental health of HIV patients. The participants participated in aerobic exercise programs, resistance exercise programs, and a combination of aerobic and resistance exercise programs. Results from the aerobic only program showed that there were significant improvements on the results of all three posttest questionnaires. The resistance only exercise demonstrated significant improvements with just the Quality of Life Questionnaire and Satisfaction with Life Scale. The Satisfaction for Life Scale also included a section on mood, which also had significant improvement. When aerobic and resistance exercises were combined, there were statistically significant improvements seen in mental health status, quality of life, emotional well-being, physical strength, energy, overall health, and cognitive function (Ciccolo, et al). The authors summarized their work by recognizing that aerobic and resistance exercise programs are independently beneficial but that when combined, there are even greater positive effects on the mental health of those suffering from HIV. They believe that remaining physically active can take on a "protective role against stress and depressive symptoms" (Ciccolo, et al).

In the United States, 700,000 citizens are currently living with a primary brain tumor or a central nervous system (CNS) tumor and 80,000 people are diagnosed with primary brain tumors every year. A primary brain tumor is one that originates in the brain and does metastasize, or

spread to other parts of the body. “Brain cancer is a devastating and highly debilitating form of cancer” (Greenwood, et al). These tumors can affect anyone, regardless of age. However, it is more commonly diagnosed in children and the elderly. For children between the ages of 0 and 14, brain tumors “are the most common cancer and is the leading cause of cancer related deaths” in that age group (ABTA). Also, central nervous system tumors and brain tumors are the “third most common cancer among adolescents and young adults age 15-39” (ABTA). In 2017, it is estimated that nearly 17,000 people will succumb to a CNS brain tumor or a malignant primary brain tumor. The prospects for patients with brain tumors are not the best because approximately 1/3, or 32%, of all brain and CNS tumors are malignant (ABTA). In addition, CNS and primary brain tumors are extremely complex. According to the American Brain Tumor Association (ABTA), “there are more than 100 histologically distinct types of brain and CNS tumors.”

In *“Exercise Improves Physical Function and Mental Health of Brain Cancer Survivors: Two Exploratory Case Studies”*, authors Gregory T. Levin, Kenneth M. Greenwood, Favil Singh, Daphne Tsoi, and Robert U. Newton discuss the positive effects physical activity has on the mental state of brain cancer patients. Some side effects of brain cancer and its treatments include “impaired physical capabilities, mild or major cognitive dysfunction, and compromised psychological well-being” (Greenwood, et al). This study featured two brain cancer survivors that participated in a 12-week exercise program twice a week and were monitored by a certified exercise physiologist. Each exercise session lasted 60 minutes and consisted of moderate to vigorous aerobic exercise and resistance exercise. These aerobic exercises included walking/jogging/running on a treadmill, riding a cycling ergometer, and utilizing a rowing ergometer. For resistance training, the participants completed exercises that focused on “major upper- and lower-body muscle groups.” These exercises included the chest press, leg press,

lateral pulldown, knee extension, knee flexion, seated row, lateral shoulder raises, step up, and bicep curls (Greenwood, et al). The researchers gave the two participants a pretest after six weeks of the exercise intervention and a posttest at the end of the 12-week period. Results showed that "both patients showed improvements in cardiovascular fitness, muscular strength and consistent improvement for all mental health outcomes. Both patients showed meaningful reductions in depression, anxiety, and total distress. The two patients also showed increases in satisfaction with life and cancer coping self-efficacy" (Greenwood, et al).

Schizophrenia is a mental disorder that currently affects 1.1% of the world's population, and approximately 3.5 million people in the United States. It is also one of the leading causes of disability for people between the ages of 20 and 40 (Backx, et al). The cost of treating schizophrenia is "estimated to be between $32.5 billion and $65 billion each year (SARDAA). In the United States, 75% of people diagnosed with schizophrenia develop he disorder between the ages of 16 and 25 (SARDAA). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), for a patient to be diagnosed with schizophrenia, they "must demonstrate two of the five symptoms and at least one symptom must be one of the first three for at least six months." The five symptoms of schizophrenia for diagnosis are: delusions, hallucinations, disorganized speech, disorganized or catatonic behavior, and negative symptoms" (SARDAA). The Schizophrenia and Related Disorders Alliance of America (SARDAA) reported that 25% of schizophrenia patients completely recover, 50% show improvements over a 10-year period, and 25% show no progress over an extended period. However, these statistics only reflect the schizophrenia patients that are being treated for the illness because 50% of people diagnosed receive no treatment (SARDAA). Most patients are treated with antipsychotic medications, but most still suffer from positive and negative symptoms, along with "comorbid psychiatric

disorders." It has also been found in previous studies that schizophrenia patients have high depression rates and the antipsychotic drugs have no effect on their depressive symptoms (Backx, et al).

T.W. Scheewe, T. Taken, F. Jorg, A.C.P. van Strater, A.G. Kroes, R.S. Kahn, W. Cahn, and F.J.G. Backx authored *"Exercise Therapy Improves Mental and Physical Health in Schizophrenia: A Randomized Controlled Trial"* with an objective of finding out if exercise or occupational therapy has a greater effect on the mental health status of schizophrenia patients. Currently, "70-75% of patients with schizophrenia can be classified as being physically inactive and do not meet minimal physical activity recommendations" (Backx, et al). This study consisted of 63 schizophrenia patients that were randomly assigned into either a group that received only exercise or only occupational therapy. The physically active group participated in cardiovascular exercises and muscle strengthening exercises six time a week for two hours, for six months. The muscle strengthening exercises focused on their "biceps, triceps, abdominals, quadriceps, pectorals, and deltoid muscles." The occupational therapy group went to therapy for one hour, twice a week for a six-month duration (Backx, et al).

The results from this study showed that being physically active can drastically reduce depressive symptoms in patients suffering from schizophrenia. The physically active group had a significant reduction in positive symptoms, disorganization, excitement, and emotional distress when compared to the occupational therapy group. The physically active group also showed a reduction in depressive symptoms by 30.2%, while the occupational therapy group's symptoms only decreased by 8.5% (Backx, et al). Not only were there mental benefits of exercising with depression and schizophrenia, but patients also showed improved cardiorespiratory fitness (Backx, et al). Additional research that was mentioned as a part of this article stated that:

> In depression, exercise leads to physiological changes such as increased levels of neurotransmitters (endorphins). Exercise increases hippocampal volumes in schizophrenia, suggesting that exercise-induced brain plasticity might instigate the mental health improvement in schizophrenia patients. Exercise therapy is an established treatment for mild to moderate depression and in schizophrenia there is some evidence that exercise decreases depressive symptoms (Backx, et al).

The researchers involved in this study suggest that exercising for one to two hours weekly can significantly "improve mental health, improve cardiovascular fitness and reduce the need of care in patients with schizophrenia" (Backx, et al).

Positive effects and benefits of exercise on the physical aspects of wellness have been well-documented and presented to the public for quite some time now. However, the effects physical activity has on mental health is not as commonly known. The research is out there, but it has not been publicized. Good physical and mental health is crucial to remaining healthy and happy. People suffering from brain cancer, schizophrenia, rheumatoid arthritis HIV, and numerous other illnesses could strongly benefit from being physically active. It has been shown to decrease pain, decrease anxiety, decrease depression, increase cardiorespiratory fitness, and improve their overall mental health. For children, being active from an early age is critical and can ensure that they will stay active throughout their lifetime. Children can also suffer from depression, anxiety, behavior problems, internalizing behavior, externalizing behavior, and several other problems. Just being active for 60 minutes a day can reduce these problems and help them to live a healthier, happier life. Adults that are physically active have been shown to have a reduction in depressive symptoms, anxiety, etc. They are more productive at work and have increased cardiorespiratory fitness. The elderly, who are at an increased risk of experiencing elder abuse and suffering from debilitating diseases, can benefit from exercise as well. For instance, Tai Chi has been shown to reduce anxiety disorders in the elderly when compared to those that just took an antianxiety medication.

For people that do not believe they have enough time in their day to exercise or do not think that they know how to exercise, there are some simple things that can be done. Taking a walk before breakfast, during lunch, and after dinner in a small way that people can get physically active. Walking is the simplest form of exercise that can be done by walking the dog, walking around the neighborhood, joining a mall-walking club, etc. Children can play with each other by engaging in age-appropriate games that increase their level of physical activity. They should also receive some type of exercise while in school at least two to three days a week. It is highly important that children are exposed to exercise so that they learn the importance early on. For the elderly, it might be more difficult for them to be physically active due to illness, mobility issues, ambulatory issues, etc. However, if they could get involved in a low-impact type of exercise such as walking, pool therapy, Tai Chi, etc., they could see the benefits on their bodies. Exercise in important throughout the lifespan. The benefits on the physical aspects and mental aspects of the body have been highly documented. With more research being completed on the all-around effects of exercise, hopefully, the number of physically inactive people will decrease, and the number of physically active people will increase.

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