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The Biological, Psychological, Cognitive, and Social Perspectives on Aging: The Design of a Healthy Aging Program for Older Adults

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CERTIFICATE OF APPROVAL

Clinical Research Project

This is to certify that the Clinical Research Project of

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Abstract

Aging is an inevitable process, accompanied by changes in physiological, cognitive, psychological, and social facets. Researchers have investigated the physiological, cognitive, psychological, and social risk factors associated with aging and have encouraged the use of physical activity, cognitive training, and dietary interventions to alleviate risk factors. However, holistic programs dedicated to promoting successful aging among older adults are uncommon. This review sought to promote successful aging by identifying physiological, cognitive, psychological, and social risk factors that affect older adults and develop a comprehensive program to holistically mitigate these risk factors. Risk factors associated with unsuccessful aging include the development of chronic health conditions, declines in cognitive function, development of psychological disorders, and reductions in social activities. The goal of this program is to assist older adults in leading a well-balanced lifestyle by encouraging engagement in evidence-based interventions such as physical exercise, diet and nutrition, mindfulness meditation, yoga, mentally stimulating activities, and building interpersonal relationships to improve aging outcomes.

THE BIOLOGICAL, PSYCHOLOGICAL, COGNITIVE, AND SOCIAL PERSPECTIVES ON AGING: THE DESIGN OF A HEALTHY AGING PROGRAM FOR OLDER ADULTS

DEDICATION

To the older adults I have worked with over the past 10 years: You have made the aging process something to look forward to with your wisdom, resiliency, and sense of humor.

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First and foremost, I want to thank God for giving me strength, guidance, and blessings. I will always continue to put you at the center of it all.

I want to thank my husband and my best friend, Michael, for supporting me throughout this journey. You have made me laugh in times of stress, and you have inspired me to be the best version of myself. You helped push me out of my comfort zone to pursue opportunities that have been instrumental in shaping me as a professional and individual. You gave up your dreams and aspirations, so I could achieve mine, and there are no words to thank you enough. Now, it is your turn, and I promise to support you every step of the way as you have supported me. I ye.

Mom, you taught me the value of having an education as the first female in our family to graduate college. You also taught me the persistence needed to achieve my goals. You have always encouraged me to put my all into everything that I do, and I thank you for always believing in me.

Erica, you have been my cheerleader throughout graduate school. You have calmed my anxieties with your humor and inspired me to be my most authentic self in times of doubt. Thank you for all the support you have given me. It is beyond appreciated.

I would like to thank Dr. Eric Rosen and Dr. Elizabeth Lane for your support, your time, and all your guidance in this process. Dr. Lane, it has been a pleasure to find someone who also shares in the same joy and passion when working with older adults. I am so grateful for the role you have had in my professional and clinical development.

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CHAPTER I: INTRODUCTION

In the last 70 years, the average life expectancy in older adults has increased more than any other period in history. In 1950, life expectancy at birth was 48 years in the developed regions of the world and 42 years in the less developed regions of the world (Mahishale, 2015). Currently, life expectancy is 78 years in the developed world and 68 years in the developing world (Mahishale, 2015). According to the World Health Organization (2018), it is expected that no country will have a life expectancy of fewer than 50 years by 2025 and the number of Americans aged 65 and older is projected to more than double from 46 million today to over 98 million by 2060 (Population Reference Bureau, 2019). The 65-and-older age group share of the total population will rise to nearly 24% from 15% (Population Reference Bureau, 2019).

Due to the increase in life expectancy, aging is often regarded as a worrisome and fearful process because of the unique and dynamic changes that accompany the aging process. Some of the inevitable signs of aging involve changes associated with physiological, cognitive, psychological, and social functions. Physiological changes that are associated with aging include the weakening of vital organ function (Sergiev, Dontsova, & Berezkin, 2015), chronic diseases (Raghupathi & Raghupathi, 2018), and changes in physical appearance (Mejia, Ryan, Gonzalez, & Smith, 2017). Cognitively, certain regions of the brain are disposed to shrinkage, especially areas related to complex mental processes (Raz et al., 2005). Abilities such as conceptual reasoning, memory, and processing speed decline gradually over time (Harada, Natelson Love, & Triebel, 2013). However, some cognitive abilities, such as vocabulary, are resilient to brain aging and may even improve with age (Horn & Cattell, 1967). Regarding mental health, older adults may experience lifelong mental health disorders or onset of mental health disorders in later-life that affect their wellness and social interactions (Blazer, 2003).

Coping with age-related changes can be a stressful and difficult process to navigate. Therefore, understanding the emerging evidence of successful aging strategies is vital when approaching age-related concerns and changes.

Physiological, cognitive, psychological, and social factors that contribute to age-related difficulties can be mitigated through evidence-based interventions that improve health and well-being. Regular exercise, diet and nutrition, maintaining a healthy weight, and avoidance of tobacco aid in the prevention of chronic diseases. Engaging in mindfulness meditation and brain games can be beneficial in improving concentration and memory, and assist in preventing neurological diseases. Additionally, socializing and engaging in psychotherapy can help in the management of emotional transitions, finding new support systems, and giving and receiving feedback regarding age-related changes and difficulties.

Problem Statement

The life expectancy in older adults has increased in recent years due to better access to health care and advancement in medicine (Mahishale, 2015). Physiological, cognitive, psychological, and social facets have shown to change with age. Recent research has intended to encourage healthy aging through the use of physical activity, cognitive training, and nutrition/dietary interventions; however, holistic programs dedicated to promote successful aging among older adults are uncommon and scarce. To date, there are few comprehensive programs designed to holistically mitigate the aging process for older adults.

Purpose of the Review

The intent of this literature review was to design an evidence-based holistic program promoting successful aging and embracing the aging process with positivity by encouraging

older adults to engage in physical, cognitive, and social activities that can assist in mitigating age-related changes.

Research Questions

This review addresses the following research questions:

1. What physiological, cognitive, psychological, and social functions are most affected by aging?
2. What evidence-based physiological, cognitive, psychological, and social interventions mitigate risk factors associated with aging?

CHAPTER II: DEVELOPMENTAL, PSYCHOLOGICAL, AND BIOLOGICAL THEORIES OF AGING

To understand what contributes to the quality of life in older adults, it is important to define successful aging, identify what constitutes older age, and identify several unique theories that offer a framework for considering individual growth and development over the lifespan through psychological, biological, and psychosocial facets.

Older adults are described as individuals who are over the age of 65 (Federal Interagency Forum on Aging-Related Statistics, 2016). Throughout the years, there have been different terms used to describe the older adult population, including *senile*, *demented*, and *aged*. While *elderly* is the most common term used today, the International Longevity Center (as cited in Avers, Brown, Chui, Wong, & Lusardi, 2011) recommended the term *older adults* be used. Using the term older adults encourages a positive representation of the aging process, rather than depicting ageist stereotypes.

Successful aging was originally coined in 1987 by researchers Rowe and Kahn. According to Rowe and Kahn, successful aging included taking preventive measures to avoid illness and disease, continuing physical activity and being able to function cognitively, and engagement in social activities (Rowe & Kahn, 1997). Rowe and Kahn believed the absence of disease and the maintenance of functional capabilities were related to and represented successful aging when combined with active engagement with life. Although Rowe and Kahn's approach to successful aging is the most widely used in biomedical and psychosocial theories (Bowling & Dieppe, 2005), some researchers have recently challenged Rowe and Kahn's definition of successful aging to incorporate concerns related to individuals (Hicks & Siedlecki, 2017) and sociocultural (Kok, Aartsen, Deeg, & Huisman, 2017) and environmental characteristics (Mejia

et al., 2017). While some researchers believed Rowe and Kahn did not capture diversity, spirituality, and disadvantages among older adults, the following discusses the unique theories that offer supplementary perspectives for considering the developmental, biological, psychosocial, and environmental characteristics that contribute to the growth and development of individuals.

Developmental Aging Theory

Erik Erikson developed the theory of development in 1950. He believed each stage presented with unique challenges and identity formation. His original theory only included 8 stages, with the final stage including individuals ages 65 and older. When he and his wife, Joan Erikson, were in their 80s, they realized that 8 stages were not enough to describe experiences occurring during later life. Joan Erikson completed her husband's work after he died and decided to include an additional stage to address "new demands, reevaluations, and daily difficulties" (Erikson, 1998, p. 105).

Erikson's original 8th stage of psychosocial development, "old age," begins at age 65 and ends at death. His theory suggests individuals at this stage encounter a psychosocial conflict of integrity versus despair. During this stage, aging adults begin to confront difficulties with their mortality. The onset of this stage is triggered by retirement, the loss of loved ones, and other challenges related to role transitions. Typically, individuals reflect on their life and accomplishments, which is usually accompanied by a sense of fulfillment or sorrow from an inability to live a fulfilled and vital life (Erikson, 1998).

The 9th stage of psychosocial development, "very old age," includes individuals aged 80 and above, and involves confronting the previous eight stages, which are described shortly. During this stage, some older adults may find challenges in coping with the physical and social

changes of aging. Autonomy may begin to disappear due to the loss of physical abilities and state of dependency, where challenges in both daily living and life transitions can be achieved by assimilating skills learned in earlier life (Erikson, 1998).

The following describes each stage of Erikson's theory, which demonstrates the impact social experiences and relationships have on growth and development. Each psychosocial stage builds on the preceding stages and can affect subsequent periods of development. During each stage, Erikson believed that individuals encounter a psychosocial crisis that aids in personality. Stages can either be successfully completed or result in an unstable sense of self. Furthermore, older adults may revisit each of these stages if they experience undesirable physical changes in their self-concept as they encounter the aging process.

Trust vs. mistrust. This occurs between birth and one year of age. During this time, infants are dependent, and their trust is based on the quality of their caregivers. If a caregiver fails to provide basic needs such as love, safety, nurturance, food, and warmth, the infant will develop distrust in adults. An infant who successfully develops trust with a caregiver will feel safe and secure in the world. Older adults who revisit this stage mistrust their physical capabilities, and hope begins to decrease as their body weakens and activities of daily living become challenging (Erikson, 1998).

Autonomy vs. shame and doubt. This occurs during early childhood and focuses on developing a sense of independence through basic actions such as toilet training. Children who successfully complete this stage feel confident, while those who do not achieve a sense of independence are left with inadequacy. When revisiting this stage, older adults may no longer trust their autonomy over their bodies and life choices (Erikson, 1998).

Initiative vs. guilt. It begins during the preschool years, while children begin to assert control through social interactions. Leaders emerge during this stage, and successful completion results in capability. Children who fail to complete this stage are left with a sense of guilt and lack of creativity. Older adults who held leadership positions in their earlier life may feel a sense of inadequacy in later life when revisiting this stage. They may not be able to carry the same sense of creativity due to the slow and constant pace (Erikson, 1998).

Industry vs. inferiority. At approximately 5 to 11 years of age, children being to develop social interactions and a sense of accomplishment. Children who successfully complete this stage feel a sense of competence when handling tasks. Failure to develop competence results in doubting proficiency and capability in their abilities. Older adults revisiting this stage develop difficulties in accepting their inadequacy in no longer being competent in certain skills (Erikson, 1998).

Identity vs. identity confusion. This occurs during the teenage years and is essential in developing a sense of self. Identity formation presents new experiences that may hinder or help in the development of identity. During older age, individuals may feel uncertain about their roles and values when revisiting this stage (Erikson, 1998).

Intimacy vs. isolation. This occurs in early adulthood when individuals are exploring interpersonal relationships. Successful resolution of this stage results in forming lasting and meaningful interpersonal relationships. During the ninth stage, older adults may feel a sense of isolation because of the hesitation and discomfort others may feel when interacting with older adults. Also, the interpersonal relationships they once shared may not be present anymore due to death and loss (Erikson, 1998).

Generativity vs. stagnation. During this stage, one establishes a commitment to one's career, family, and devoting time to a productive life. Those who are successful during this phase feel that they are active in their home and community, while those who do not reach a successful resolution of this stage feel a sense of unproductivity. Older adults revisiting this stage may have less energy and capacity to adjust to the changes that are occurring within their surroundings and bodies. Generativity is no longer expected at this age, which may result in withdrawal from others (Erikson, 1998).

Despair vs. integrity. As mentioned previously, during this stage, the impact of aging is of concern through different role transitions. When revisiting this stage, older adults may feel a sense of inadequacy due to the "serious demands on the senses of elders" (Erikson, 1998, p. 112). Older adults become discouraged because of the challenges they may face with their cognition and physical abilities (Erikson, 1998).

Erikson's developmental theory is important in understanding how growth and development can contribute to the aging process. Erikson believed everyone encounters social interactions with the environment that contribute to the development of personality. Erikson's eight stages of development present with unique challenges that can be resolved and completed or result in conflicts within the self. During the eighth stage of psychosocial development, older adults may begin to confront challenges with their mortality and role transitions. These challenges may be met with reflections that accompany a sense of fulfillment or sorrow from the inability to live a meaningful life. While not every older adult may experience the ninth stage, older adults that do encounter this stage typically experience challenges in physical and social abilities. They may begin to lose their sense of autonomy, where difficulties in activities of daily living can no longer be achieved, resulting in confronting the previous eight stages.

Completing each psychosocial stage is important to the development of a stable sense of self and healthy interactions with the environment.

Psychosocial Theories of Aging

Erikson's developmental theory of aging encompasses stages that contribute to the mastering of attitudes and skills at each stage of development. The mastering of such skills assists with the adjustment of the social and physical challenges adults experience as they age. The following theories explore how role transitions, relationships, and culture have impacts on aging and the ability to adjust. Theories associated with psychosocial changes of aging are activity theory, disengagement theory, and continuity theory.

Activity theory. Developed by Havighurts and Albercht (1953), activity theory connects healthy aging and keeping active. As older adults participate in meaningful interpersonal relationships and stay physically active, they can cope with the adjustment and transition of retirement, bereavement, or losing life roles. This theory assumes that increased levels of activities can promote life satisfaction (Paggi, Jopp, & Hertzog, 2016).

Disengagement theory. Unlike activity theory, disengagement theory proposes that voluntary withdrawal and isolation can be beneficial for older adults because of the emancipation from social responsibilities such as raising and caring for children and employment. The willingness to separate oneself from society gives older adults a sense of freedom and autonomy (Bergstrom & Holmes, 2000; Harris & Bodden, 1978).

Continuity theory. Continuity theory supports the notion that personality is stable, and the behaviors, activities, and relationships older adults shared when they were younger remain unchanged (Bergstrom & Holmes, 2000; Breheny & Griffiths, 2017).

The psychosocial theories of aging focus on the social and psychological aspects of successful aging. Each theory presents a unique stance on how people progress in later life. Some may find comfort in participating in meaningful relationships and being mindfully and physically active, while others may find contentment in being alone and free from financial burden and social responsibilities. Although each theory is different, how older adults adapt to challenges assumes the relationship between successful aging and life satisfaction, which is discussed further in Chapter VI.

Biological Theories of Aging

Unlike the developmental and psychosocial theories of aging, which emphasize identity development and interactions with the environment, biological theories of aging offer a framework that describes the aging process as a slow decline due to multiple biological functions. Many theories attempt to describe the mechanisms related to aging; however, the most modern biological theories of aging can be put into two categories: programmed and damaged (Sergiev et al., 2015).

Programmed theories. Programmed theories, also referred to as genetic theories, suggest aging is genetically predisposed and that the human body has an internal biological clock that is programmed throughout the lifespan (Hayflick, 1979). Leonard Hayflick coined the term *biological clock*, which is a response to regulated changes in gene expression that controls the physiological actions of the human body throughout the lifespan (Hayflick, 1979). The systems that are connected with this theory of aging are the endocrine system, immune system, and the structure of telomeres.

Endocrine theory. The body's endocrine system produces and secretes hormones that regulate the activity of cells or organs, including metabolism, excretion, and reproduction (Jin,

2010). The endocrine theory proposes that biological clocks act through hormones to control the pace of aging (Jin, 2010). For example, as individuals age, the systems of the body become less efficient, leading to changes such as menopause (Isidori et al., 2000).

***Immunological theory*.** According to this theory, the immune system is programmed to decline through the years. The immune system's decline over time leads to an increased vulnerability to infections and diseases (Jin, 2010). T-cells actively participate in the immune system's response to fight off infections and diseases. However, as people age, the function of the T-cell decreases, causing part of the immune system to weaken (Fulop, Witkowski, Pawelec, Alan, & Larbi, 2014).

Telomere theory. In the nucleus of each cell, chromosomes make up DNA. At the end of every chromosome, there are small structures called telomeres. Telomeres are responsible for protecting the ends of the chromosomes by protecting genetic information during cell division (Fitzpatrick et al., 2007). Telomeres shrink with each cell division, making them progressively shorter with time (Simon et al., 2006). The shortening of telomeres leads to apoptosis (Hoxha et al., 2009). Abnormalities in apoptosis can lead to possible degenerative diseases such as cancer (Cawthon, Smith, O'Brien, Sivatchenko, & Kerber, 2003), Parkinson's disease (Epel et al., 2009), Alzheimer's disease (Hoxha et al., 2009), and autoimmune diseases (Simon et al., 2006).

Programmed theories of aging suggest that the human body is genetically predisposed to deterioration throughout the lifespan. Genetics, the endocrine system, and the immune system slow over time, causing signs of aging. This means that death and aging are natural and inevitable.

Damaged theories. Damaged theories, also known as stochastic theories, differ vastly from programmed theories. Damaged theories propose that aging is a decline in the

deterioration of the body over the years. With this theory, it is assumed that environmental factors influence the health of humans, leading to the gradual damage of cells and organs (Sergiev et al., 2015). The concepts that are connected with this theory of aging are wear-and-tear, rate of living, free radicals, cross-linking, and somatic DNA theories.

Wear-and-tear theory. According to this theory, progressive damage to cells, tissues, and body systems happens over time, resulting in aging. For example, vital organs such as the stomach and skin are damaged by environmental toxins. Physical and emotional stress will also contribute to the wearing down of the body (Jin, 2010). Essentially, parts of the body will wear out due to repeated use, like components of an aging car (Park & Yeo, 2013).

Rate of living theory. This theory proposes that living organisms have a finite number of heartbeat and breathing cycles within the lifespan. The faster an organism's metabolism, the shorter the lifespan (Jin, 2010). This theory was originally created by Max Rubner in 1908. He observed that larger animals tend to outlive smaller animals and proposed that a slower metabolism may be associated with longevity (Ferrucci, Schrack, Knuthm, & Simonsick, 2013).

Free radical theory. Free radicals form when cells create energy, producing unstable oxygen molecules. Free radicals are uncharged molecules that can damage cells in one's body because they contain unpaired electrons (Wickens, 2001). The free radical theory of aging proposes that aging occurs because free radicals cause damage to the macromolecular components of the cell, such as nucleic acids, lipids, sugars, and proteins (Jin, 2010). The accumulated damage to the cells causes organs to eventually stop functioning by stealing their electrons through oxidation (Mesa et al., 2016).

Cross-linking theory. According to this theory, aging results from the accumulation and inappropriate attachments of cross-linked proteins (Jin, 2010). Cross-linking occurs when

glucose molecules stick to proteins, disabling the function of the proteins (Jin, 2010). Through cross-linking, tissues become stiffer and do not function properly, creating damage to the cells and tissues (Bailey, 2001). Cross-linking has been found responsible for wrinkles and other age-related skin changes through the cross-linking of skin protein collagen (Bailey, 2001).

***Somatic DNA theory*.** This theory postulates that aging is determined by inherited genes. Cells within the body are continuously reproducing, and each time a cell divides, there is a chance that the genes are incorrectly copied (Jin, 2010). Also, exposure to toxins can cause alterations in gene expression, causing genetic mutations to accumulate (Rossi et al., 2007). Mutated cells can then accumulate, leading cells to weaken, which can affect the body's functioning (Rossi et al., 2007).

Damaged theories of aging suggest that the human body is like a machine and is prone to damage and deterioration over time. The wide range of sub-theories described above emphasizes that the aging process is due to environmental assaults, which result in the inability to battle the natural process of aging and death.

While programmed theories focus on a biological timeline that controls the pace of aging and damaged theories assert that aging is caused by environmental damage to the body's systems, both theories propose that aging is an inevitable and natural process of living. Despite the dissimilarities within each theory, one thing is certain, aging is unavoidable. Although we are unable to live forever, various activities can be done to slow the aging process. Participating in activities that take care of the body and mind can inhibit premature aging by improving the chances of living a long and healthy life. More information regarding these activities will be discussed in subsequent chapters, pertaining to physiological, cognitive, and social interventions that promote successful aging.

Brain-Environment Interactions

Developmental, psychosocial, and biological theories are important factors in considering the aging process through personality development and the inevitable changes the human body undergoes. However, another factor to consider when thinking about the aging process is the effects of aging on the brain and cognition. Age-related diseases can contribute to the acceleration of cognitive decline; however, not every individual may undergo such cognitive changes. Individual differences in cognition allow some people to cope better than others with cognitive decline (Stern, 2009). The theory of cognitive reserve emphasizes the importance of brain-environment interactions and explains why cognitive changes may present as less severe in some individuals as opposed to others.

Cognitive reserve. The theory of cognitive reserve suggests that the brain attempts to cope with age-related brain changes such as those that occur in dementia or Alzheimer's disease, "by using preexisting cognitive processing approaches or by enlisting compensatory approaches" (Stern, 2012, p. 2). Epidemiological studies suggest individuals with higher experiential resources, including educational and occupational accomplishment and participation in physical activities, can increase cognitive reserve and display higher cognitive function (Stern, 2012; Tucker-Drob, Johnson, & Jones, 2009). With greater cognitive reserve, individuals are better able to prevent signs and symptoms of deteriorating brain changes associated with neurodegenerative diseases such as Parkinson's disease, stroke, or dementia (Batterham, Mackinnon, & Christensen, 2011). A robust cognitive reserve can also help the brain cope with any failures and difficulties such as stress or toxins in the environment because of the brain's ability to modify its neuronal connections, structure, and function in response to life-changing experiences (Garrett, Grady, & Hasher, 2010).

While aging is susceptible to healthy brain changes, measures could be taken to slow the process of cognitive decline and deterioration. Through cognitive reserve, the brain can improvise and find alternative ways to complete tasks. The way to increase or maintain cognitive reserve is by engaging in a level of curiosity, which is heightened through education (Stern, 2012), participating in cognitively stimulating activities (Park et al., 2014) such as crossword puzzles, jigsaw puzzles, board games, card games, quilting, photography, musical instruments, crafts, and reading (Hughes, Chang, Bilt, & Ganguli, 2010), utilizing technology-based applications (Stephankova, Lukavsky, Buschkuehl, Kopeck, & Ripova, 2014), and seeking out new experiences (Tennstedt & Unverzagat, 2013). By engaging in such behaviors, neurons in the brain are strengthening their connections and delaying symptoms of neurodegenerative diseases (Dahlin, Nyberg, Backman, & Neely, 2008). For example, research has shown that individuals can mask the clinical expression of dementia because they have a great amount of cognitive reserve that allows the brain to change the way it operates by using alternative resources (Garibotto et al., 2008).

Understanding the aging process through a biopsychosocial lens is important in considering the factors that contribute to the aging process. From the moment of birth, individuals are encountering life experiences that shape who they are as people. The developmental theory of aging emphasizes the importance of confronting social and environmental challenges throughout the lifespan. When older adults encounter the eighth stage of development, despair versus integrity, they start to contemplate their accomplishments. Older adults may feel a sense of fulfillment and see themselves leading a successful life, or they may feel dissatisfied, which may lead to feelings of hopelessness (Erikson, 1998). Additionally, older

adults may encounter the ninth stage of development, which includes difficulties with social and physical abilities (Erikson, 1998).

Social abilities can be recognized from a psychosocial theory of aging lens, which demonstrates how people progress and adapt in later life. Some may find comfort in participating in meaningful relationships (Paggi et al., 2016), while others find contentment in being alone and free from financial burden and social responsibilities (Bergstrom & Holmes, 2000; Harris & Bodden, 1978). Some older adults experience difficulties in physical abilities, which may be a result of the slow decline that the biological theories of aging postulate. Biological theories propose that aging is the result of an internal biological clock or environmental damage to the body's systems (Sergiev et al., 2015). Although each theory has a different approach to aging, they all share commonalities—the aging process is inevitable and physiological, cognitive, psychological, and social dynamics are encountered as individuals age.

CHAPTER III: PHYSIOLOGICAL FUNCTIONS THAT ARE AFFECTED WITH AGING

Physiology refers to the characteristics and functions of the body and its systems. With aging comes a complex and multifaceted process, involving the degeneration of organ systems and tissues. The progressive decline in physiological functions usually occurs over decades and is influenced by genetics and environmental factors such as exercise, diet, exposure to toxins, pollutants, and diseases (Jin, 2010). The variations in genetics and environmental factors explain why individuals of the same age differ in physiological appearance and state (Scott, Loenneke, Slattery, & Dascombe, 2016).

Maintaining independence and autonomy is important as individuals age. However, due to the degeneration of physiological mechanisms, limitations in mobility may occur, such as unsteady gait, difficulty walking, or difficulties rising from a seated position and balancing (Yordanova, Hohnsbein, & Falkenstein, 2004). These limitations are indicative of a decline in functional health associated with the neuromuscular system and motor functions (Costello, Sizemore, O'Brien, & Manning, 2019). The neuromuscular system is comprised of the muscles and nerves in the body that work together to perform gross and fine motor movements. Involuntary loss in skeletal muscle tissue, called sarcopenia, occurs with the decline of age and begins at age 40 (Vilestra et al., 2019). The progressive loss of muscle occurs at approximately 8% per decade until the age of 70 (Vilestra et al., 2019). After the age of 70, the loss of muscle mass increases to 15% every decade, and 50% by the age of 80 (Vilestra et al., 2019).

Consequently, a decline in the neuromuscular system can affect motor performance in older adults (Hunter, Pereira, & Keenan, 2016). The occurrence of muscle fiber atrophy results in a reduced velocity of movement and impairment in productivity in older adults, producing

deficits in the ability to carry out motor tasks (Hunter et al., 2016). Common motor performance deficits include coordination difficulty, slowing of movement, and difficulties with balance and gait (Musich, Wang, Ruiz, Hawkins, & Wicker, 2018).

Unfortunately, along with declines in the neuromuscular and motor systems, older adults are susceptible and are at high risk for chronic diseases. Chronic diseases are among the most prevalent and costly health conditions in the United States (Raghupathi & Raghupathi, 2018). Approximately 45% of all Americans suffer from at least one chronic disease (Raghupathi & Raghupathi, 2018). Hypertension, high cholesterol, arthritis, heart disease, and diabetes are the most common chronic health conditions among older adults. Additionally, obesity is a common shared risk factor among some of these chronic health conditions. Interestingly, research has also shown that chronic health conditions can impact cognitive function. Cognitive function includes mental processes, such as perception, attention, processing speed, memory, decision making, and language. These mental processes play a crucial role in everyday behavior, which is discussed further in Chapter IV.

Chronic Health Conditions

Hypertension. According to Frayer, Ostchega, Hales, Zhang, and Kruszon-Moran (2017), the prevalence of hypertension is 63.1% in individuals aged 60 and over. Hypertension is another name for high blood pressure. Blood pressure is determined by the amount of blood that the heart pumps and the amount of blood flow into the arteries (Lionakis, Mendrinos, Sanidas, Favatas, & Georgopoulou, 2012). Risk factors associated with hypertension include age, gender, and family history (Ranasinghe, Cooray, Jayawardena, & Katulanda, 2015). The older a person is, the more likely he or she is to get high blood pressure due to the loss of elasticity of the blood vessels (Edwards & Hettinga, 2018). Men under the age of 64 are at

greater risk than women for high blood pressure, and women over the age of 65 are more likely to get high blood pressure (Baldo et al., 2016). Consuming foods high in salt and calories is another risk for developing high blood pressure (Sacks, Svetkey, Vollmer, & Appel, 2001). Additionally, hypertension can also negatively impact cognitive functions.

Research has shown white matter hyperintensities and cortical shrinkage are linked to hypertension, age-related deficits in executive functions (Raz, Rodrigue, & Acker, 2005), and risk for dementia (Kelly et al., 2016). Reitz, Tang, Manly, Mayeux, and Luchsinger (2007) conducted a study to investigate the association between hypertension and the risk of developing mild cognitive impairment. The study consisted of 918 participants without mild cognitive impairment or dementia at baseline, who were over the age of 65. Assessments that measured orientation, language, abstract reasoning, visuospatial abilities, and memory were administered to participants. During the follow-up evaluation, results revealed hypertension was associated with an increased risk of mild cognitive impairment, with 334 participants having incident mild cognitive impairment, 160 participants with amnestic mild cognitive impairment, and 174 participants with non-amnestic mild cognitive disorder (Reitz et al., 2007). The impact hypertension has on cognitive functioning has been understood by the alternation in the structure and function of cerebral blood vessels. However, exactly how these effects lead to cognitive impairment has not been fully understood (Ladecola & Gottesman, 2019).

High cholesterol. The prevalence of high cholesterol in males aged 65 to 74 was 56.7% and 56.4% in males aged 75 and older (Benjamin et al., 2017). The prevalence of high cholesterol in females aged 65 to 74 was 58.8% and 56.9% in females aged 75 years and older (Benjamin et al., 2017). High cholesterol develops as a result of fatty deposits in the blood vessels. The fatty deposits then make it difficult for blood to flow through the arteries. Risks

associated with high cholesterol include diabetes or early heart disease (Centers for Disease Control and Prevention, 2017). According to the Centers for Disease and Prevention (2017), smoking is another risk factor for developing high cholesterol. Cigarettes contain acrolein, a yellow liquid chemical that is produced by burning plants such as tobacco. When acrolein enters the lungs, it affects the process of metabolizing cholesterol, thus, leading to fat accumulation in the bloodstream and throughout the rest of the body (Alwis, deCastro, Morrow, & Blount, 2015).

Furthermore, researchers have investigated the impact of elevated cholesterol levels on the development of cognitive disorders. Kivipelto et al. (2001) sought to evaluate the impact of high cholesterol levels and blood pressure on the development of mild cognitive impairment. Participants were derived from the North Karelia Project and the Finnish Multinational Monitoring of Trends and Determinants in Cardiovascular Disease, which are both large, population-based random sample studies that were conducted between 1972 and 1987. Participants consisted of 1,449 older adults aged 65 to 79 who were reexamined 20 years later for cholesterol levels and cognitive functioning. Self-administered questionnaires on health status and medical history were completed by participants. Neuropsychological assessments were also utilized to assess areas associated with cognitive functioning, verbal fluency, memory, and executive functioning. Results from this study revealed that elevated cholesterol levels ($\geq$ 6.5 mmol/L) were a significant risk factor for mild cognitive impairment. From the study, 6.1% of participants were diagnosed as having mild cognitive impairment (Kivipelto et al., 2001). While this study was conducted over 15 years ago, recent research has also supported the relationship between elevated cholesterol and cognitive impairments. Ma et al. (2017) also examined the association between higher blood cholesterol concentration and faster cognitive

decline in 2,291 community-dwelling older adults. Participants underwent several tests at baseline to assess for blood concentrations of total cholesterol, high-density lipoprotein cholesterol, and high-density lipoprotein cholesterol. Global cognitive functioning was assessed through the utilization of a cognitive screening measure that included attention, memory, language, and visuospatial skills. Results showed that higher blood concentrations of total cholesterol and low-density lipoprotein cholesterol in late-life were significantly associated with faster global cognitive decline (Ma et al., 2017).

While some studies suggest high cholesterol in midlife is associated with an increased risk of late-life cognitive decline (Kivipelto et al., 2001; Ma et al., 2017), other studies reveal high cholesterol levels showed no association with cognitive function when measured in late-life (Silverman & Schmeidler, 2018). In a recent study, Silverman and Schmeidler (2018) investigated whether cholesterol measures were associated with cognitive decline at different ages by utilizing data from the Framingham Heart Study. Cholesterol levels were evaluated in two groups: “midlife” total cholesterol and “late-life” total cholesterol. Midlife included individuals aged 40 years and over, while late-life individuals were those 75 years and older. Results from the study revealed cholesterol levels in midlife were associated with an increased risk of cognitive decline. However, in participants aged 85 to 94, a high midlife total cholesterol level was associated with a reduced risk for cognitive decline. Researchers attributed reductions in risk for cognitive decline at later-life with the protected survivor model, which postulates that protective factors can mitigate the negative effects of a risk factor. Research has yet to determine which protective factors impact cognitive functioning in older adults (Silverman & Schmeidler, 2018). However, the theory of cognitive reserve may contribute to the reduced risk

of cognitive decline in later-life, although high midlife cholesterol levels were present because of the brain's ability to cope with age-related brain changes.

Arthritis. According to Barbour, Helmick, Boring, and Brady (2017), the prevalence of arthritis in older adults is 49.6%. The risk of arthritis increases with age and is more common among women than men (Barbour et al., 2017). Arthritis is a musculoskeletal disease that causes inflammation to one or more joints (Lange et al., 2018). The two most common types of arthritis in older adults are osteoarthritis and rheumatoid arthritis. Osteoarthritis involves wear and tear damage to the cartilage of the joints, and in rheumatoid arthritis, the body's immune system attacks the joint capsule, causing the joint parts to become inflamed (Zhang et al., 2002). Risk factors for arthritis include obesity and joint injuries due to occupational stress (Baker et al., 2018; Centers for Disease Control and Prevention, 2018; Colmegna, Hitchon, Bardales, Puril, & Bartlett, 2016).

Neurological manifestations of arthritis are uncommon (Vitturi, Nascimento, Alves, Campos, & Torigoe, 2019). However, several studies have revealed the impact arthritis can have on cognitive function (Shadick et al., 2019; Shin, Katz, Wallhagen, & Julian, 2012; Vitturi et al., 2019.) Viturri et al. (2019) conducted a cross-sectional case-control study with 210 participants with rheumatoid arthritis and 70 healthy controls. Participants were evaluated using cognitive screeners that measured attention, memory, language, executive function, and visuospatial skills. Findings from the study are indicative of cognitive impairments in older adults with rheumatoid arthritis with significantly lower scores on cognitive measures compared to the control group (Viturri et al., 2019). Areas of memory and word-finding difficulties have also been associated with individuals who have rheumatoid arthritis (Shadick et al., 2019). Other studies have also revealed older adults with rheumatoid arthritis had impairments of

visuospatial, language, and abstract reasoning (Katchamart et al., 2019). Although the mechanisms of cognitive decline in rheumatoid arthritis are unknown, it has been proposed that the inflammatory process that affects arthritis can affect organs that involve neural tissue (Katchamart et al., 2019).

Cardiovascular disease. According to Mozaffarian et al. (2016), the prevalence of cardiovascular disease in women aged 60 to 79 is 69.1% and 67.9% in men (Mozaffarian et al., 2016). In women aged 80 years and over, the prevalence of cardiovascular disease is 84.7% and 85.9% in men (Mozaffarian et al., 2016). Cardiovascular disease involves conditions that block or narrow blood vessels that can lead to heart attacks, angina, or stroke. There are many risk factors associated with cardiovascular disease, such as aging, tobacco use, and obesity. Advancing age can cause changes in the heart and blood vessels, increasing the risk of heart disease (Fleg, 2012). There is also increased stiffness, thickening, and dilation of large arteries due to collagen and calcium deposition (Arnold et al., 2005; Fleg, 2012). As mentioned previously, chemicals in cigarette smoke, such as acrolein, can lead to cardiovascular disease because the cells that line the blood vessels become inflamed, causing blood vessels to become narrow (Centers for Disease Control and Prevention, 2017).

In addition to age, smoking and obesity risk factors have been suggested to increase cognitive decline and dementia in cardiovascular disease (Schievink et al., 2017). Schievink et al. (2017) conducted a study with 1,823 participants, aged 24 to 85 years. The objective of the study was to investigate the cognitive trajectories in cardiovascular disease over 12 years. Measures that evaluated verbal memory, executive function, and processing speed were used to assess participants at baseline and every six years. At baseline, 195 participants were classified with prevalent cardiovascular disease. Most of these participants were smokers, hypertensive,

diabetic, had lower education attainment, and experienced depressive symptoms. At follow-up, 204 participants had incident cardiovascular disease and were mostly overweight, hypertensive, diabetic, and reported depressive symptoms. Results from the study revealed, at baseline, participants with prevalent and incident cardiovascular disease showed a decline in memory and processing speed compared to health controls (Shievink et al., 2017). Areas related to mood and sensory perception, executive functioning, attention, learning, and memory have also been related to cardiovascular diseases (Leritz, McGlinchey, Kellison, Rudolph, & Milberg, 2011)Research has revealed an association between cognitive functioning and alterations in brain structure, such as white matter lesions and gray matter atrophy, have shown to occur with cardiovascular disease and associated risk factors (Leritz et al., 2011).

Diabetes. Almost one-third of older adults in the United States have prediabetes (Kalyani, Golden, & Cefalu, 2017). These numbers are projected to grow over the next few decades (Narayan, Boyle, Geiss, Saaddine, & Thompson, 2006). The prevalence of diabetes is more than two times higher among older adults compared to young adults (Cowie, Rust, Eberhardt, & Byrd-Holt, 2009). With type two diabetes, the pancreas makes insulin, but cells do not use the insulin as well as they should, leading to glucose buildup (Bainbridge, Hoffman, & Cowie, 2011). Risk factors associated with diabetes include obesity, family history, and physical inactivity (Kalyani et al., 2017). Individuals with diabetes have a high risk of developing coronary heart disease (Kalyani, Saudek, Brancati, & Selvin, 2010; Pijpers et al., 2012). Goraya et al. (2002) conducted a study to test the prevalence of coronary atherosclerosis among diabetics. The study examined the association between diabetes and atherosclerosis in 293 autopsied individuals with diabetes and without a clinical diagnosis of coronary heart disease. Individuals were over the age of 30 and were analyzed by the use of a global coronary score and

high-grade stenosis. Results revealed that diabetes was associated with a higher prevalence of coronary atherosclerosis, with nearly 75% having coronary heart disease (Goraya et al., 2002).

Older adults with diabetes are also at increased risk of falling (Pijpers et al., 2012). Pijpers et al. (2012) conducted a study to compare the incidence of recurrent falls in older adults with and without diabetes. The population-based study was from the Longitudinal Aging Study Amsterdam and consisted of 85 individuals with diabetes and 1,065 without diabetes, aged 65 years and older. Falls were assessed every three months during a three-year follow-up. Results indicated 30.6% of older adults with diabetes experienced recurrent falls compared to 19.4% of older adults without diabetes (Pijpers et al., 2012). Diabetes is also associated with risk for vision and hearing impairments. According to the American Diabetes Association (2017), 40% of individuals with diabetes are more likely to have glaucoma and 60% are more likely to have cataracts. Among U.S. older adults, the prevalence of self-reported hearing impairment was 50.5% for individuals with diabetes and 43.6% for individuals without (Kalyani et al., 2010).

Another risk of diabetes is the development of cognitive impairment. Older adults with diabetes who are unable to manage the disease through regular treatment can become at risk for physical and cognitive decline (Chau et al., 2011). Cognitive impairments that may occur with diabetes include memory difficulties (Montserrat et al., 2015) and reduced performance in processing speed (van den Berg et al., 2010), attention (Zilliox, Chadrasekaran, Kwan, & Russell, 2017), and executive functioning (van den Berg et al., 2010).

Obesity. Obesity has been known to be among the leading causes of elevated cardiovascular disease mortality and morbidity (Akil & Ahmad, 2011). Obesity is the result of poor diet and nutrition and exacerbates age-associated declines in physical, cognitive, and mental health (Field et al., 2001). Over one-third of Americans, aged 65 and older, are

overweight, and the statistics on obesity are projected to increase from 47.8 million in 2015 to 82.3 million by 2040 (Cohen, Greaney, & Sabik, 2018). Khan et al. (2018) conducted a study on the examination of risk estimates of cardiovascular disease with estimated years lived without cardiovascular disease by weight status. A population-based study was conducted using pooled individual-level data across 10 large U.S. prospective cohorts. Individuals were between the ages of 20 and 79 and free from cardiovascular disease. The results from the study found that obesity was associated with shorter longevity and increased risk for cardiovascular morbidity and mortality compared with healthy BMI (Khan et al., 2018). Furthermore, excess weight increases pressure on the joints, producing functional limitation, pain, and disability (Messier et al., 2004); therefore, the prevention of obesity can reduce the risk of disabilities, hypertension, cholesterol abnormalities, and arthritis (Centers for Disease Control and Prevention, 2019).

Obesity has been associated with changes related to brain structure and functioning. Studies examining obesity in older adults have revealed changes in the hippocampal regions. For example, Raji et al. (2010) conducted a study to investigate the brain volumes of 94 obese, overweight, and healthy older adults. Tensor-based morphometry was used to examine gray matter, white matter, and volume differences between the groups. Results from the study revealed that obese older adults displayed atrophy in the frontal lobes, anterior cingulate gyrus, hippocampus, and thalamus compared to individuals with normal BMI. Older adults who were overweight showed atrophy in the basal ganglia and corona raditata. Higher body mass index was also associated with lower brain volumes in obese and overweight older adults. Overall, the areas that exhibited alterations are associated with memory, motor movements, and sensory signals (Raji et al., 2010). Unfortunately, studies are uncertain about whether associations

between obesity and cognitive function are a result of being overweight or the behaviors that lead to weight gains such as foods consumed or the development of chronic health diseases.

The aging process is accompanied by variations in genetics and exposure to environmental factors that can lead to several health problems for older adults. The human body undergoes changes in physiological mechanisms and neuromuscular systems such as progressive loss of muscle mass and challenges with coordination, walking, and balancing. Along with a progressive decline in physiological functions, older adults are at high risk for chronic diseases. Hypertension, high cholesterol, arthritis, heart disease, and diabetes are the most common chronic health conditions among older adults. Age, gender, and family history are general risk factors for chronic health conditions; however, each condition has individual risk factors to be cognizant of. Risk factors for hypertension include men under the age of 64 and women over the age of 65 and consuming foods high in salt and calories. Risk factors for high cholesterol include a history of diabetes, early heart disease, and smoking. Obesity, joint injuries due to occupational stress, and women are more susceptible to developing arthritis. Tobacco, obesity, and physical inactivity are risk factors for both cardiovascular disease and diabetes.

Additionally, the studies highlighted in this chapter show the significance of the brain-body connection. The development of chronic health conditions affects not only the body, but it has also been associated with alterations in brain structure and function. Cognitive impairment has been observed in connection with hypertension, high cholesterol, arthritis, heart disease, diabetes, and obesity. Cognitive functions that are impacted as a result of developing a chronic health condition include memory, attention, language, visuospatial skills, executive functioning, language, abstract reasoning, and sensory perception (Montserrat et al., 2015; van den Berg et

al., 2010; Zilliox et al., 2017). While many changes accompany aging, commitment to an improved lifestyle can reduce modifiable risk factors for physiological decline.

Evidence-based Physiological Interventions that Improve and Promote Successful Aging in Older Adults

With aging comes inevitable physiological changes. By making healthier lifestyle choices, individuals can reduce the likelihood or severity of acquiring chronic diseases (Madden, Lockhart, Cuff, Potter, & Meneilly, 2009). The prevention of chronic diseases will require changes in behaviors related to physical activity, weight management, nutrition, smoking, and the way individuals attach meaning to their lives and interpersonal relationships (Hafez et al., 2018).

Physical activity. Regular physical activity through middle age has been associated with better health in old age and longevity (Hamer, Lavoie, & Bacon, 2014). Regular physical exercise helps improve quality of life, overall health, chronic health conditions, and mental health disorders (Centers for Disease Control and Prevention, 2019). Several studies have expressed the importance of physical activity playing a key role in improved mobility and reducing the risk of chronic diseases such as cardiovascular disease (Madden et al., 2009), stroke (Rahbar et al., 2018), diabetes (Tyrovolas et al., 2015), and arthritis (Yu et al., 2018).

Gopinath, Kifley, Flood, and Mitchell (2018) conducted a longitudinal study that examined the association between physical activity and successful aging. For comparison, they also examined the association between levels of physical activity and mortality risk. The study included 1,584 adults aged 49 years and older. Successful aging was determined by the absence of depressive symptoms, cognitive impairment, disability, and chronic diseases. They were followed over 10 years and provided information on their performance of moderate to vigorous

activities and walking exercises. Their level of activity was used to determine their total metabolic equivalent minutes (METs) of activity per week. Results revealed that there were 15.7% of participants who were successful agers, 46.5% who were healthy agers, and 37.8% who died. Healthy agers were identified as older adults who were alive during the 10-year follow-up, but who were not deemed as successful agers due to the presence of chronic diseases, cognitive impairments, disabilities, or being functionally dependent. Successful agers were more likely to be younger, married, physically active, and less likely to smoke. There were a limited number of participants who were current smokers or obese. Therefore, researchers were unable to examine associations between physical activity and successful aging within those groups. However, after using multivariable polytomous logistic regression analyses to evaluate physical activity and the outcome of aging status, results revealed older adults who participated in the highest level of physical activity (≥ 5000 MET minutes) had a higher likelihood of successfully aging (OR = 2.08; 95% CI = 1.12, 3.88) compared to participants in the lowest level of physical activity (< 1,000 MET minutes). Results also showed a significant association with successful aging and older adults who engaged in continual high levels of physical activity, which constituted a 1,000 MET increase from baseline to the 10-year follow-up (OR = 1.08; 95% CI = 1.02, 1.14; p = .008). Mortality risk was not associated with physical activity (Gopinath et al., 2018). Overall, the study suggested a positive association between physical activity and successful aging.

Organizations such as the Centers for Disease Control and Prevention (2019) and the World Health Organization (2019) have recommended that older adults should participate in at least 150 minutes of moderate-intensity physical exercise or 75 minutes of vigorous-intensity physical exercise throughout the week to improve circulatory and respiratory systems, muscle

strength, and bone health in older adults. Examples of moderate-intensity exercises may include brisk walking, swimming, hiking, dancing, water aerobics, or cycling (Centers for Disease Control and Prevention, 2019; World Health Organization, 2019). However, many older adults have considered a lack of time as a barrier to accomplishing the recommended amount of physical exercise (Tully et al., 2007). As a result, several studies have also examined the effects of walking below the current recommended levels of exercise in adults.

Park et al. (2014) explored the effects of a walking program on cardiovascular disease risk markers that involved a below current minimum physical activity recommendation (< 150 minutes per week). Twenty-eight participants over the age of 60 participated in a 12-week study. Participants were divided equally between the walking group and the control group. Participants in the walking program walked 30 to 50 minutes, 2 days per week. Results from the study revealed that systolic and diastolic blood pressures were significantly lower than baseline (95% CI = 3.91 to 13.38 mmHg, $p = 0.002$) in the walking group after 12 weeks (95% CI = 5.42 to 12.15 mmHg, $p < 0.001$). HDL cholesterol was also significantly lower at 12 weeks than baseline in the walking group (95% CI = 0.50 to 11.76, $p = 0.035$; Park et al., 2014). Tully et al. (2007) also conducted a 12-week study to determine if exercising below the recommended amount could improve cardiovascular risk factors. Participants consisted of 106 adults, ages 40 to 61 years old. Results from the study revealed significantly improved blood pressure in participants who walked for 30 minutes, 3 days per week (Tully et al., 2007). Overall, both studies indicated the amount of exercise above 150 minutes of moderate-intensity physical exercise or 75 minutes of vigorous-intensity physical exercise throughout the week could be beneficial in mitigating risk factors for chronic disease, as long as older adults engage in at least 30 minutes of physical activity, 2 to 3 days per week. In addition to cardio, older adults should

also participate in strength training exercises at least two days per week to maintain strength, increase muscle mass (Baker et al., 2001), and improve physical function, pain, and mobility (Messier et al., 2004).

Nutrition. Chronic conditions affecting older adults can be attributed to common risk factors they all share, which are associated with obesity and diet. Realistic modifications for diet, such as limiting the consumption of sugar and sugar-based drinks and food, can prevent most cardiovascular disease, stroke, diabetes, and hypertension (Khan et al., 2018; Schulze et al., 2004; Xu,). The reduced intake of fats and sugar-based beverages and foods can also prevent obesity (Tyrovolas et al., 2015).

According to the World Health Organization (2019), reductions in saturated fat and salt intake have been shown to improve blood pressure and cholesterol concentrations. Increasing fruit and vegetable intake by 30% can also decrease risks for developing chronic diseases (Sacks et al., 2001). Sacks et al. (2001) conducted a study to investigate whether reducing the level of sodium from the average intake of foods in the United States would lower blood pressure. The average sodium intake in the United States is approximately 150 mmol per day (Sacks et al., 2001). The study was a randomized trial consisting of 412 participants who were randomly assigned to the control diet typical of intake in the United States or the DASH diet for 30 days. The DASH diet contained vegetables, fruits, and low-fat dairy products. The results of the study found that reducing sodium intake below the recommendation of 100 mmol per day through the DASH diet reduced blood pressure (Sacks et al., 2001). Similar studies also suggest daily salt intake is a risk factor for developing hypertension, with a fall in blood pressure in hypertensive adults who reduce their salt intake (Cappuccio, Markandu, Carney, Sagnella, & MacGregor, 1997; Tabiban et al., 2018).

Avoidance of tobacco. Cigarette smoking causes damage to most organ systems and susceptibility to diseases such as lung cancer (Shi et al., 2013), chronic obstructive pulmonary disease (Hedström, Stawiarz, Klareskog, & Alfredsson, 2018), coronary heart disease (Kurth et al., 2003), stroke (Kurth et al., 2003), diabetes (Shi et al., 2013), and rheumatoid arthritis (Hedström et al., 2018). According to the Centers for Disease and Control (2018), smoking increases the risk of coronary heart disease by 2 to 4 times, and approximately 480,000 deaths each year are due to cigarette smoking. Smoking cessation has shown improvements in cholesterol, a reduction in heart rate, and decreasing risks for chronic diseases (Korhonen, Goodwin, Miesmaa, Dupuis, & Kinnunen, 2011). If smoking cessation is not achieved, research has revealed that reductions in tobacco exposure with the implementation of exercise can decrease the risk for heart disease, with improvements in the inflammation of white blood cells, red blood cells, heart rate, and oxygen levels (Korhonen et al., 2011). According to the American Cancer Society (2018), the absence of cigarette smoking before the age of 40 can reduce the risk of dying from smoke-related diseases by approximately 90%.

In addition to improving the cardiovascular profile, the reduction in tobacco can also lower blood pressure (Mallaina et al., 2013). D'Elia et al. (2014) conducted a longitudinal study to assess the role of smoking cessation in blood pressure in 1,085 men from the Olivetti heart study. Participants were evaluated throughout the course of eight years. Participants were placed into three groups: current smokers, former smokers, and participants who had never smoked. Participants with a diagnosis of a systolic blood pressure of ≥ 140mm Hg and a diastolic blood pressure of ≥ 90mm Hg or evidence of diabetes were excluded from the study at baseline. Basal body mass index, systolic blood pressure, and diastolic blood pressure were obtained. Multiple linear regression analysis was used to evaluate the effect of smoking on blood pressure after a

follow-up period of eight years. After 8 years of follow-up, during the last examination, when adjusting for age, body mass index, blood pressure, heart rate, and tobacco exposure, former smokers showed a significantly lower risk of hypertension than current smokers (OR = 0.30; 95% CI = 0.15, 0.58; p = .001). Overall, this study revealed an association between smoking cessation and a reduction in blood pressure in healthy men (D'Elia et al., 2014).

Life satisfaction. Promoting meaning and greater purpose in life have been associated with lower rates of chronic disability in older adults (Hafez et al., 2018; Tkatch et al., 2017). Feller, Teucher, Kaaks, Boeing, and Vigl (2013) sought to explore the association between life satisfaction and risk for myocardial infarction, stroke, cancer, and type two diabetes mellitus. The study included 50,358 participants from the European Perspective Investigation into Cancer and Nutrition Study. At baseline, the participants were given a self-administered questionnaire to collect data on diet and lifestyle. Physical examinations were also conducted to assess for chronic diseases. During an 8-year follow-up, results revealed that women who were unsatisfied with life at baseline showed a significantly increased risk of cancer (HR = 1.45; 95% CI = 1.18, 1.78; p = .005), stroke (HR = 1.69; 95% CI = 1.05, 2.73; p = .004), and type two diabetes (HR = 1.27; 95% CI = 0.98, 1.64; p = .04). On the contrary, there were no associations between life satisfaction, stroke, and myocardial infarction in men. Overall, the results of the study suggest that life satisfaction is related to the risk of chronic diseases predominantly in women (Feller et al., 2013).

Hafez et al. (2018) conducted a 4-year longitudinal cohort study of 3,907 older adults who did not have diabetes during baseline analysis. The Ryff and Keyes' Scales of Psychological Well-Being was measured at baseline to assess the participants' purpose of life. Over four years, multivariable linear regression was utilized to examine the association between

blood sugar levels and purpose in life. Results revealed that older adults who experienced higher purpose and meaning in their lives had lower odds of developing diabetes compared to older adults with lower purpose (OR = 0.78; 95% CI = 0.62, 0.98; *p* = .037; Hafez et al., 2018). Folling, Solbjor, Midthjell, Kulseng, and Helvik (2016) also suggested that being a part of a social network, having a positive attitude, understanding risks of type two diabetes, and maintaining an active lifestyle were important factors in preventing type two diabetes.

Lower rates of life satisfaction can trigger stress, which may increase the risk of heart disease, high blood pressure, and cholesterol levels (American Heart Association, 2018). Schneider et al. (2012) conducted research on 201 African American men and women with coronary heart disease. Each participant was randomized to either the transcendental meditation program or the health education program. Participants were assessed at baseline, three months later, and then every six months after baseline for blood pressure, body mass index, and program adherence. Diet, nutrition, exercise, and psychosocial distress were assessed annually. During a five-year follow up, results revealed participants in the transcendental meditation program showed a reduction in mortality, myocardial infarction, and stroke (HR = 0.52; 95% CI = 0.29, 0.92; *p* = .025). Reductions were also seen in revascularizations, cardiovascular hospitalizations, blood pressure, and psychosocial stress factors (HR = 0.76; 95% CI = 0.51, 1.13; *p* = .17; Schneider et al., 2012).

With aging comes the alternation of physiological functions involving appearance state (Scott et al., 2016), progressive decline of the organ systems (Sergiev et al., 2015), neuromuscular and skeletal systems (Costello et al., 2019), and vulnerability to chronic health conditions (Raghupathi & Raghupathi, 2018). Health conditions most commonly seen in older adults are hypertension, high cholesterol, arthritis, heart disease, and diabetes. Risk factors

associated with these diseases include age, gender, family history, smoking, obesity, physical inactivity, diet, and present chronic health conditions. Fortunately, there are lifestyle changes that could be made to reduce these risk factors.

Research has shown regular physical activity has been associated with better health and longevity (Hamer et al., 2014). Although larger organizations recommend roughly 150 minutes of moderate-intensity physical exercise or 75 minutes of vigorous-intensity exercises throughout the week to improve circulatory and respiratory systems (Centers for Disease Control and Prevention, 2019; World Health Organization, 2019), other studies suggest older adults can engage in at least 30 minutes of exercise, 2 to 3 times per week, to mitigate cardiovascular risk factors (Park et al., 2014; Tully et al., 2007). Additionally, engaging in strength training exercises at least two days per week is encouraged to maintain strength, increase muscle mass (Baker et al., 2001), improve physical function and mobility, and reduce pain (Messier et al., 2004).

Maintaining a healthy weight and eating a well-balanced diet consisting of vegetables, fruits, low-fat dairy products (Sacks et al., 2001), and limiting sugar (Tyrovolas et al., 2015) and salt intake (Tabiban et al., 2018) are also important factors to consider. Additionally, the absence of cigarette smoking has shown improvements in decreasing risks for chronic diseases (Korhonen et al., 2011). Physical exercise, nutrition, and avoidance of tobacco are all encouraged to reduce the risk of physiological decline in older age; however, all of these factors coupled with a greater purpose and meaning to life can greatly lower chances of developing chronic health conditions in later life (Hafez et al., 2018; Tkatch et al., 2017).

CHAPTER IV: COGNITIVE CHANGES THAT ARE AFFECTED WITH AGING

Cognition is the mental process involved in understanding and knowledge that is related to specific structures and functions of the brain. Cognition is a significant facet to the aging process because changes in the brain are associated with healthy aging (Raz et al., 2005). Age-related cognitive changes are accompanied by reductions in the structural and functional connectivity between different regions of the brain (Raz et al., 2005). Recent studies suggest physiological changes, independent of dementia, include changes in brain mass (Fjell, Sneve, Grydeland, Storsve, & Wallhovd, 2017), white matter (Kray, Eppinger, & Mecklinger, 2005), and cortical density (Raz et al., 2005). These changes can affect several higher-level functions, also referred to as neurocognitive domains. There are six neurocognitive domains (i.e., memory, language, executive function, processing speed, visuospatial abilities, and attention), which are discussed in detail shortly.

The changes in cognitive function accompanying the aging process are generally referred to as age-related cognitive decline (Banerjee, Das, & Sil, 2019). Although age-related decline may sound like symptoms of dementia, it is essential to distinguish the two. Dementia is a neurological disorder characterized by a global deterioration in memory, problem-solving, learning, language, orientation, and judgment that affects the ability to perform everyday activities due to disease of the brain (Banerjee, Das, & Sil, 2019). Age-related cognitive decline is not considered a neurological disorder and does not impair the ability to perform tasks associated with daily living, but difficulties may be seen in the areas of abstract reasoning, processing speed, and memory (Singer, Vergaeghen, Ghisletta, Lindenberger, & Baltes, 2003). The inability to forget things and conversations occasionally, remember details of an event that took place a few months ago, or occasionally having word-finding difficulties are examples of

age-related cognitive decline. However, forgetting things and conversations more frequently, inability to remember details of recent events, or difficulty explaining something would be examples of dementia.

Cognition can deteriorate or improve with age. However, there is a striking contrast in empirical results regarding the age at which cognitive decline begins (Allen, Bruss, Brown, & Damasio, 2005). Some studies suggest that cognitive performance starts to decline when adults are in their 20s or early 30s (Salthouse, 1998; Salthouse, 2009; Schroeder & Salthouse, 2004), whereas other studies have indicated that cognitive decline begins later in life (Aartsen, Smits, Van Tilburg, Knipscheer, & Deeg, 2002; Plassman et al., 1995; Ronnlund, Nyberg, Backman, & Nilsson, 2005). Discrepancies between the data may be attributed to the type of empirical research being conducted, whether the researchers performed a longitudinal, cross-sectional, within-person, between-person, or comparison study (Salthouse, 2009). However, empirical evidence has shown consistency in the areas of cognition that are influenced by age, such as crystallized and fluid intelligence (Crawford & Stankov, 1996; Horn & Cattell, 1967). Crystallized intelligence refers to the ability to use learned skills and knowledge that is based on experience and can remain stable or gradually improve with age. Fluid intelligence is the ability to solve problems and reason independently from what one has learned and could be compromised as people age. Additionally, abilities such as vocabulary are resilient and can improve with age (Crawford & Stankov, 1996; Horn & Cattell, 1967) and other abilities, as mentioned above, such as abstract reasoning, processing speed, and memory deteriorate over time (Singer et al., 2003).

Neurocognitive Domains

Memory. Memory is the ability of the brain to encode, store, and retrieve information. The process of these three stages can take various forms depending on what the information is and how long it is retained by the individual, which is also referred to as short-term and long-term memory. Research has revealed that short-term and long-term memory gradually decline with increasing age, but the rate of decline slows at middle age for both short-term and long-term memory (Mahapatra & Sahoo, 2016). This gradual decline in memory has been linked to changes in the structure of the hippocampal regions (Mahapatra & Sahoo, 2016).

Throughout the years, research has shown in healthy cognitive aging, some types of memory are susceptible to decline or can remain the same with age. Older adults may have trouble remembering minor details such as the placement of their keys, where they parked their car, or the time of an appointment. Episodic memory, the ability to recall personal facts and experiences, characterizes this type of memory loss. Semantic memory, the ability to recall general facts, knowledge, and concepts that are not related to personal experience, remains stable throughout the aging process (Kausler & Puckett, 1980). Understanding the concept of using a clock, language comprehension, or knowing the names of colors are examples of semantic memory. For older adults, this means that their ability to process ideas that are common knowledge and information that was learned in school is not susceptible to decline, whereas their ability to remember personal events or associated emotions pertaining to those events may worsen (Salthouse, 2009). Although certain memory domains decline with normal aging, the process at which decline occurs varies among individuals.

Executive function. Higher-level cognitive skills, such as the ability to organize, plan, initiate tasks, control impulses, think abstractly, and self-monitor, are the mental processes that

comprise executive function. Reductions in executive functioning have been associated with age-related structural and functional brain connectivity of the frontal lobe (Fjell et al., 2017; Kray et al., 2005; Raz et al., 2005). Among these changes are a gradual decrease in white matter volume and loss of dopaminergic receptors, which is thought to contribute to executive dysfunction and attention dysregulation (O'Sullivan et al., 2008).

Executive function decline has also been associated with the apolipoprotein E (APOE) gene, which is a risk factor for Alzheimer's disease (Reas et al., 2019). Reas et al. (2019) wanted to investigate whether $APOE_2$ and $APOE_3$ alleles were associated with normal cognitive aging or cognitive decline while modifying for behavioral characteristics such as exercise, alcohol consumption, and smoking. Investigators used a community-based sample of 1,393 older adults, aged 44-99, from the Rancho Bernardo Study in California. Participants were assessed up to 7 times over 27 years. Assessments measuring cognitive impairment, set-shifting, psychomotor speed, semantic fluency, and episodic memory were utilized. Participants were also genotyped for APOE. APOE has three common types: $APOE_2$ reduces the risk of Alzheimer's, $APOE_3$ is the most common allele and does not influence risk, and the $APOE_4$ increases the risk of Alzheimer's. Results from the study revealed $APOE_2$ carriers demonstrated slower executive function decline with age compared to $APOE_3$ and $APOE_4$ carriers. However, $APOE_4$ carriers showed more rapid executive function decline. Regarding behavioral characteristics, the $APOE_4$ allele did not differ by sex, smoking, or exercise, but episodic memory had a significant effect on participants who drank alcohol (Reas et al., 2019).

The executive system is associated with many skills necessary for adaptive human behavior. Poor performance on executive tasks in older adults has been correlated with a greater risk for car accidents and failure to adhere to medication management (Daigneault, Joly, &

Frigon, 2002; Insel, Morrow, Brewer, & Figueredo, 2006). Most importantly, the decline of executive functioning in older adults hinders the ability to participate in functional living skills and instrumental activities of daily living due to the impact executive function has on other cognitive domains such as attention, working memory, and processing speed (Cahn-Weiner, Malloy, Boyle, Marran, & Salloway, 2000).

Processing speed. The rate at which an individual can understand and perform a mental task is a cognitive ability called processing speed. Processing speed is the strongest predictor of performance across cognitive tasks in older adults, given it is the most common area of decline in healthy aging (Salthouse & Ferrer-Caja, 2003). The structural changes associated with processing speed involve cerebral small vessel disease, which reduces the neural network of the dorsolateral prefrontal cortex (Kochunov et al., 2010; van Dijk et al., 2008). Changes in gray and white matter volume have also been attributed to decreased processing speed (Chee et al., 2009; Fjell et al., 2009). A decline in processing speed typically impacts skills related to executive function, organizing, planning, flexible thinking, and working memory (Salthouse & Ferrer-Caja, 2003). Motor skills can also become impacted, leading to a decline in motor performance. Several studies have found that slower gait speed is a reliable indicator of cognitive slowing in older adults (Costello et al., 2019).

Recent research has also found that the age-related decline of fluid intelligence is associated with decreases in processing speed. Schretlen, Pearlson, Anthony, and Aylward (2000) explored whether processing speed and executive functions were mediated by age-related changes in fluid intelligence. They used 112 healthy adults between the ages of 20 and 92. Measures of perceptual comparison speed, working memory, executive ability, and brain volumes were obtained using resolution magnetic resonance imaging. Results showed that

perceptual comparison speed, executive ability, and frontal lobe volume each made contributions to fluid intelligence and complemented one another (Schretlen et al., 2000).

Visuospatial abilities. Visuospatial attention plays a role in the performance of various activities that are important for processing visual information and perceiving moving stimuli (Paquette & Fung, 2011). Spatial abilities allow individuals to understand two- and three-dimensional spatial relationships within the environment through mental rotation. The cortex controls visual information and is processed in the occipital lobe. From the occipital lobe, the dorsal pathway projects visual data into the parietal lobe, which plays a major role in spatial localization (Paquette & Fung, 2011). Muller-Oehring, Schulte, Rohlfing, Pfefferbaum, and Sullivan (2013) conducted a study with 55 healthy adults between the ages of 25-84 years. The participants underwent an MRI and performed a visual search task to assess perceptual and attentional demands through the use of feature-search and color-form search. Results revealed decreased search performance was related to older age and volume shrinkage of nodes in the dorsolateral processing stream (Muller-Oehring et al., 2013).

Changes in the areas associated with visuospatial abilities can affect the ability of older adults to function independently. Visuospatial abilities are an important function that allows the participation in several tasks such as driving, following a map, reading, recognizing faces and the location of objects, putting on makeup, and getting dressed. As individuals age, visuospatial attention declines, particularly a decline in visual tracking abilities, a decline in saccade direction accuracy, and poor performance in visual search tasks (Hahn & Burraccio, 2017).

Attention. There are two regions of the brain involved in attention: the prefrontal cortex and the parietal cortex. These two brain regions work to select and concentrate on relevant stimuli. Attention is not a singular process but instead involves components such as selective,

sustained, and divided. Selective attention refers to the ability to focus on a particular stimulus in the environment while ignoring others. For example, an individual may be sitting on a bench in a park, and instead of paying attention to the conversations that other people are having, he is attending to the book he is reading. Studies have suggested that older adults are slower in their ability to sustain selective attention than younger adults. This can be attributed to slower information processing (McDowd & Shaw, 2000). Sustained attention is the capability to maintain concentration and attentiveness on a task over time. The ability to read a book or listen to a lecture are examples of sustained attention, where an individual can focus on an activity for an extended period. Studies reveal older adults perform similarly to younger adults on tests of sustained attention (Carriere, Cheyne, Solman, & Smilek, 2010; McAvinue et al., 2012). Little research has been conducted to assess sustained attention in older adults; yet, it has been indicated that sustained attention deficits start to appear in individuals over the age of 70 (Filley & Cullum, 1994). Unlike selective and sustained attention, divided attention requires the performance of two or more tasks simultaneously. Compared to younger adults, older adults have reported more difficulty with dividing their attention among activities depending on their complexity (Basak &Vergaeghen, 2011; McDowd & Shaw, 2000).

Along with the different components of attention, working memory is a critical cognitive component of learning. Attention allows the ability to selectively process information while working memory helps the brain retain, access, and make sense of the information. Studies have suggested an age-related cognitive decline in the ability of older adults to hold information in working memory (Cappell, Gmeindl, & Reuter-Lorenz, 2010). Working memory and attention are important cognitive skills needed to achieve everyday activities such as driving, following

instructions, reasoning, and decision-making behavior (DeLuca, Rothman, Bialystok, & Pilatskas, 2019).

Language. Vocabulary is resistant to the aging brain and can improve with age (Singh-Manoux et al., 2012). Salthouse (2019) conducted a longitudinal study to compare memory, speed, reasoning, and vocabulary in over 5,000 participants. The study began in 2004 and concluded in 2017. The participants were reported to be in good health, had completed over 15 years of education, and had above-average IQs. Participants ranged from ages 20 to 90 years. Cognitive functioning was evaluated to assess memory, speed, reasoning, and vocabulary every three years. Results from the study revealed that healthy cognitive aging is characterized by linear declines from early adulthood in speed, memory, and reasoning. However, vocabulary knowledge increased until the age of 60 (Salthouse, 2019). Kavé and Halamish (2015) also investigated age-related differences in vocabulary in 150 participants and their confidence regarding their vocabulary knowledge. Participants were divided into 3 groups: young adults (M = 24.58), middle-age (M = 51.56), and older adults (M = 75.06). They were given a vocabulary test consisting of 35 target nouns in the question of "What is the meaning of . . .?" Participants were also asked to report their confidence on a scale from one (not at all confident) to seven (completely confident) in each response immediately after providing their answer. Results from the study indicated that older adults were more confident in their answers and performed better than young and middle-aged adults (Kavé & Halamish, 2015).

Despite the stability of language, neurocognitive processes are not independent of one another. Although older adults maintain or improve their knowledge of words, they may suffer deficits in verbal fluency with age (Zec, Markwell, Burkett, & Larsen, 2005). Verbal fluency requires retrieving information from memory, requiring both processing speed and working

memory, which decline with aging. On the contrary, several studies suggest vocabulary is immune to decline because of the communication and interactions individuals experience daily, leading to a strengthening of language expressions (Burke, MacKay, Worthley, & Wade, 1991; Kemper, Thompson, & Marquis, 2001).

Age-related cognitive decline is associated with healthy aging. Changes in structural and functional connectivity between different regions of the brain are seen in the hippocampal regions (Mahapatra & Sahoo, 2016), frontal lobe (Fjell et al., 2017), gray and white matter (Colcombe et al., 2006), brain mass (Fjell et al., 2017), and cortical density (Raz et al., 2005). The changes in brain structure affect the mental processes involved with memory, language, executive function, processing speed, visuospatial abilities, and attention. Studies reveal the ability to use learned skills and knowledge can remain stable over time, such as semantic memory and vocabulary (Crawford & Stankov, 1996; Horn & Cattell, 1967). However, abilities involving problem-solving and reasoning, such as processing speed, episodic memory, executive function, spatial abilities, and attention, are compromised as people age (Singer et al., 2003). While cognitive functions decline with normal aging, sustaining cognitive and mental function is not inevitable. There are many activities to assist in strengthening and maintaining brain function through mental and physical stimulation.

Evidence-based Cognitive Interventions that Improve and Promote Successful Aging in Older Adults

Research has found that brain structures and functions are susceptible to deterioration with aging (Raz et al., 2005). However, research also suggests the brain is capable of becoming flexible and adaptable if measures are taken to maximize brain health (Dahlin et al., 2008). Engaging in stimulating activities such as exercise, mindfulness meditation, and brain-training

games could slow the process of age-related cognitive decline by strengthening neural activity in the brain. The way physical exercise keeps our bodies strong and working more efficiently is the same way mental exercises keep our minds sharp.

Physical activity. Regular physical activity through middle age has been associated with better health in old age and longevity (Hamer et al., 2014). Physical exercise has also been associated with neuroplasticity and structural brain changes related to increased gray matter in the frontal and hippocampal regions (Colcombe et al., 2006)**,** which can enhance the growth of new brain cells that are essential for learning and memory (Erickson et al., 2011).

Chu, Chen, Hung, Wang, and Chang (2015) investigated how cardiovascular fitness effects executive function. Forty-six healthy older adults between the ages of 60 to 70 years were recruited, with 22 older adults in the higher fitness group and 24 older adults in the lower fitness group. The distribution of fitness groups among individuals was determined by an inclusion criterion that consisted of completing an exercise test with a YMCA cycle ergometry protocol that assessed the participants' maximal oxygen uptake. Within two weeks, the participants went to a laboratory individually on three separate days, with a three-day interval between each day. During exercise days, the participants completed an acute cycling ergometer protocol with heart rate monitoring. The participants also completed assessments of executive function within five minutes of exercise cessation. On control days, participants completed procedures similar to those on exercise day. However, instead of completing assessments of executive function, they read a book related to exercise and cognition. A mixed three-way analysis of variance was conducted, with a between subjects and two within-subjects to analyze response time and accuracy. The between-subjects analysis consisted of the lower vs. higher fitness group. The two within-subjects analyses were conducted to assess control vs. exercise

treatment and the congruent vs. incongruent conditions of executive functioning assessments. Overall, results from the study revealed an interaction between the treatment and fitness group ($F(1, 44) = 10.17$, $p = .03$, partial $\eta^2 = 0.18$). There was a shorter response time for the exercise condition compared to the control condition in both the higher ($p = .001$) and lower fitness groups ($p = .001$). The higher fitness group also revealed a shorter response time compared to the lower fitness group for the exercise condition ($p = .04$). Overall, following exercise, older adults demonstrated increased accuracy and a shorter response time in both the congruent and incongruent conditions of executive functioning assessments, demonstrating improvements in executive functioning tasks when participating in acute exercises, with levels of higher fitness showing more improvement in cognition (Chu et al., 2015).

Weekly physical activities have also been positively linked to reduced cognitive decline in speed, memory, and mental flexibility (Angevaren et al., 2007). Studies have shown that participating in regular physical activity, such as walking, cycling, and hiking at least three times per week, can reduce the risk or slow the progression of dementia (Hertzog, Kramer, Wilson, & Lindenberger, 2008; Larson et al., 2006). Rao and Sarkar (2017) conducted a study to evaluate the effects of physical activity on cognitive decline in 30 older adults aged 60 years and older. Participants participated in a 15-minute brisk-paced walk every day for 4 weeks. Before and immediately after exercise completion, participants were given a questionnaire that assessed memory and verbal performance. The results of the study revealed significant improvement in cognition (Rao & Sarkar, 2017).

Increased activity has also been seen in specific brain regions after engagement in physical exercise (Colcombe et al., 2006). Shimada et al. (2017) sought to examine the effects of exercise on brain activity during walking. Participants consisted of 24 older adults between

the ages of 75 and 83. Participants were assigned to either an intervention group or a control group. The intervention group attended 3 months of biweekly 90-minute exercises consisting of aerobic exercise, strength training, and physical therapy. By the end of the study, participants in the intervention group showed increased activity in the part of the brain that plays an important role in spatial and episodic memory (Shimada et al., 2017).

Mindfulness meditation. Meditation refers to the practice of a variety of techniques meant to encourage attention, awareness, and achieve mental self-regulation. The goal of meditation is to focus on the present moment and reach a state of relaxation. Meditation has shown associations with reduced age-related cognitive decline and increased cognitive processes (Hodgins & Adair, 2010; Moore & Malinowski, 2009). Several studies have also shown that meditation influences the way we manage attention, reduce impulsivity, and cognitively control behavior (Moore & Malinowski, 2009).

Prakash et al. (2011) conducted a cross-sectional study of 22 older adults, comparing the cognitive performance of long-term meditators and non-meditators. Short-term memory, attention, executive functioning, and perceptual speed were measured through the use of neuropsychological assessments. Overall, results from the study demonstrated that long-term meditation practices are related to improvements in the ability to inhibit cognitive interference, visual scanning, attention, motor skills, and short-term auditory memory (Prakash et al., 2011). Studies have also shown that mindfulness-based stress reduction can decrease memory complaints. Mindfulness-based stress reduction is an eight-week evidence-based program that supports individuals with stress, anxiety, depression, and chronic pain (Lenze et al., 2014). Lotte, Hotterbeekx, van Os, and van Boxtel (2018) conducted a study to examine the effects of mindfulness-based stress reduction on 13 adults between the ages of 45-85 with memory

complaints. Participants completed the pre- and post-intervention questionnaires and neuropsychological assessments that measured quality of life, psychological distress, memory function, executive function, and processing speed. Participants were to engage in weekly 2.5-hour meditation sessions for 8 weeks. Results from the study revealed engagement in mindfulness-based stress reduction was accompanied by fewer memory complaints, increased quality of life, and reduction in depressive and stress symptoms (Lotte et al., 2018). For some older adults, 2.5 hours of weekly meditation may be a tedious task due to the sustained attention and focus that is needed; therefore, engaging in at least 10 minutes of mindfulness meditation at least 5 times per week can also show significant improvements in areas of executive control and emotional regulation (Malinowski et al., 2017).

The practice of meditation has shown to enhance gray matter thickness, specifically regions associated with attention, orbitofrontal cortex, hippocampus, and sensory processing (Lazar et al., 2005; Luders, Toga, Lepore, & Gaser, 2009). Meditation can lead to improved neurological health and the development of cognitive reserve due to the involvement in sustaining attentional focus (Lazar et al., 2005).

Mental stimulation. Research has shown that people who participate in meaningful activities feel more positive and healthier (Sewdas et al., 2017). Keeping the mind engaged increases the ability to learn new skills and improve cognition (Stephankova et al., 2014). For instance, one study found that engagement in cognitively demanding activities such as quilting or digital photography significantly increased memory in older adults than those who participated in less demanding activities such as watching movies or reminiscing (Park et al., 2014). The ACTIVE study, the largest, longitudinal randomized trial to assess the effectiveness of memory, reasoning, and visual-spatial speed of processing in maintaining cognitive health,

revealed older adults showed improvements in processing speed abilities, fewer difficulties when performing instrumental activities of daily living, improved quality of life, and lower rates of motor vehicular accidents when engaged in cognitively stimulating activities (Tennstedt & Unverzagt, 2013).

Hughes et al. (2010) wanted to examine whether there was an association between participating in hobbies and dementia risk. Participants were recruited from the Monongahela Valley Independent Elders Survey project and consisted of 942 adults who were at least 65 years of age, fluent in English, and had at least a 6th-grade education. Participants were followed throughout two years. They were given a cognitive battery and a self-report measure that asked information related to reading and hobbies. Hobbies on the measure included board games, crafts, crossword puzzles, jigsaw puzzles, musical instruments, bridge, and card games. Participants were also given the opportunity to report any other hobbies in which they participated. The amount of time spent on each activity was also considered. Participants were measured at baseline and during follow-up. The study revealed participants who had a lower risk of dementia participated in a greater number of activities for about an hour each day. Results from the study also demonstrated that engaging in cognitively stimulating activities such as reading, crossword puzzles, and playing board or card games can delay future cognitive decline (Hughes et al., 2010).

Interestingly, several studies have supported the use of technology-based interventions to enhance cognition. Stephankova et al. (2014) investigated the generalizing effects of a working memory intervention and visuospatial skills. Participants included 68 community-dwelling older adults who were randomly assigned to either of the 2 experimental groups or a control group over the course of a month. Both experimental groups completed a computer-based working

memory intervention at home. The intervention consisted of a verbal n-back task. N-back games or tasks measure working memory capacity and consist of "stimuli that are sequentially presented, and the participant has to decide whether the currently presented stimulus is the same as the one presented one, two, or more trials before" (van Wessel, Verhage, Holland, Frens, & van der Geest, 2016, p. 319). In this study, large yellow capital letters were presented in the middle of a screen with a blue background. Participants had to specify whether the currently presented letter was the same as the one presented previously. The low-frequency experimental group trained twice per week for 7-12 sessions, whereas the high-frequency experimental group trained 4 times per week for 18-23 sessions.

The control group did not train. All participants were tested twice, at baseline and posttest. Results revealed that the training group measures of working memory and visuospatial skills outperformed the control group (Stephankova et al., 2014.) The study suggests evidence for plasticity of cognitive functions for older adults because improvements in visuospatial skills appeared even though the intervention was restricted to the verbal domain (Stephankova et al., 2014). Utilizing technology such as an iPad or learning new skills through the use of technology has also shown improvements in episodic memory and processing speed in older adults (Chan et al., 2014). Chen et al. (2014) conducted a study to explore the use of technology on cognition in older adults between the ages of 60-90. Results from the study revealed participants who attended a 10-week program that consisted of learning new skills on an iPad, such as navigating the iPad, utilizing social networking, "following" each other on Twitter, uploading photos, and playing games such as Words with Friends, resulted in enhanced episodic memory and processing speed (Chan et al., 2014). Whether engagement of mentally stimulating activities is accomplished through the use of technology or through traditional means such as quilting, board

games, card games, or jigsaw puzzles, these activities have shown to strengthen brain connectivity.

The aging process is accompanied by cognitive decline resulting in changes in brain structure and functions (Raz et al., 2005). Changes in the hippocampal regions of the brain have been associated with a gradual decline in memory, specifically in areas related to the ability to recall personal facts and experiences (Mahapatra & Sahoo, 2016). Abilities in executive functioning, such as organizing, planning, impulse control, and abstract thinking, can become compromised due to reductions in brain connectivity of the frontal lobes (Fjell et al., 2017; Kray et al., 2005; Raz et al., 2005). Changes in gray and white matter volume have also been associated with declining age (Kray et al., 2005). White and gray matter play rolex in regions of the brain involved in muscle control, which can impact processing speed and the way older adults perform mental and motor tasks (Schretlen et al., 2000). Other abilities, such as visuospatial abilities and attention, are compromised as people age. Volume shrinkage of nodes in the dorsolateral processing stream affects the ability to process visual information and to perceive moving stimuli (Muller-Oehring et al., 2013), which can impact tasks related to driving, reading, and putting on makeup.

Additionally, activities such as following instructions, decision-making, and focusing on an activity for an extended period involve attention and working memory, which are also shown to decline with age (DeLuca et al., 2019). While some neurocognitive domains degenerate with age, language appears to remain stable. Studies have revealed that vocabulary is resistant to decline (Salthouse, 2019). The stability in vocabulary may be due to the continual communication and interaction experienced daily, which leads to the strengthening of language expressions (Burke et al., 1991; Kemper et al., 2001). Similarly, neurocognitive domains that

are seen to decline with age can also strengthen if tasks influencing those domains are experienced more often.

Research has revealed engaging in at least 90 minutes of brisk walking exercise biweekly can increase brain activity in areas of spatial and episodic memory (Shimada et al., 2017). Physical exercise in the form of cycling, hiking, and strength training can enhance the growth of new brain cells, strengthening areas associated with learning, memory, and executive function (Centers for Disease Control and Prevention, 2019; Park et al., 2014; World Health Organization, 2019). Areas of attention, motor skills, self-regulation, and memory can improve with mindfulness meditation for at least 10 minutes, 5 days per week (Malinowski et al., 2017). The goal of meditation is to focus on the present moment and to reach a state of relaxation, which can aid in the development of neurological health by enhancing gray matter thickness. Additionally, engaging in mentally stimulating activities, for at least an hour each day, can also strengthen neuronal activity in the brain and keep the mind sharp (Sewdas et al., 2017). Playing games that require strategy can become cognitively demanding, which can keep the brain consistently active. Games and skills, such as crossword puzzles, jigsaw puzzles, board games, card games, quilting, photography, musical instruments, crafts, and reading, can delay future cognitive decline and lower the risk of dementia (Hughes et al., 2010). Studies have also shown the utilization of technology-based applications can enhance episodic memory and processing speed (Stephankova et al., 2014). Overall, physical exercise, meditation, and mentally stimulating activities are all encouraged to reduce the risk of age-related cognitive decline.

CHAPTER V: IMPACT OF PSYCHOLOGICAL HEALTH ON AGING

Mental health is essential to the overall quality of life because it can have profound effects on how individuals think, feel, and behave. Mental health includes emotional, psychological, and social well-being. According to the American Psychological Association (2018), 20% of people over 55 suffer from a mental health disorder. The American Association of Geriatric Psychiatry (as cited in the Centers for Disease Control and Prevention, 2008) has reported anxiety and depression as the most common mental health disorders in older adults. Often, anxiety and depression are underdiagnosed or untreated due to the stigma placed on mental health and the importance placed on medical treatment. The clinical presentation of these disorders can also interfere with treatment needs because anxiety and depressive symptomology in older adults can overlap with medical conditions such as hyperthyroidism or somatic problems (Ho, 2007). Depression can also co-occur with other medical conditions such as diabetes, Parkinson's disease, and cancer. As a result, older adults may solely consult with their primary care physician on such issues, which can impede mental health treatment.

The cognitive and physiological factors of aging are accompanied by normal declines; however, depression and anxiety are not a normal part of aging (Adams, Miller, & Zylstra, 2008). Symptoms of anxiety and depression may occur in older adults due to significant life changes that produce stress, worry, and sadness (Blazer, 2003). Additionally, research has also shown that mood states have a significant impact on cognition in the areas of memory, executive functioning, attention, and processing speed (Beaudreau & O'Hara, 2009). The influences mood has on cognitive function have been linked to the overlapping of cortical and subcortical brain regions associated with cognition and emotion (Pauls, Petermann, & Lepach, 2015). While mental health disorders are not a normal part of aging, it is essential to discuss risk

factors of depression and anxiety in older adults and ways to mitigate these risk factors through interventions.

Depression

Depressive symptoms are less frequent in late-life than in midlife (Charles, Reynolds, & Gatz, 2001; Murrell, Himmelfarb, & Wright, 1983). The decrease in depressive symptoms in older adults compared with people in midlife are associated with fewer financial hardships, fewer negative interpersonal exchanges, and spiritual beliefs (Schieman, van Gundy, & Taylor, 2002); Although depressive symptoms decrease in late-life, the suicide rate among older adults causes late-life depression to be an increasingly prevalent health problem (Ho, 2007). Depression that is developed in later life affects more than 6.5 million older adults in America (Fiske, Wetherell, & Gatz, 2009). According to the World Health Organization (2017), older men and women show the highest suicide rate in the world, with the highest suicide rate in older white males in the United States. Several risk factors contribute to suicidal behavior and late-life depression among older adults. The primary risk factors for suicidal behavior are becoming a widow, bereavement, other mental health disorders, and physical illness (Fiske, Wetherell, & Gatz, 2009).

Factors that contribute to late-life depression include a wide range of age-related concerns, including biological and psychosocial influences (Blazer, 2003). Biological risk factors for late-life depression include chronic health conditions, poor health status, and physical disability (Blazer, 2003). Having biological risk factors does not mean that an older adult will automatically become depressed. However, individuals with chronic health conditions and disabilities are more suspectable to facing unique challenges (e.g., accessibility, mobility, social barriers) that place them at increased risk for developing depression. Psychosocial risk

factors for late-life depression include trauma, lower socioeconomic status, cognitive impairment, lower self-efficacy, stressful life events, and impaired social support (Blazer, 2003). Often, psychosocial risk factors can be intertwined with older adults' perceptions of how they view their lives. Lack of purpose, autonomy, self-efficacy, stress surrounding loneliness, financial status and retirement, caring for a sick spouse, or the death of relatives can contribute to depression (Motl et al., 2005).

Symptoms of depression vary among older adults, but the most common symptoms are sadness, feelings of hopelessness, low self-esteem, memory problems, and the neglect of personal care (Motl et al., 2005). Older adults can also experience impaired functioning as a result of depression (Conner, McKinnon, Roker, Ward, & Brown, 2018). Impaired functioning as a result of depression can take a variety of forms. For example, pseudodementia is a cluster of symptoms that resemble dementia but occurs due to depression. This condition is commonly seen in older adults. Symptoms associated with cognitive impairment in depressive disorders are characterized by declines in attention, concentration, arousal, affect, perception, intellectual functioning, and personality (Caine, 1986). Recent studies have explored the nature of cognitive functioning that affects depression. These links have been associated with impairments in memory and executive functioning (Pauls et al., 2015). Pauls et al. (2015) conducted a study to evaluate memory performance in 215 depressed individuals ages 16 to 69 years in comparison to a control group. Results from the study revealed significantly lower episodic memory, and executive functioning performances were found in depressed participants across all ages compared to health controls. Neuropsychological performance in the area of processing speed has also been associated with depression in older adults. In a study conducted by Sheline et al. (2006), processing speed was a core cognitive deficit in late-life depression, followed by

executive functioning. Overall, depressive symptoms are suggested to affect various areas of cognitive function. The areas of cognitive function affected by depression can have an impact on daily functions, such as sleeping, eating, relationships, health, and productivity (Pauls et al., 2015).

Anxiety

Prevalence rates of anxiety disorders among older adults are 4% to 10% in community samples and 15% to 20% in older adults who do not meet full criteria for an anxiety disorder but experience anxiety symptoms (Gum, King-Kallimanis, & Kohn, 2009; Mehta et al., 2003). Similar to depression, the prevalence of anxiety in older adults may be higher due to unreported cases. Few studies have examined changes in anxiety in older age. From those studies, results suggest anxiety decreases with age (Henderson et al., 1998; Lee, Gatz, Pedersen, & Prescott, 2016; Mirowsky & Schieman, 2008). Lee et al. (2016) conducted a study to describe the age trajectories of anxiety symptoms in the second half of life. The study was based on data from the Swedish Adoption/Twin Study of Aging and included 1,482 participants aged 50 and older. Results from the study suggested anxiety symptoms declined during the transition from midlife to the mid-60s followed by a mild increase that gradually plateaued in the 80s (Lee et al., 2016).

Comorbid late-life depression and anxiety are common in older adults (Preville, Herbert, Bravo, & Boyer, 2002). The onset of anxiety in later life can stem from psychosocial risk factors also associated with depression (Steffens & McQuoid, 2005). Fears and changes that occur with aging, such as losses, dependence, living expenses, and death, can contribute to late-life anxiety (Steffens & McQuoid, 2005). Anxiety symptoms and disorders vary from person to person, but symptoms typically include excessive worry, preoccupation with routine, avoidance of social situations, being overly concerned with safety, poor sleep, and somatic reactions such

as sweating or a racing heart (Wetherell, Gatz, & Craske, 2003). Anxiety can interfere with the ability to perform activities of daily living, lower levels of well-being, and the abuse of antianxiety medications (Wetherell et al., 2003). Anxiety is characterized by a state of excessive worry and stress (Grillon, 2002), which is associated with the disruption of cognitive performance (Maloney, Sattizahn, & Beilock, 2014). Lukasik, Waris, Soveri, Lehtonen, and Laine (2019) sought to explore the associations between anxiety and working memory performance. Participants from the study consisted of 503 non-depressed adults, aged 18 to 70. Self-report measures and neuropsychological assessments assessed anxiety, stress, and areas of working memory. Results from the study showed a trend toward a negative association between anxiety and working memory (Lukasik, 2019). Similar to the effects of depression on cognition, mild anxiety has also been shown to exhibit declines in executive functioning (Kassem et al., 2017). As anxiety can impact working memory and executive functioning, carrying out responsibilities in these areas can pose challenges for older adults such as focusing, following directions, learning new skills, and making decisions.

While depression and anxiety are not a part of the normal aging process (Adams et al., 2008), the American Association of Geriatric Psychiatry (as cited in the Centers for Disease Control and Prevention, 2008) reported anxiety and depression as the most common mental health disorders in older adults. Older adults show the highest suicide rate in the world, with the highest rate among older White males in the United States (World Health Organization, 2018). Several biological and psychosocial risk factors contribute to late-life suicidal behavior and depression among older adults. Psychosocial risk factors include lower socioeconomic status, impaired social support, becoming a widow, financial status, and retirement (Motl et al., 2005).

Biological risk factors include chronic health conditions, poor health status, and physical disability (Blazer, 2003).

The prevalence rate of anxiety disorders among older adults is 4% to 10% in community samples and 15% to 20% in older adults who do not meet all criteria for an anxiety disorder but experience anxiety symptoms (Gum et al., 2009; Mehta et al., 2003). Similar to depression, several risk factors contribute to late-life anxiety. Risk factors that are associated with anxiety include losses, dependence, living expenses, and death (Steffens & McQuoid, 2005). Often, anxiety and depression are underdiagnosed or untreated; however, there are important symptoms to look for. Symptoms of depression among older adults may include sadness, feelings of hopelessness, low self-esteem, memory problems, and the neglect of personal care (Motl et al., 2005). Regarding anxiety, symptoms typically include excessive worry, preoccupation with routine, avoidance of social situations, being overly concerned with safety, poor sleep, and somatic reactions such as sweating or a racing heart (Wetherell et al., 2003). Being mindful of these symptoms is essential to getting the proper treatment.

Evidence-based Psychological Interventions that Improve and Promote Successful Aging in Older Adults

Pharmacological interventions are the most used treatments for anxiety and depression in older adults compared to non-pharmacological interventions (Mark et al., 2011). Using medications in later-life can pose several risks to older adults, such as medical illness and aversive side effects (Mohlman, Lauderdale, DeVito, & Dobkin, 2017). On average, older adults tend to take more medications than other populations (Mohlman et al., 2017). Medication can pose dangerous risks for older adults that can affect their thinking, balance, sleep, mood, and possible overdose (Desai, 2003). Older adults are at increased risk for aversive side effects

because of the changes in digestion, leading to a reduction of first-pass metabolism and increased bioavailability (Desai, 2003). Therefore, a shift to non-pharmacological interventions, such as physical exercise, group therapy, cognitive-behavioral therapy, and yoga, are becoming more preferred for the management of depression and anxiety in older adults.

Physical activity. Physical exercise has shown to improve risks for developing chronic diseases and age-related decline. Research has also shown the impact physical exercise has on mood. Exercise has shown to decrease symptoms by increasing serotonin levels in the brain, which regulates mood, behavior, appetite, sleep, and memory (Desai, 2003). Tsutsumi, Don, Zaichkowsky, and Delizonna (1997) conducted a study on 42 healthy older adults (M = 68 years old) to investigate the benefits of strength training on muscle strength and psychological affect. Participants were randomly assigned to three groups: high-intensity strength training, low-intensity strength training, and non-exercise control group. The high- and low-intensity strength training group attended a variety of weight machine sessions (e.g., extension, leg curl, shoulder press, bench press, arm curl) per week for 12 consecutive weeks. Participants in the high-intensity group performed 2 sets of 8 to 10 repetitions for an estimated 75% to 85% of 1 repetition maximum. Participants in the low-intensity group performed 2 sets of 14 to 16 repetitions for an estimated 55% to 65% of 1 repetition maximum. Pre- and post-measures were utilized to assess psychological and physiological health. Mood state, anxiety, self-efficacy, cognitive functioning, blood pressure, heart rate, arm and leg muscle strength, body composition, and oxygen consumption were assessed. The results of this study revealed that both the high- and low-intensity groups were associated with improvements in physiological fitness and psychological functioning. In both groups, increased muscle strength by 38.6% and reduced body fat by 3.0% were seen (Tsutsuni, 1997).

Additional studies have also shown the effects of physical exercise on depression and anxiety. Watanabe, Okada, Takeshima, and Inomata (2000) examined the effects of an exercise program on anxiety. Participants consisted of 73 healthy older adults who were randomly assigned to either a water exercise group or a land group. Anxiety was assessed before and after exercise sessions. The 70-minute water exercise program consisted of a warm-up, brisk walk, rhythmic dancing, resistance training, and cool down. However, the land exercise group consisted of 30 minutes of combined endurance and resistance exercise with a 10-minute warm-up and cool-down exercise. Despite the difference in time within each exercise program, results suggested that both exercise groups had shown significantly lower scores on anxiety after exercise (Watanbe et al., 2000). Regarding depression, Yuenyongchaiwat, Pongpanit, and Hanmanop (2018) conducted a study on 156 older adults to investigate the impact of physical exercise on depression among older adults with and without cognitive impairment. Participants completed measures to assess overall cognitive function and depression. A physical activity questionnaire was also used to assess the level of physical activity per week. High levels of total physical activity were defined as ≥ 15,000 MET minutes per week, and low levels of physical exercise were characterized by < 600 MET minutes per week. Results from the study revealed significant differences in physical exercise on depression between older adults with and without cognitive impairment. High levels of exercise suggested decreased depressive symptomatology (Yuenyongchaiwat et al., 2018).

Group therapy. Group therapy for older adults typically focuses on physical disabilities and limitations. Thus, the development and engagement of group psychotherapy for older adults are rare (Heisel, Talbot, King, Tu, & Duberstein, 2015). Research has shown that group psychotherapy has been effective in treating mental health disorders because it offers the

opportunity for older adults to develop interpersonal relationships, share age-related concerns, and a chance to give and receive feedback (Koementas-de Vos, Nugter, Nugter, & Engelsbel, 2018).

Processing and supportive group therapy, such as reminiscence therapy, is a popular treatment modality used for depression in older adults (Moral, Terrero, & Galen, 2015). Reminiscence therapy allows older adults to reconstruct their life story by focusing on their past and exploring as many details of events as they can. Moral, Terrero, Galán, and Rodríguez (2015) sought to investigate reminiscence intervention effects in the reduction of depressive symptoms, improvement in life satisfaction, psychological well-being, self-esteem, and integrity. Thirty-four older adults were recruited through health and social centers. Pre and post-intervention measures were administered to the intervention group and control group, which included measures that assessed self-esteem, life satisfaction, and well-being. Eight 60-minute reminisce group therapy sessions were held with activities and discussions surrounding events that occurred during childhood, adulthood, and older adulthood. A quasi-experimental design was used to evaluate outcome variables throughout the six-week intervention period. Results revealed no significant differences between groups at pre-treatment but in comparison to the control group, older adults in the intervention group showed statistically significant reduction in depression symptoms ($F(1, 32) = 19.47$, $p = .001$, $\eta^2 = 0.378$), improvement in life satisfaction ($F(1, 32) = 5.45$, $p = .026$, $\eta^2 = 0.146$), self-esteem ($F(1, 32) = 6.97$, $p = .013$, $\eta^2 = 0.179$), and integrity ($F(1, 32) = 14.93$, $p = .001$, $\eta^2 = 0.318$) posttreatment. Regarding the psychological well-being dimensions, the intervention group also showed statistically significant improvement in self-acceptance ($F(1, 32) = 23.21$, $p = .000$, $\eta^2 = 0.332$), positive relations with others ($F(1, 32) = 29.27$, $p = .000$, $\eta^2 = 0.478$), autonomy ($F(1, 32) = 12.91$, $p = .000$, $\eta^2 = 0.330$),

environmental mastery ($F(1, 32) = 20.75$, $p = .000$, $\eta^2 = 0.393$), personal growth ($F(1, 32) = 10.87$, $p = .002$, $\eta^2 = 0.254$), and purpose in life ($F(1, 32) = 26.02$, $p = .000$, $\eta^2 = 0.448$) posttreatment. Through reminisce therapy, older adults can reflect and resolve conflicts from the past while receiving support from others and providing coping strategies to one another. This type of therapy intends to decrease symptoms of depression, increase life satisfaction, and help older adults cope with grief and difficult life transitions (Moral et al., 2015). Additionally, recalling past experiences can strengthen memory and cognitive abilities (Zhou et al., 2012).

Cognitive-behavioral therapy. Cognitive behavior therapy (CBT) is an evidence-based practice approach that focuses on the idea that thoughts, feelings, and behaviors are influenced by one another in a cyclical pattern (Beck, 2011). Several studies have suggested CBT as an effective intervention in treating mental health disorders among older adults (Boswell, Lles, Farchione, & Gallagher 2017; Campbell-Sills, Barlow, Brown, & Hofmann, 2006; Gorenstein et al., 2005). Cognitive-behavioral therapy interventions are focused on improving mood, behavior, and overall quality of life by evaluating thoughts so that thinking can become more realistic.

Behavioral activation is a common cognitive behavioral therapy technique used to treat individuals suffering from depression. Behavioral activation suggests that negative life events can lead to fewer positive reinforcements. An older adult who is experiencing symptoms of depression may lack the motivation to complete responsibilities and participate in enjoyable tasks, leading older adults to become isolated or participate in unhealthy behaviors. During behavioral activation, older adults are encouraged to engage in a balance of enjoyable activities, while also attending to responsibilities that may have been neglected. Additionally, older adults who suffer from anxiety participate in avoidance behaviors, which minimizes distress in the

short-term but exacerbates symptoms and fear in the long-term (Campbell-Sills et al., 2006). Behavioral strategies within anxiety intend to challenge patterns of avoidant behaviors by encouraging engagement with situations that are reinforcing and meaningful to gain rewarding experiences and behaviors (Boswell et al., 2017). Behavioral strategies are often focused on the engagement in daily activities and the monitoring of moods, which aids in reducing negative affect and enhancing positive affect.

Stanley et al. (2003) conducted a 15-week study using 85 older adults with generalized anxiety disorder (GAD). Researchers wanted to address the efficacy of CBT to decrease anxiety and depression. All participants completed outcome measures consisting of worry, anxiety, and quality of life. Participants were placed in either the CBT treatment condition or the minimal contact control group (MCC). Components of CBT included education and awareness training, progressive deep muscle relaxation, and exposure. MCC involved weekly telephone calls to assess symptoms and care. CBT sessions occurred weekly for one hour. Repeated measures multiple analysis of variance was used to assess posttreatment effects for all participants. Although, 14 participants dropped out of the study before posttreatment assessment, results of the study revealed significant improvement in worry ($F(3, 60) = 6.68$, $p = .01$), anxiety ($F(32, 60) = 17.61$, $p = .01$), depressive symptoms ($F(3, 60) = 9.84$, $p = .01$), and quality of life ($F(2, 61) = 10.60$, $p = .01$) in the CBT group relative to the MCC group (Stanley et al., 2003).

Gorenstein et al. (2005) also conducted a six-month study using 42 older adults who wanted to reduce the consumption of antianxiety medications. Using randomization, participants were put either into the cognitive behavioral therapy group or the medical management for the medication taper group. Results revealed CBT participants reduced

medication use and showed an advantage over the medication tapering participants for alleviating psychological symptoms associated with anxiety (Gorenstein et al., 2005).

Yoga. Emerging research has been recently exploring the impact yoga has on health outcomes (Chen et al., 2009; Field, Diego, Delgado, & Medina, 2013). There are different modalities of yoga practices, but they all encompass a mind and body exercise, consisting of performing different postures. The practice of yoga is intended to strengthen and calm the body and sharpen the mind (Chen et al., 2005). The regular practice of yoga postures and deep breathing exercises have shown to produce physical and psychological well-being (Damodaran et al., 2002). Yoga posture and daily practices of meditative yoga have also shown to improve sleep and reduce fatigue, depression, anxiety, and stress in older adults (Halpern et al., 2014). In an observational, cross-sectional study surveying a sample of 211 female yoga practitioners aged 45-80 years, increased yoga experience predicted higher levels of positive psychological attitudes, mental mastery, subjective vitality, and high levels of psychological well-being (Moliver, Mika, Chartrand, Haussmann, & Khalsa, 2013). Similarly, Halpern et al. (2014) found the effectiveness of yoga on overall sleep quality, depression, anxiety, stress, tension, and vitality in individuals over the age of 60 when performed at least 25 minutes per day (Halpern et al., 2014). The benefits of yoga for older adults are the same as their younger counterparts (Delgado & Medina, 2013). Benefits range from increased muscle tone, balance, and improved mood, to stress reduction (Delgado & Medina, 2013).

Mental health is a dynamic and vital facet of the aging process because it impacts thoughts, behaviors, and emotions, which can play a role in the overall quality of life. According to the American Psychological Association (2018), Twenty percent of people over 55 suffer from a mental health disorder with anxiety and depression as the most common. Depression that

is developed in later life affects more than 6.5 million older adults in America (Fiske et al., 2009) and the prevalence rates of anxiety disorders among older adults are 4% to 10% in community samples (Gum et al., 2009; Mehta et al., 2003). Symptoms of depression and anxiety vary from person to person but can co-occur in older adults. Symptoms of depression may include sadness, feelings of hopelessness, low self-esteem, memory problems, and the neglect of personal care (Motl et al., 2005). Anxiety symptoms typically include excessive worry, preoccupation with routine, avoidance of social situations, being overly concerned with safety, poor sleep, and somatic reactions such as sweating or a racing heart (Wetherell et al., 2003).

Life transitions, changes, and fears that occur with the aging process such as finances (Motl et al., 2005), thoughts about death, becoming a widow, lower socioeconomic status, lack of social support, and chronic health conditions (Blazer, 2003) can lead to possible symptoms of depression and anxiety. Noticing signs and symptoms of mental health difficulties is helpful in being proactive in seeking proper treatment. Pharmacology interventions are the most used treatment for anxiety and depression in older adults (Mark et al., 2011). The use of medications can lead to side effects such as thinking difficulties, balance, sleep, mood, and possible overdose (Desai, 2003). Therefore, non-pharmacological interventions are becoming more preferred. Interventions consisting of group therapy, cognitive behavioral therapy, and yoga help increase levels of overall well-being (Moral et al., 2015).

Research revealed engaging in group therapy for at least 60 minutes per week is effective in treating mental health disorders in older adults because it offers them an opportunity to form interpersonal relationships, share age-related concerns, and a chance to give and receive feedback (Koementas-de Vos et al., 2018). Supportive and processing group therapy, such as reminisce therapy, has been a popular treatment modality for older adults Studies have revealed

participating in reminisce therapy can decrease depression symptoms and improve life satisfaction, self-esteem, and integrity (Moral et al., 2015). Engaging in reminisce therapy can also strengthen memory and cognitive abilities due to recalling past experiences and events (Zhou et al., 2012). CBT is another effective intervention in treating mental health disorders among older adults (Gorenstein et al., 2005). Studies have revealed that engaging in CBT for at least an hour per week can assist in identifying daily activities that can reduce negative affect and enhance positive affect (Boswell et al., 2017) while alleviating symptoms of depression and anxiety through the reduction of medication (Gorenstein et al., 2005). Additionally, the impact of engaging in yoga for at least 25 minutes per day has been shown to be beneficial to improving muscle tone, balance, improved mood, and stress reduction (Field, Diego, Delgado, & Medina, 2013). Physical exercise, group therapy, CBT, and yoga are all interventions that have shown to reduce the risk of anxiety and depression in later life. Being emotionally healthy can promote effectiveness in activities of daily living and promote life satisfaction (Damodaran et al., 2002).

CHAPTER VI: SOCIAL FACTORS THAT ARE AFFECTED WITH AGING

Healthy interpersonal relationships are important for individuals to remain mentally, physically, and emotionally stable. However, older age is usually accompanied by social changes. As mentioned in Chapter II, Erikson's eighth stage of psychosocial development involves reflecting on one's life and accomplishments. If an older adult is satisfied with the productivity of his or her life, he or she will develop a feeling of integrity (Erikson, 1998). On the contrary, if one contemplates accomplishments and experiences dissatisfaction, one may undergo feelings of despair (Erikson, 1998). Older adults who feel a sense of despair can experience challenges and difficulties with role transitions and adjustments, which can lead to social isolation and withdrawal (Erikson, 1998).

Cudjoe et al. (2018) conducted a study to understand objective social isolation by gathering data from the National Health and Aging Trend Study. Results from their study revealed that approximately 7.7 million community-dwelling older adults reported social isolation in 2011. Factors that were associated with social isolation included being unmarried, lower education, low income, and being male. Additionally, Hispanic and Black older adults had lower probabilities of isolation compared to White older adults (Cudjoe et al., 2018). Social isolation can increase the risks of depression, cognitive decline, and chronic illnesses (Beller & Wagner, 2018). Interpersonal interactions tend to decrease as individuals age for an array of reasons, including role traditions and adjustments relating to retirement, the death of loved ones, or role loss (Cudjoe et al., 2018).

Role Transitions and Adjustments

Retirement. According to the Social Security Administration (2019), the retirement age was 65 for many years. However, the age of retirement has increased to 67 years old. In 2018,

24% of men and an estimated 16% of women ages 65 and older were in the workforce. By 2026, these numbers are projected to increase to 26% for men and 18% for women (Population Reference Bureau, 2019). In the United States, older adults often remain in the workforce after retirement because of the economic climate. The costs of living and the need for additional health insurance coverage aside from Medicare are crucial factors to workforce participation (White, Burns, & Conlon, 2018). Other factors contributing to workplace longevity are advances in healthcare, allowing older adults to become employed longer. Studies have shown favorable outcomes in areas of cognitive function (Adam, Bonsang, Grotz, & Perelman, 2013), reduced the risk of dementia (Dufouil et al., 2014), and delayed the onset of Alzheimer's disease (Lupton et al., 2010) when older adults have a later departure from the workforce. As such, associations between retirement and cognitive aging has been linked to cognitive reserve (Grotz et al., 2017). As older adults remain employed, their brains become more mentally stimulated in a way to compensate for the effects of age-related cognitive decline (Grotz et al., 2017).

Grotz et al. (2017) conducted a study to investigate the psychological transition and adjustment process related to retirement and cognitive performance. The participants of this study consisted of 590 older adults without dementia at baseline. Participants filled out a questionnaire related to their psychological transition and adjustment process of retirement. Questions were to be rated on a five-point Likert scale ranging from one (I do not agree at all) to five (I totally agree) and consisted of nine domains. Domains entailed the following: factors that pushed people to retire, factors that held people into employment, the experience of retirement transition, perception of control over the departure from the workforce, time availability since retirement, how much individuals are enjoying the decrease in stress and responsibilities, development of new activities since retirement, acceptance of the end of working life, and

adaptation to free time. A neuropsychological assessment was also administered to assess episodic and semantic memory, attention, verbal fluency, and psychomotor speed. Results from the study revealed that the domain associated with factors that held people to employment was significantly associated with better performance in verbal fluency (β = 0.55, p = .036), episodic memory (β = 0.34, p = .016), and attention (β = 0.31, p = .090). The domain that assessed the development of new activities after retirement was associated with better verbal fluency (β = 0.45, p = .001), attention (β = 0.30, p = .001), and episodic memory (β = 0.12, p = .088). Additionally, performances in verbal fluency (β = 1.08, p = .001) and attention (β = 0.47, p = .017) were associated with older adults who reported lack of boredom and time to participate in activities. No significant associations were found between the other domains and cognitive performance. Overall, results from this study revealed psychological transition and adjustment to retirement were determinants of positive cognitive performances (Grotz et al., 2017).

While positive associations are seen between working during retirement and improved cognitive function, older adults who choose not to remain in the workforce during retirement may experience age-related cognitive decline in areas of verbal memory (Xue et al., 2018) and immediate and delayed recall (Rohwedder & Willis, 2010). Rohwedder and Willis (2010) conducted a cross-sectional study to compare the cognitive performance of retired older adults with non-retired older adults by using data from the U.S. Health and Retirement Study, the English Longitudinal Study of Ageing, and the Survey of Health, Ageing, and Retirement in Europe. A measure of memory performance was utilized to assess the immediate and delayed recall of 10 words. Results from the study showed that older adults who retired in their early sixties experienced a decline in cognitive ability, more specifically memory (Rohwedder & Willis, 2010).

The departure from the workforce can also involve numerous changes in work role status and occupational attachment with challenges involving transitioning from employee to retiree (Adam et al., 2013). Retirement is associated with a large adjustment in a person's daily routine. The lack of interaction with coworkers and independence from earning an income can result in isolation and loneliness (Sewdas et al., 2017). Therefore, continued engagement in meaningful activities and hobbies during retirement is important for cognitive stimulation and life satisfaction.

Role loss. Older adults are at greater odds of experiencing interpersonal loss because adult children may become intertwined in their own lives with a variety of different responsibilities consisting of childrearing, being employees, and tending to their spouses (Ha, Carr, Utz, & Nesse, 2006). Role loss also occurs as older adults start losing roles as spouses. Grieving the loss of a spouse is multifaceted and can have psychological and physical consequences such as feelings of depression, anger, and loss of appetite, sleep, and energy (Utz, Carr, Nesse, & Worthman, 2002). The interest in caring for oneself becomes neglected, resulting in susceptibility to infections and diseases (Van Willigen, 2000). Adapting to new responsibilities, such as managing finances and participating in household tasks, also comes as a challenge (Utz et al., 2002).

Many older adult couples have fixed traditional roles within their marriage, where each spouse is responsible for accomplishing specific tasks and duties (Van Willigen, 2000). For example, many wives may have prepared meals for their husbands and did their laundry; therefore, if the responsibility of making dinner and washing clothes falls on the husband after his wife passes, he may feel overwhelmed and confused. When older adults lose their role as a friend, sibling, or spouse, they generally have less contact with others, resulting in isolation and

withdrawal from their social groups. When role loss occurs, older adults who are unable to adjust and maintain their social wellness by interacting with others may experience a loss of control over their lives with lower levels of life satisfaction (Van Willigen, 2000).

Evidence-Based Social Interventions that Improve and Promote Successful Aging in Older Adults

Adjusting to different role transitions and responsibilities can pose difficulties and challenges to older adults. Retirement, role loss, and the death of loved ones can create psychological distress and social isolation. Research has shown that older adults who are isolated also have an increased risk for morbidity and mortality compared to those who engage in interpersonal relationships (Shankar, McMunn, Demakokos, Hamer, & Steptoe, 2017). As a result, developing interpersonal relationships and engaging in meaningful activities are important factors in providing older adults with overall life satisfaction. Social engagement among those aged 65 and older is a strong protective factor for health (Ellwardt, Van Tilburg, & Aartsen, 2014). Older adults reporting a greater number of interpersonal relationships in their social networks also showed higher cognitive functioning (Ellwardt et al., 2014).

Interventions that focus on interpersonal relationships and building social connections in older adults are scarce. However, research has shown a relationship between social connectedness, physical health, and psychological well-being (Pietzak & Southwick, 2014).

Group interventions, as described in Chapter V, can be utilized to aid older adults in finding purpose and meaning to their lives to prevent social withdrawal and isolation (Koementas-de Vos et al., 2018). Processing and supportive group therapy can increase life satisfaction, help older adults with difficult life transitions, and receive support from others (Moral et al., 2015). As mentioned previously, group therapy has been shown to reduce social

isolation and enhance social supports in older adults because of the opportunity to share age-related concerns and develop interpersonal relationships in a safe environment (Koementas-de Vos et al., 2018). Additionally, participating in leisure activities with others that are enjoyable such as volunteering in the community, playing cards, starting a book club, or trying a new hobby, has been shown to decrease the risk for chronic health conditions, reduce the risk for Alzheimer's disease, and reduce the risk for depression (Koementas-de Vos et al., 2018).

CHAPTER VII: GOLDEN ZEST HEALTHY AGING PROGRAM DESIGN

Purpose of the Program Design

The intention of this program design is to assist older adults in embracing age with positivity by promoting successful aging through the development of an evidence-based holistic program. Thus far, programs that promote a holistic view of the wellness of older adults are uncommon. This program will simulate a gym setting, where older adults can have opportunities to share age-related concerns while engaging in physical, cognitive, and mentally stimulating activities to maintain a well-balanced lifestyle. The evidence-based interventions that were gathered for this literature review will facilitate the program design. Before individuals join Golden Zest, they will fill out a questionnaire on general information regarding education and vocational history, social history, mental health history, and medical history. Furthermore, inclusion and exclusion criteria will be implemented to ensure the safety of individuals.

Inclusion. Although this literature review focuses on individuals over the age of 65, it is important to take preventive measures to ensure adults are engaging in stimulating activities. Therefore, Golden Zest will be intended to provide services for individuals 50 years and older. Members need to consult with their primary care physician (PCP) regarding their ability to participate in physical activities throughout the program. While members can modify their level of physical exercise to best fit their needs, unless their PCP says otherwise, if a member is unable to participate in an offered program due to chronic illness or disease, members can participate in other aspects of the program.

Exclusion. Individuals who are experiencing active suicidal ideation are encouraged to seek mental health care before participating in Golden Zest. Individuals who are chronic drug and alcohol users are not encouraged to participate in the programs offered. The chronic use of

drugs and alcohol can impede their ability to participate in activities that require mental and physical stimulation.

Biopsychosocial questionnaire. Individuals will be asked to fill out a biopsychosocial questionnaire to gain information on their overall well-being and ensure they receive the activities necessary and desired before becoming Golden Zest members. There will be five domains within the questionnaire that will encompass different aspects of the individual's life. The first domain, general information, will allow Golden Zest to gain data on the person's gender, age, address, and emergency contact. The second domain, education and vocational history, allows insight into the individual's current employment status. If an individual is retired, social isolation and adjustment to new role transitions may emerge; therefore, this individual might benefit highly from activities that encompass socialization. The third domain, social history, provides Golden Zest information on an individual's support network, activities, and substance use. As mentioned previously, an individual has chronic drug or alcohol use is unable to become a member and will be given resources to contact mental health professions that could assist in their substance use treatment. The fourth domain, mental health history, is beneficial in gathering information on the individual's symptoms, suicidal ideation, and mental health needs, which will be valuable when psychotherapy groups are conducted. Due to the exclusion criteria, individuals experiencing active suicidal ideation are unable to become members of Golden Zest until they receive treatment stabilization, due to the possibility of becoming emotionally heightened during psychotherapy activities. Last, the fifth domain will cover medical history. The purpose of obtaining information on current health status, medication, and exercise is to ensure the individual is participating in the proper level of

physical activity throughout the program (see Appendix A). Furthermore, all participants must have a PCP on file in case of an emergency.

Additional measures. Individuals also will be screened for anxiety and depression by utilizing the Patient Health Questionnaire-9 (PHQ-9) and Generalized Anxiety Disorder-7 (GAD-7). Exercise also will be assessed using the Community Healthy Activities Model Program for Seniors Physical Activity Questionnaire (CHAMPS).

Golden Zest

Golden Zest is a holistic program that focuses on the whole person; therefore, the presence of several professionals would benefit the program design and ensure safety measures. Mental health professionals can facilitate various activities such as group psychotherapy, mindfulness, and active mind exercises, and provide guidance on coping skills and understanding thoughts, feelings, and behaviors by encouraging members to achieve their goals. Personal trainers and fitness instructors have general knowledge of health and exercise and can help decide which level of physical activity would benefit members. They can facilitate psychoeducation on nutrition, aerobic exercises, provide members with fitness support, and assist in walking and hiking exercises. Communication with the PCP of each member is advised to determine if levels of physical activity are becoming strenuous or harmful. Additional events that will be occurring at Golden Zest, such as book clubs, painting, planting, crochet, and learning to play a musical instrument, are directed by skilled volunteers.

Golden Zest is a holistic program for adults over the age of 50. The program will resemble a gym with different areas to engage in various activities throughout the week. Activities will encompass physical, cognitive, psychological, and social exercises. Refer to Table 1 for the weekly schedule. Members also will be asked to fill out a self-evaluation form

that rates their satisfaction in the following domains: individual, social, physical, psychological (mood), and overall well-being. Members will rate each domain on a scale of 1 to 10, with 10 being the most satisfied. The form will be given at the start of membership and again every six months. This self-evaluation form will be imperative to assessing progress and overall fulfillment and contentment with the activities offered at Golden Zest. Additionally, members will be given a wellness book where they could keep track of their physical exercise, activities, mood, and food intake daily. This wellness book will be revisited with mental health professions and personal trainers every six months to monitor individual progress.

Table 1

Golden Zest Weekly Program Schedule

Time	Monday	Tuesday	Wednesday	Thursday	Friday
	Physical exercise [a]	Physical exercise	Physical exercise	Physical exercise	Physical exercise
	Active mind [b]	Active mind	Active mind	Active mind	Active mind
8am-8:10am	Meditation	Meditation	Meditation	Meditation	Meditation
8:30am-9am	Aerobics class	Outdoor walk	Outdoor hike	Aerobics Class	Outdoor walk
9:30am-10:30am	Planting	Nutrition & Weight [c]	Crochet	CBT	Risk factors for mental health disorders
11am-12pm	Navigating technology [c]	CBT	Risk factors for ARCD [c]	Smoking cessation [c]	RT
2pm-3pm	Painting and art	Prevention of chronic diseases	RT	Music	Book club
4pm-4:25pm	Yoga	Yoga	Yoga	Yoga	Yoga

Note. RT = Reminisce therapy; CBT = cognitive behavior therapy.
[a] Physical exercise is available throughout the day with the use of treadmills and ellipticals.
[b] Active mind activities are available throughout the day, with activities consisting of board games, crossword puzzles, card games, crochet, crafts, iPad usage, and planting.
[c] Psychoeducation.

Activities Offered

As mentioned previously, the evidence-based interventions that were gathered for this literature review will facilitate the activities offered at Golden Zest, with duration and intensity

recommendations to aid in mitigating risk factors associated with physiological, cognitive, psychological, and social changes that occur with aging.

Physical exercise. The engagement in physical activity has shown to mitigate risk factors associated with all areas of aging in this literature review. Physical exercise can mitigate risk factors for chronic disease, depression, and anxiety. It has also been associated with neuroplasticity and the enhancement of new brain cells, which could help slow the process of cognitive decline in the domains of learning and memory. It is recommended that older adults engage in at least 30 minutes of exercise and strength training, 2 to 3 times per week (Baker et al., 2001; Park et al., 2014; Tully et al., 2007). Older adults could engage in mild to moderate intensity exercise depending on their physical abilities.

Golden Zest will have cardiovascular machines (e.g., treadmills, ellipticals) and strength training equipment (e.g., barbells, dumbbells) for members to use throughout the day as strength training helps older adults maintain strength and increase muscle mass. Activities that promote physical exercise, such as walking, hiking, and aerobics, will be offered throughout the week for 30 minutes (Park et al., 2014; Tully et al., 2007).

Nutrition. Psychoeducation on nutrition and health will be provided. Topics will focus on the prevention of chronic diseases, mental health difficulties, and age-related cognitive decline by limiting sodium intake, consumption of sugar-based drinks and food, and the avoidance of tobacco. During psychoeducation classes, members will be given a list of healthy foods (e.g., vegetables, fruits, low-fat dairy products) and recipes that aid in maintaining a healthy weight. Members will be encouraged to write down their daily food intake in their wellness book to review with their fitness trainer. If members are currently tobacco smokers and have a desire to quit, smoking cessation information will be available, along with cessation

resources for programs offered in their area. Both psychoeducation classes will be held for an hour, once per week.

Mindfulness meditation and yoga. Meditation will allow members to reach a state of relaxation through techniques that encourage attention, awareness, reduced impulsivity, and mental self-regulation. Ten minutes of meditation, five days per week, is recommended to improve areas of attention, motor skills, self-regulation, and memory (Malinowski et al., 2017). Also, engaging in yoga for at least 25 minutes per day is beneficial in improving muscle tone, balance, sleep quality, improved mood, and stress reduction (Halpern et al., 2014). Meditation will be offered daily for 10 minutes. Yoga also will be offered daily for 25 minutes.

Active mind. Participating in intellectually engaging activities can benefit the connections between neurons in the brain while promoting positive and healthier lifestyles. (Stephankova et al., 2014). Keeping the mind engaged also increases the ability to learn new skills and improve cognition by strengthening neuronal activities (Sewdas et al., 2017). Members can also take this opportunity to build social connections and support. An area called "Golden Jewels" will be open throughout the day and will consist of activities such as board games, crossword puzzles, and card games. Cognitive demanding hobbies such as quilting have shown to increase memory in older adults; therefore, events will be offered weekly that engages older adults in planting, painting, book clubs, crochet, and learning to play a musical instrument. Learning new technological skills has shown to enhance memory and processing speed; therefore, a class that provides information on navigating iPads will be offered once per week for an hour. iPads will be available in Golden Jewels. N-back games, words with friends, and scrabble will be downloaded on the iPad. Members are recommended to engage in mentally stimulating activities for at least an hour each day (Hughes et al., 2010; Sewdas et al., 2017).

Group psychotherapy. Group psychotherapy is effective in treating mental health disorders while developing interpersonal relationships and receiving support in a safe environment. Golden Zest will offer reminisce therapy and CBT. Reminisce therapy will allow members to explore details of their life and discuss events surrounding childhood and adulthood. As members recall areas of their lives, they can receive support and provide coping strategies to one another, while improving self-esteem and a sense of fulfillment and comfort as they look back on positive memories and events. CBT focuses on improving mood, behavior, and overall quality of life by evaluating thoughts so that thinking can become more realistic. This group will focus on several topics consisting of managing depression, anxiety, and role transitions. Techniques consisting of behavioral activation will also be utilized so members can lead an active and engaging lifestyle on days they are not attending Golden Zest. Members are recommended to attend each psychotherapy group for an hour per week (Moral et al., 2015; Stanley et al., 2003).

Psychoeducation. The focus of this program design is to promote successful aging. As a result, it would be an important aspect for members to understand the importance of engaging in the numerous activities offered at Golden Zest. Along with providing psychoeducation on smoking cessation and nutrition, psychoeducation on the risk factors and benefits of preventing chronic diseases, age-related decline, and mental health will be offered. Psychoeducation will be provided on each topic once per week for one hour.

Maintenance. All members are recommended to participate in the duration and intensity of all activities. If members are unable to attend some of the activities offered at Golden Zest, they are encouraged to engage in those activities off-site. For example, studies recommend participating in yoga exercises for at least 25 minutes per day. However, Golden Zest will only

be open five days per week. As a result, 50 minutes of yoga should be completed on the weekend. Members are also encouraged to download and participate in applications such as n-back games, words with friends, and mentally stimulating games while off-site to continue stimulating their brains.

This literature review demonstrates that biological, psychosocial, and psychological changes of aging influence one another; therefore, Golden Zest takes a holistic approach to improve aging outcomes. Although this program is designed to encompass the whole person, Golden Zest is intended to be individualized. The utilization of self-report measures and questionnaires gauge which interventions should be weighted more heavily. This is an important facet of the program, given that changes associated with aging are perceived and managed distinctively between individuals. Individual differences reveal how a person adapts to life stressors and situations. For instance, a retired older adult with a strong social support network and a sense of psychological resiliency may have decreased vulnerability for risk factors associated with depression, anxiety, and isolation because of their ability to cope with a crisis and engage in meaningful relationships. Nevertheless, they may lack participation in activities that promote physical and cognitive well-being; therefore, focusing on physical and cognitive stimulation may be the most beneficial for these older adults. Consequently, identifying specific needs can emphasize interest and promote the strengthening in areas that are neglected, which can increase motivation and participation.

Overall, this comprehensive, holistic program design is intended to alleviate risk factors associated with the physiological, cognitive, psychological, and social facets of aging. The goal of this program is to assist older adults in leading a well-balanced lifestyle by encouraging the recommended engagement in evidence-based interventions such as physical exercise, diet and

nutrition, mindfulness meditation, yoga, mentally stimulating activities, and building interpersonal relationships. Refer to Figure 1 for the comprehensive visual of the risk factors and interventions associated with healthy aging.

CHAPTER VII: DISCUSSION

Summary of Findings

The objective of this literature review was to examine risk factors associated with the physiological, cognitive, psychological and social facets of aging, and to design an evidence-based holistic program that can provide interventions to mitigate risk factors. The design of Golden Zest was to promote successful aging by helping older adults embrace aging with positivity through the engagement of physical, cognitive, and social activities.

To understand the factors that impact aging and the interventions that can help mitigate such risk factors, it was important to examine what constitutes older age, identify successful aging, and theories that explore how individuals age. Older adults are described as individuals who are over the age of 65 (Federal Interagency Forum on Aging-Related Statistics, 2016). "Older adult" is the recommended term to use rather than "elderly" or "aged" because it encourages positive representation of the aging process (as cited in Avers et al., 2011). Successful aging is described as taking preventive measures to avoid illness and disease, continuing physical activity, and being able to function cognitively, and engagement in social activities (Rowe & Kahn, 1997). However, other theories incorporate developmental, psychosocial, biological, and brain-environmental characteristics that contribute to the aging process.

Developmental theories of aging emphasize the importance of confronting social and environmental challenges throughout the lifespan. For the purposes of this review, the emphasis was placed on the eighth and ninth stages of development. When older adults confront the eighth stage of development, they start to contemplate their accomplishments. Older adults may feel a sense of fulfillment with their lives, or they may feel dissatisfied (Erikson, 1998). During

the ninth stage of development, older adults may experience difficulties with social and physical abilities (Erikson, 1998). The psychosocial theory of aging demonstrates how people progress and adapt in old age. Some may find comfort in participating in meaningful relationships (Paggi et al., 2016), while others find contentment in being free from financial burden and social responsibilities (Bergstrom & Holmes, 2000; Harris & Bodden, 1978). Biological theories propose that aging is the result of an internal biological clock or environmental damage to the body's systems (Sergiev et al., 2015). Last, brain-environmental interactions, such as the theory of cognitive reserve, suggest that the brain attempts to cope with age-related brain alterations by utilizing compensatory approaches (Stern, 2012). Several studies suggest that increasing cognitive reserve can be achieved through experiential resources, educational and occupational accomplishment, and participating in physical and mentally stimulating activities (Stern, 2012; Tucker-Drob et al., 2009). A robust cognitive reserve can help the brain find alternative ways to cope with any failures, difficulties, environmental toxins, or stress because of the brain's ability to modify its neuronal connections, structure, and function in response to life-changing experiences (Garrett et al., 2010). Each theory has a different approach to the aging process, but they all share commonalities—the aging process is unavoidable and physiological, cognitive, psychological, and social dynamics are part of healthy aging.

Physiological factors and interventions associated with aging. Genetics and environmental factors such as exposure to toxins, pollutants, and diseases influence the progressive decline of physiological functions (Jin, 2010). Degeneration of physiological mechanisms including loss of skeletal tissue (Vilestra et al., 2019), muscles, and nerves in the body can contribute to limitations in fine and gross motor skills, balance, and coordination (Costello et al., 2019; Hunter et al., 2016). Along with declines in neuromuscular and skeletal

systems, older adults are at high risk for chronic diseases. Hypertension, high cholesterol, arthritis, heart disease, diabetes, and obesity are among the most common chronic health conditions among older adults (Raghupathi & Raghupathi, 2018), which can have physical and cognitive impacts. The development of chronic health conditions has been associated with alterations in brain structure and function. Cognitive impairment has been observed in connection with hypertension, high cholesterol, arthritis, heart disease, diabetes, and obesity. As a result of developing a chronic health condition, cognitive functions that are impacted include memory, attention, language, visuospatial skills, executive functioning, language, abstract reasoning, and sensory perception (Montserrat et al., 2015; van den Berg et al., 2010; Zilliox et al., 2017). Approximately 45% of all Americans suffer from at least one chronic disease (Raghupathi & Raghupathi, 2018); therefore, commitment to an improved lifestyle can reduce risk factors for chronic diseases and declines in neuromuscular and skeletal systems.

The studies in this review suggest physical activity, nutrition, avoidance of tobacco, and life satisfaction as evidence-based physiological interventions shown to improve and promote successful aging in older adults. Regarding physical activity, positive associations between physical exercise and successful aging have been observed (Gopinath et al., 2018). The recommended engagement in physical exercise for older adults includes at least 30 minutes of exercise, 2 to 3 times per week (Park et al., 2014; Tully et al., 2007) and strength training exercise at least 2 days per week. Participating in physical exercise and strength training can mitigate cardiovascular risk factors and increase muscle mass and strength (Baker et al., 2001; Messier et al., 2004). Studies have also expressed the importance of physical activity playing a key role in improved mobility and reducing the risk of chronic diseases such as cardiovascular

disease (Madden et al., 2009), stroke (Rahbar et al., 2018), diabetes (Tyrovolas et al., 2015), and arthritis (Yu et al., 2018).

Limiting the consumption of sugar-based drinks and food (Tyrovolas et al., 2015) while eating well-balanced diet involving vegetables, fruits, and low-fat dairy products can prevent obesity (Sacks et al., 2001), which is known to be the leading cause of elevated cardiovascular disease mortality and morbidity (Akil & Ahmad, 2011). Studies have also shown reducing sodium intake can reduce blood pressure (Sacks et al., 2001; Cappuccio, Markandu, Carney, Sagnella, & MacGregor, 1997; Tabiban et al., 2018). Cigarette smoking is also a risk factor for developing chronic health problems such as lung cancer (Shi et al., 2013), chronic obstructive pulmonary disease (Hedström et al., 2018), coronary heart disease, stroke (Kurth et al., 2003), diabetes (Shi et al., 2013), and rheumatoid arthritis (Hedström et al., 2018). Smoking cessation has shown improvements in cholesterol, a reduction in heart rate, and decreasing risks for chronic diseases. Smoking cessation, coupled with exercise, has effects on the inflammation of white blood cells, red blood cells, heart rate, and oxygen levels (Korhonen et al., 2011). Last, life satisfaction has been associated with lower rates of chronic disability in older adults. Having a sense of meaning and greater purpose to life, having a positive attitude, understanding risks for developing chronic disease, and being part of a social network have been associated with lower rates of chronic disability in older adults (Folling et al., 2016; Schneider et al., 2012).

Cognitive factors and interventions associated with aging. Age-related cognitive decline is seen with healthy aging. Changes in reductions in structural and functional connectivity between different brain regions can affect higher-level functioning. Several studies have revealed abilities involving processing speed, episodic memory, executive function, spatial abilities, attention, and problem-solving and reasoning decline as people age (Basak &

Vergaeghen, 2011; Chee et al., 2009; Fjell et al., 2017; Mahapatra & Sahoo, 2016; Singer et al., 2003). Abilities that can become affected with healthy age-related decline are recalling facts and experiences, organizing, planning, initiating tasks, impulse control, sustaining attention, and tasks such as getting dressed, putting on makeup, or driving. While some mental processes are affected by the aging process, other areas involving semantic memory and vocabulary knowledge remain stable over time (Crawford & Stankov, 1996; Horn & Cattell, 1967).

The studies in this review suggested physical exercise, mindfulness meditation, and mental stimulation as evidence-based physiological interventions shown to slow the process of age-related cognitive decline. Similar to physiological interventions, biweekly engagement in physical exercise such as brisk walking has shown to increase brain activities in areas of spatial and episodic memory (Rao & Sarkar, 2017; Shimada et al., 2017). Hiking, cycling, aerobic exercise, and strength training are associated with strengthening areas in the brain related to learning and executive functioning (Park et al., 2014; Shimada et al., 2017).

Meditation has also shown increased cognitive processes in the areas of attention, memory, and executive function (Hodgins & Adair, 2010; Moore & Malinowski, 2009; Park et al., 2014). Meditation allows individuals to focus on the present moment to reach a state of relaxation leading to improved neurological health (Lazar et al., 2005). While the benefits of practicing meditation for 2.5 hours per week have demonstrated improvements in memory complaints, increased quality of life, and reduction in depressive and stress symptoms (Lenze et al., 2014), for some older adults 2.5 hours of weekly meditation may feel monotonous. As such, Park et al. (2014) suggested engaging in at least 10 minutes of mindfulness meditation at least 5 times per week can show significant improvements in cognitive function, relaxation, and mood (Park et al., 2014).

Older adults who participate in meaningful activities feel more positive and healthier (Sewdas et al., 2017). Research has revealed engaging in meaningful activities for at least an hour per day can also strengthen neuronal activity in the brain (Sewdas et al., 2017), specifically in areas related to the ability to learn new skills and improve cognition (Stephankova et al., 2014). Playing games (e.g., crossword puzzles, jigsaw puzzles, board games, card games), quilting, photography, music instruments, crafts, and reading are cognitively demanding and can lower the risk for age-related cognitive decline and dementia (Hughes et al., 2010). Furthermore, learning new technological skills has shown to enhance memory and processing speed; therefore, the utilization of technology-based applications, including words with friends and n-back games, is recommended (Chan et al., 2014).

Psychological factors and interventions associated with aging. The American Association of Geriatric Psychiatry (as cited in the Centers for Disease Control and Prevention, 2008) has reported anxiety and depression as the most common mental health disorders in older adults. While depression and anxiety are not part of the normal aging process, risk factors associated with both disorders have profound effects on older adults (Adams et al., 2008). According to the World Health Organization (2017), older adults have the highest suicide rate in the world, with the highest rate among older White males in the United States. Lower socioeconomic status, impaired social support, becoming a widow, financial status, and retirement contribute to late-life depression and suicidal behaviors (Motl et al., 2005). Chronic health conditions, poor health status, and physical disability also contribute to depressive symptoms in older adults (Blazer, 2003). The prevalence of anxiety disorders in older adults is 4% to 10% in community samples and 15% to 20% who do not meet full criteria for anxiety disorder but display anxiety symptoms (Gum et al., 2009; Mehta et al., 2003). Studies have

shown that the onset of anxiety in older adults stems from changes and fears associated with losses, dependence, finances, and death (Steffens & McQuoid, 2005).

Similarly, the risk factors that impact depression have also been shown to impact anxiety; therefore, comorbid depression and anxiety are common in older adults (Preville, Herbert, Bravo, & Boyer, 2002). Additionally, mood states have shown to have a significant impact on cognition in the areas of memory, attention, and processing speed in older adults (Beaudreau & O'Hara, 2009). The influences mood has on cognitive function have been linked to the overlapping of cortical and subcortical brain regions associated with cognition and emotion (Pauls et al., 2015).

The studies in this review revealed physical exercise, group therapy, cognitive-behavioral therapy, and yoga as evidence-based psychological interventions shown to improve and promote successful aging in older adults. Pharmacological interventions are the most used treatment for anxiety and depression in older adults (Mark et al., 2011), but in recent years there has been a shift to utilizing non-pharmacological interventions to decrease the aversive side effects medication can pose on older adults (Desai, 2003). Group therapy can take several modalities, such as processing and supportive. Studies have shown that engaging in reminisce therapy, once per week for one hour, has been effective in treating mental health disorders because it offers the opportunity for older adults to explore details of their life story, develop interpersonal connections, share age-related concerns, and a chance to give and receive feedback (Koementas-de Vos et al., 2018).

Physical exercise has shown to improve the risks of developing chronic diseases but has also shown to improve mood. The recommended participation in physical exercise to improve anxiety is at least 30 minutes (Watanabe et al., 2000). Studies also suggest both high intensity

and low-intensity exercise can improve symptoms of depression (Yuenvongchiwat et al., 2018). In addition to mood, exercise has also shown to regulate behavior, appetite, sleep, and memory (Desai, 2003).

Cognitive-behavioral therapy is another treatment modality that focuses on how thoughts, feelings, and behaviors are influenced by one another. Often, negative life events can lead to fewer positive reinforcements. As a result, cognitive-behavioral techniques, such as behavioral activation, have shown to improve overall mood by engaging in a balance of enjoyable activities while also attending to responsibilities that have been neglected. Studies have also shown efficacy in the engagement of CBT interventions for one hour per week. Interventions consisting of deep muscle relaxation and exposure can alleviate symptoms of anxiety and depression.

Developing research has been examining the impact of yoga on psychological distress. Although yoga takes different modalities, they all encompass a mind and body exercise consisting of performing different postures (Chen et al., 2009; Field et al., 2013). Yoga has been shown to strengthen and calm the body, mental mastery, and produce higher levels of vitality, and psychological well-being (Chen et al., 2005; Moliver et al., 2013). Research has shown engaging in at least 25 minutes of yoga per day can benefit overall sleep quality, depression, anxiety, stress, and tension in individuals over the age of 60 (Halpern et al., 2014).

Social factors and interventions associated with aging. In 2011, approximately 7.7. million community-dwelling older adults reported social isolation (Cudjoe et al., 2018). Later, life is associated with role transitions and adjustments, which can lead to social isolation and withdrawal (Erikson, 1998). Role transitions and adjustments include retirement, the death of a loved one, or role loss (Cudjoe et al., 2018). Studies have shown advantageous outcomes in

areas of cognitive function (Adam et al., 2013), reduced risk of dementia (Dufouil et al., 2014), and delayed onset of Alzheimer's disease (Lupton et al., 2010) when older adults have a later departure from the workforce. These positive outcomes could be attributed to the mental stimulation that occurs when working (Grotz et al., 2017). Older adults who do not remain in the workforce during retirement could experience a decline in areas related to verbal memory and immediate and delayed recall (Rohwedder & Willis, 201). Additionally, challenges with transitioning from employee to retiree can lead to isolation and loneliness, as a lack of interaction with coworkers and adjusting to a new daily routine can pose difficulties (Adam et al., 2013).

Losing roles as spouses can also impact older adults. Studies show when role loss occurs depression, anger, and loss of appetite, sleep, and energy may occur, as caring for oneself becomes neglected (Utz et al., 2002). Adapting to new responsibilities may also pose challenges, as most older adult couples have fixed traditional roles (Van Willigen, 2000). Retirement and role loss may result in a lack of interpersonal interactions and can increase risks for depression, chronic illness, cognitive decline, and lower levels of life satisfaction (Beller & Wagner, 2018).

The studies in this review revealed group therapy and building social connectedness can to improve and promote successful aging in older adults. As mentioned previously, processing and supportive group therapy have been shown to reduce withdrawal and isolation by enhancing social support (Koementas-de Vos et al., 2018). Participating in activities such as playing cards, starting a book club, volunteering in the community, or trying a new hobby has been associated with increased life satisfaction and reduced risks for dementia, Alzheimer's, and social isolation (Koementas-de Vos et al., 2018).

Strengths and Limitations

Aging is an inevitable and dynamic process that most individuals do not necessarily think about during their day-to-day experiences. However, everything we endure seems to affect our aging process from the foods we eat, activities we participate in, to the interpersonal relationships we share. Often, when individuals start to contemplate the aging process, it is accompanied by feelings of fear and negativity. Therefore, this literature review was intended to do the opposite. This review was intended to promote successful aging by identifying risk factors associated with the aging process but also promote positivity by encouraging the participation in interventions that aid in mitigating age-related decline. To date, there are few comprehensive programs designed to holistically mitigate the aging process for older adults; therefore, Golden Zest appears to be relatively comprehensive for understanding the risk factors associated with aging and the importance of engaging in evidence-based treatment to alleviate risk factors. Studies with older adults typically examine one factor of well-being or several. Nevertheless, this literature review was able to encompass complete health, which is defined as physical, cognitive, mental, and social well-being (World Health Organization, 2020). The biopsychosocial approach taken in this review also creates the opportunity to easily identify risk factors and interventions necessary to decrease age-related decline. Additionally, the majority of the studies that contributed to this literature review included moderate to large sample sizes and utilized control groups.

While there are strengths to this review and program design, there are some limitations. Quantitative research that examines evidence-based interventions that mitigate risk factors for physiological, cognitive, psychological and social factors of aging vary in quality and quantity. Studies investigating physiological and cognitive risk factors of older adults contain the most

research; therefore, the evidence-based interventions for alleviating risk factors were robust in these areas. On the contrary, studies examining psychological and social risk factors of older adults are scarce. The limited information in these areas could be attributed to the stigma placed on mental health and the importance placed on medical treatment. Risk factors associated with the social adjustments of aging could lead to isolation and withdrawal, which could produce mental health difficulties such as depression and anxiety. Often, anxiety and depression are underdiagnosed because symptoms of depression and anxiety overlap with medical conditions, placing more priority on physical well-being at the expense of mental health (Ho, 2007).

Due to limitations on studies for psychological and social risk factors, obtaining information on evidence-based practices was challenging. More specifically, group therapy for older adults has shown to improve mental health and an opportunity to form interpersonal relationships (Koementas-de Vos et al., 2018). However, group therapy for older adults typically targets physical disabilities (Heisel et al., 2015); therefore, studies in this area were inadequate. Additionally, the use of effect sizes is important in research because they add significance to studies by evaluating the magnitude of difference between groups. In this review, most researchers did not reference effect sizes in their studies. For the Golden Zest program, including studies that contained effect sizes would have been valuable in incorporating activities that have a medium to large effect on mitigating risk factors.

Clinical Implications and Recommendations for Future Research

Overall, this program design was developed to promote successful aging by identifying interventions that can help mitigate risk factors associated with the physiological, cognitive, psychological, and social changes of aging. Given that this literature review is focused on older adults, future studies should utilize empirical research to assess for interventions that can

alleviate psychological and social risk factors associated with aging, as most research is primarily focused on the physical and cognitive health of older adults. Additional research in these areas could enhance interventions used in this design, making for a more robust holistic program. Although this program is intended to simulate a gym setting, due to the lengthy process it may take to create such a program, future research can utilize this program design as a stimulated study to evaluate the intensity and duration of the interventions proposed and its effects on the physiological, cognitive, psychological, and social well-being of older adults. Furthermore, Figure 1 provides a framework for future studies to utilize to assess which interventions should be weighted more heavily based on individual needs.

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Appendix A: Biopsychosocial Questionnaire

A. General Information
    1. Name:
    2. Date of Birth:
    3. Gender:
    4. Current Address:
    5. Phone Number:
    6. E-mail Address:
    7. Emergency Contact:
    8. Briefly describe your interest in joining Golden Zest:

B. Educational and Vocational History
    a. Highest grade completed:
    b. Current employment status:
    c. Have you served in the military? If so, describe your branch, rank, length of service, and discharge type:

C. Social History
    a. With whom do you currently live?
    b. Are you single, in a relationship, married, divorced, or widowed?
    c. How many children do you have?
    d. What do you do in your spare time?
    e. Do you have a support system?
    f. Do you drink alcohol or use recreational drugs? If so, state the amount and frequency.

i. If you answered yes, do you feel like you have a problem with drugs and/or alcohol?

g. Describe your current religious or spiritual beliefs and practices:

D. Mental Health History

a. Have you ever participated in any form of counseling or treatment?

i. If you answered yes, what did you find to be the most helpful and the least helpful?

b. Have you been diagnosed with a mental health disorder? If so, please list them:

E. Medical History

a. Please provide the name and telephone number of your primary care provider:

b. How would you describe your current health?

c. When was your last physical exam?

d. List any allergies:

e. List any current related health-related problems you have:

f. List all the medications you are currently taking:

F. Additional Measures

a. PHQ-9

b. GAD-7

c. CHAMPS

Appendix B: Golden Zest Model of Individualized Care

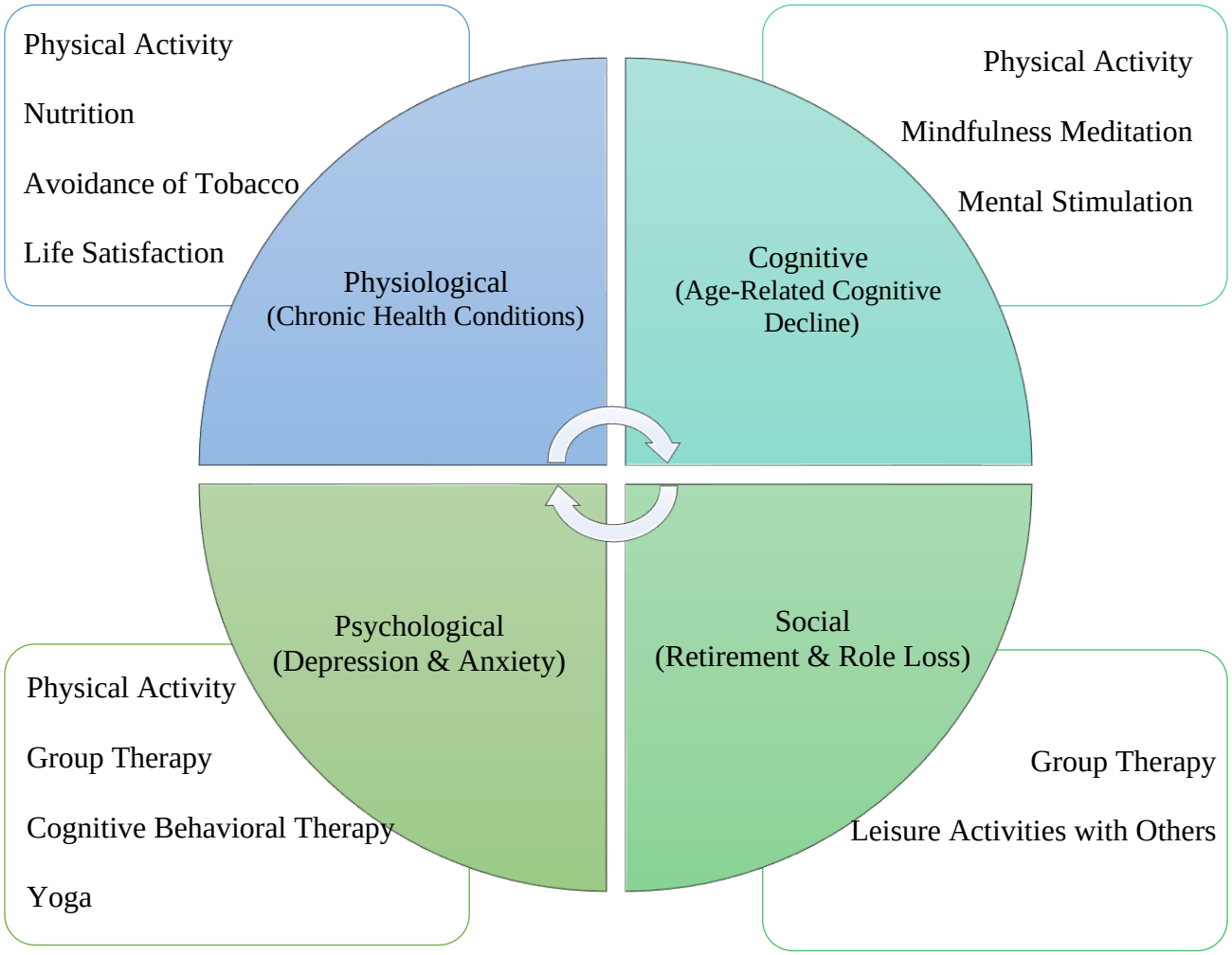

Figure 1. An overview of the factors associated with healthy aging and the evidence-based interventions shown to alleviate risk factors. The cyclical pattern shows the influence each factor of aging has on one another. The rectangles denote the interventions that mitigate the risk factors associated with aging.