EXERCISE AND CLINICAL PRACTICE: INTEGRATION ISSUES AND KNOWLEDGE IN MENTAL HEALTH PROFESSIONALS

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Dedication

I would like to dedicate this project to my family for their endless love and support and their willingness to listen to me go on an on about health and psychology. To my husband for his respect, encouragement, and fascination of learning: thank you doesn't even come close to expressing my gratitude. Your earnest support and unparalleled faith in me has been—and will continue to be—utterly irreplaceable.

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I would like to acknowledge my chair and committee for all of their support and persistence in helping me to see this project through. Thank you for believing in me enough to allow me to stick with this through all of the obstacles.

Abstract

Decades of research attest to the psychological benefits of exercise, documenting improved psychological functioning for specific disorders as well as biological systems. Notable trends include reduction of psychological symptoms (e.g., anxiety, depression), increases in self-esteem, facilitation of neurogenesis, enhancement of cognitive functioning, and improvements in stress response. The majority of these studies call for increased utilization of exercise interventions within clinical practice. However, decades of exercise research and the two existing studies on practice habits suggest that exercise continues to be widely underutilized. The data suggest that clinicians believe exercise is beneficial; they report high confidence and rates of utilization in exercise interventions; however, they also report low levels of education in exercise psychology. It was hypothesized that one possible cause for this persistent research-practice gap may be mental health professionals' (MHPs') misperceptions of their own competence, namely the Dunning-Kruger phenomenon. *Methods:* An original, electronic survey was disseminated to MHPs via email, social media posting, and snowball sampling. Eighty-three clinicians completed the survey, which collected data on beliefs and practice habits; perceptions of confidence and competence; and research knowledge. *Results:* Findings supported previous observations, documenting high levels of confidence amongst MHPs despite low levels of exercise education. Knowledge of research was poor; data suggest that the Dunning-Kruger phenomenon is a factor in the ongoing research-practice gap within exercise psychology. *Conclusions:* This is the first study to measure fact-based competence of MHPs and offer an explanation for the longstanding underutilization of exercise. Findings suggest that clinicians may be at risk for overestimating their own abilities in areas that are less familiar. Further research is needed regarding MHPs' exercise-related competence in order to elucidate the complex nature of factors examined here.

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CHAPTER I

Introduction: Evidence and Interventions

In an environment of persistent dominance of the Western medical model as well as ever-growing diversity, it has not only become necessary to gain understanding of patients' cultures, values, and customs, but it has also become vitally important to utilize treatment methods that suit the needs and values of each individual person. Just as it would be unethical for physicians to push an elective procedure on a patient if it does not align with their health beliefs, it would be unethical to neglect familial factors in the psychological treatment of an individual that identifies as heavily collectivistic. Best practice guidelines for most health professions now include requirements for providers to consider and accommodate patients' cultural identities when providing treatment and recommendations (APA, 2010). This would seem to allow for discussion of interventions that may have some evidence base or benefit even if providers may not use them as the primary method of treatment.

According to the biomedical model, these alternative forms of intervention—which are often referred to in the health literature as Complementary and Alternative Medicines (CAMs)—generally include treatments such as herbal remedies (e.g. Saint John's Wort), manual healing (e.g. acupressure and massage therapy), mind/body control (which encompasses typical psychological interventions like psychotherapy and hypnotherapy), diet and nutritional modifications (e.g. nutritional supplements), and alternative medical practice (e.g. homeopathic medicine and shamanism) (Becvar, Cook, & Pontious, 1998). While some health professionals integrate CAMs into the treatment of their patients, one study surveying various medical professionals found that physicians had an almost entirely negative attitude towards alternative therapies (Risberg et al., 2004).

Unfortunately, little research has been performed on the attitudes and practices of mental health professionals (MHP) regarding CAMs (Wilson, White, & Obst, 2011). However, themes in existing psychological CAM research demonstrate the following: there is increased need for health professionals to be educated about CAMs due to growing need for patient consultation (Becvar, Cook, & Pontious, 1998; Frenkel & Borkan, 2003); patients often feel uncomfortable discussing potential CAMs with their healthcare providers (Mao, Palmer, Healy, Desai, & Amsterdam, 2010). In one study exploring psychologists' attitudes about CAMs, Wilson, White, and Obst (2011) found that in general psychologists held positive beliefs towards integrating CAMs into treatment. However, clinicians also expressed a notable level of concern regarding the risks of integrating alternative treatments that have not received scientific validation. Indeed, Frenkel and Borkan (2003) point out that efficacy studies for a majority of CAMs have not yet been conducted or have not yielded conclusive results.

It seems that clinicians regard the use of exercise interventions in a similar way. That is, given the literature's ongoing call for increased utilization of exercise within clinical practice, mental health professionals appear to be either hesitant to utilize exercise within clinical practice, or lacking some needed resource. While this approach may be warranted for many—if not most—CAMs, it should not represent the use of exercise as a treatment. Unlike many CAMs, exercise possesses a deep foundation of evidence and a growing body of literature that provide strong empirical support for its use as a treatment for innumerable physical and mental health conditions.

Although there is a wealth of evidence supporting the health benefits of exercise—both physiologically and psychologically—it is generally considered to be a form of alternative intervention in medicine and psychology alike. It remains an underutilized treatment that many

MHPs still do not recognize as being appropriate or beneficial to therapy. McEntee and Halgin (1996) examined client cases from the Psychological Services Center at the University of Massachusetts at Amherst to find that even with clients who reported dissatisfaction with their weight, exercise was discussed in only 1.5% of cases. Findings like these seem to support the idea that there are barriers preventing MHPs from integrating exercise into clients' treatment, regardless of how relevant the presentation may render its use. As such, exercise continues to hold a place in clinical work that is functionally similar to that of CAMs—in the category of interventions that are often avoided and likely underutilized.

In actuality, research studies rarely identify exercise as an alternative therapy, perhaps because compelling empirical evidence for its psychological benefits has been published for decades. *This fact alone suggests that aside from being elevated past "CAM status" exercise should be regarded as an evidence-based practice (EBP) for some diagnoses.* In fact, as a result of the comprehensive benefits of exercise, it is now being utilized as a central component to large-scale prevention movements, such as the Let's Move! program sponsored by the First Lady of the United States, Michelle Obama, or the MOVE! intervention series provided by VA facilities across the US. Many other health organizations are also advocating for more physical activity (PA) as a prevention measure for improving overall public health, yet evidence-based, strategic advocacy and education remain uncommon practices in clinical settings.

Paradoxically, MHPs are perhaps the most qualified of all professions to be constructing and directing behavioral change (e.g.., exercise) programs, from private clients to public health initiatives. No other discipline receives in-depth training on how to understand, assess, and modify cognitions, behavior, and surrounding systems—all of which are essential components in achieving any major lifestyle change, especially adopting an exercise regimen. Furthermore, it

seems that as leaders of the cultural health competency movement, MHPs should place extraordinary value on exercise as the highly cost-effective, ever-accessible, cross-disciplinary, and cross-cultural treatment tool that it is.

Given this argument for exercise as a uniquely useful psychological intervention, the objectives of the next chapter are as follows: to provide a standardized definition for exercise as it relates to research and health practice; to illustrate the documented physiological, psychological, and diagnosis-specific evidence base of exercise; to outline the therapeutic qualities of exercise that augment its value as a treatment tool for mental health populations; and to discuss barriers that exist between exercise research and its implementation within clinical settings.

CHAPTER II

Exercise as a Treatment Tool

Definitions of Exercise

Prior to discussing the efficacy of exercise as an adjunctive intervention, it is important to define "exercise" and associated recommendations for PA to ensure clear understanding of the role they play in research and treatment. In general, all major organizations and governing bodies that address health behaviors endorse the following recommendations for PA, which is defined as "any bodily movement produced by skeletal muscles that requires energy expenditure" (World Health Organization [WHO], 2014, para. 1). By this definition, standing, walking, doing chores around the house, cooking, or physically searching for something would all be considered forms of PA. In contrast, the extra effort and commitment to physical activity is what differentiates "exercise" as it's own distinct category. Specifically, exercise is defined as: "a subcategory of physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective" (World Health Organization, 2014, para. 4). Note that from its very foundation, the definition of exercise automatically steers consumers away from the idea of achieving mental health benefits from an exercise regimen, since it cites only improvements in "physical fitness" as the objective. While the intention of physical exclusivity may have been supported by science decades ago, this paper argues that a preponderance of evidence now exists for including "improvements in mental health" as a feasible outcome of routine exercise.

Mental benefits of exercise will be addressed at length in subsequent sections, but regardless of intent and benefit it is essential for clinicians to know the current recommendations for maintaining health. The American Heart Association (AHA, 2014) suggests moderate aerobic

activity for 30 minutes 5 days per week or 25 minutes of vigorous aerobic activity 3 days per week, combined with moderate to high-intensity muscle-strengthening activity 2 days per week. WHO (2010) recommendations for adults aged 18-64 echo those of AHA; however, WHO specifies that *for enhanced physical health benefits, adults should double the amount of time spent doing moderate or vigorous PA.* That is, 150 minutes of moderate exercise per week is recommended only as a minimum amount by which individuals may maintain their health and is not viewed as being enough to improve or enhance any aspect of fitness (brain or otherwise). The U.S. Department of Health and Human Services (DHHS) (1996a), (which encompasses the Centers for Disease Control and Prevention [CDC] as well) upholds WHO's recommendations for obtaining increased health benefits.

Essentially, any physical task other than sitting may be considered PA, whereas exercise is an organized, goal-directed health behavior aiming for "physical fitness," a desired set of attributes related to exercising (DHHS, 1996a). These "attributes," such as aesthetics (e.g. weight and body fat loss), athletic achievement (e.g. completing a marathon), or health outcomes (e.g. increased mobility, metabolism, heart health) are the key factors driving individuals' motivation to exercise. While the latter aims are indeed valuable achievements, it is once again important to point out that none of the aforementioned objectives point towards *brain* health. Although there is a large body of evidence demonstrating PA-induced increases in mental health and brain function, the association between exercise and psychological health remains narrow on a public level. Anecdotally, society's "fit" individuals may be categorized as many things, but being of superior mental health is not typically one of them.

However, just as there are numerous attributes associated with physical fitness, there are different subtypes of exercise that can be linked to specific health outcomes and are named for

the physiological effects they produce. The majority of research using physical activity as an intervention has been conducted using aerobic exercise, or repetitive, rhythmic, large-muscle movements that increase endurance and cardiorespiratory fitness (WHO, 2010, p. 52). For example, running, biking, and swimming are typical experimental treatments used to measure the influence of exercise on various psychological factors. In contrast, little research has been conducted utilizing anaerobic exercise, which targets muscular strength and high-intensity energy systems and is generally accomplished via resistance or strength training (DHHS, 1996a). Examples of this type of exercise include weight lifting, body weight exercises (e.g., lunges versus running), and some circuit training (brief, high-intensity bursts of various exercises). Although the body of research examining anaerobic exercise in relation to psychological factors is minimal, scientific evidence for the various benefits of resistance training are continually emerging (Conley & Rozenek, 2001) and are reflected where relevant in subsequent sections.

Physiological Benefits of Exercise

In contrast with the slow uptake of exercise as a treatment for psychological problems, it is arguably the most widely-known, accepted, and recommended preventative "treatment" for physiological health conditions. Although the exercise benefits discussed here are purely physiological rather than psychological, this knowledge is essential for MHPs to have because physical and mental health are so deeply interrelated. Furthermore, a limited understanding of the bodily mechanisms of health can limit appreciation for the benefits that exercise holds for mental well-being. In fact, numerous physical health markers that are related to exercise have started to become markers of brain health as well. A summary of these well-known health benefits will be reviewed here in order to provide a conceptual foundation for exercise as a treatment that addresses many facets of mental and physical functioning simultaneously.

In general, physical activity is considered to be a preventative measure for some of the most pervasive health conditions. In a recent meta-analytic review of the health literature on exercise, WHO (2014) stated:

> Overall, strong evidence demonstrates that compared to less active adult men and women, individuals who are more active have lower rates of all-cause mortality, coronary heart disease, high blood pressure, stroke, diabetes, metabolic syndrome, colon cancer, breast cancer, and depression. Strong evidence also supports the conclusion that, compared to less active people, physically active adults and older adults exhibit a higher level of cardiorespiratory and muscular fitness, have a healthier body mass and composition, and a biomarker profile that is more favourable for preventing cardiovascular disease and type 2 diabetes and for enhancing bone health. (p.25)

These benefits are generally known by health professionals and the public alike. Unfortunately however, the molecular mechanisms underlying the effectiveness of exercise (the same that also enhance psychological functioning) remain largely unknown by individuals without training in biology or physiology.

Ultimately, exercise is considered preventative for conditions like heart disease, diabetes, and stroke because of its effectiveness in reducing the contributory biomarkers. Physical activity is known to reduce body fat and improve weight control, lower blood pressure, inhibit poor lipid profiles (i.e. high levels of triglycerides, high “bad” cholesterol [LDL], and low levels of “good” cholesterol [HDL]), improve the level and stability of glucose and insulin, improve autonomic tone (i.e. rate of firing of the sympathetic nervous system), and decrease cellular and systemic inflammation, among other mechanisms (Vina, Sanchis-Gomar, Martinez-Bello, & Gomez-

Cabrera, 2012; Warburton, Nicol, & Bredin, 2006a). Untreated, all of these characteristics are serious factors contributing to the aforementioned health conditions; by reducing and inhibiting these biomarkers, exercise acts as a preventative measure for later development of more serious health conditions as well as increased mortality (Macera, Hootman, & Sniezek, 2003).

It is important to note that each of these major contributors to poor health and disease are ultimately inseparable from various psychological issues as well. For example, it is arguably impossible to separate obesity from self-perception and self-esteem; dismiss the relationship between high blood pressure and anxiety; ignore that plaque buildup implicated in Alzheimer's disease can be mediated by exercise; or reject the understanding that autonomic tone and increased firing of the sympathetic nervous system are a direct result of perceived stress or danger (Cohen, Janicki-Deverts, & Miller, 2007). While there are many complex connections between exercise and the biological and psychological symptoms of illness, further discussion that investigates the in-depth physiological and molecular mechanisms is beyond the scope of this paper. However, explanatory research linking exercise and psychological factors will be discussed in subsequent sections.

The Relationship Between Exercise and Psychology

Although the physiological benefits of exercise stand alone in warranting physical activity, to say that these benefits to our bodily health are the only reason to exercise would be largely amiss. While the body of research supporting connections between exercise and physical wellness is immense, it is arguable that the growing pool of evidence for exercise-induced health of the brain (and corresponding cognitive and psychological functioning) holds the potential for greater health implications overall. Because the brain regulates all physiological processes—including biomarkers of poor health outcomes—exercise-induced changes in psychobiological

functioning may prove to be more pivotal in determining physiological expressions of illness. As such, the following commentary summarizes the neurobiological, cognitive, and psychosocial processes affected by exercise in order to demonstrate its efficacy as a comprehensive health treatment that should be employed by MHPs.

Neurobiological and neurocognitive benefits of exercise. While the physiological health benefits of exercise have been demonstrated for decades, the connection between physical activity and enhanced neurobiology is relatively new. Still, explorations in this area have yielded strong evidence demonstrating remarkable growth and preservation of brain structures as a function of exercise in both children and adults. Far beyond the physiological effects of exercise, neurobiological and neurocognitive outcomes are important for comprehensive clinical knowledge as psychobiological functioning and psychological presentation are inseparable. However, keeping in mind the scope of knowledge that would be of benefit and use to a typical MHP in a clinical setting, the present discussion of neurobiological benefits will be limited in depth.

Neurotrophic factors. Of primary focus regarding the neurobiology and neurocognitive benefits of exercise are neurotrophic factors (NF), a class of various proteins handling the growth, differentiation, and survival of neurons (Pareja-Galeano et al., 2013). Specifically, three NFs found to be most highly involved in the neurogenesis and neuroplasticity of exercise are brain-derived neurotrophic factor (BDNF), insulin-like growth factor (IGF-1), and vascular endothelial growth factor (VEGF). Functionally, these proteins have similar purposes in that they each contribute to brain growth: BDNF is most active upon hippocampal functioning, which relates to synaptic plasticity and learning (Cotman, Berchtold, & Christie, 2007); IGF-1 has been shown to affect hippocampal neurogenesis and regulate exercise-induced angiogenesis, which

stimulates capillary growth and supplies nutrients to cells (Cotman et al., 2007); similar to IGF-1, VEGF contributes to vasculogenesis (i.e., stimulation of de novo blood vessel formation) and angiogenesis, also mediating the growth of the hippocampus (Hillman, Erickson, & Kramer, 2008). Although there are many other NFs involved in exercise and neurogenesis, BDNF, IGF-1, and VEGF are most commonly valued and discussed across the research.

Brain health and function are linked to overall mood state on a neurotrophic level as well. BDNF is decreased in psychiatric populations, specifically in individuals with depression, schizophrenia, PTSD, autism, and bipolar disorder among other mental health conditions (Pareja-Galeano et al., 2013). To further examine this relationship with regard to preventative potential, Pareja-Galeano et al. (2013) performed a study comparing nine "fit" and seven "sedentary" adolescent boys to examine serum levels of BDNF and IGF-1, among other factors. Fit adolescents had been cyclists exercising for an average of 19 hours per week for three years; in comparison, sedentary individuals had not engaged in physical activity other than school-required sports for 2 hours twice per week. Results were significant for increased levels of BDNF and IGF-1 in the cycling adolescents, although there were no statistical differences between the two groups for body composition, weight, cholesterol, or other measures of health.

Lower-level activity has also yielded some observable changes in adults who were only moderately physically active. One study demonstrated that in comparison with a non-aerobic control group, adults in a year-long walking group showed greater functional connectivity within their temporal and parahippocampal regions, which was associated with increases in BDNF, IGF-1, and VEGF (Voss et al., 2013). Further findings showed that greater baseline levels of VEGF predicted greater increases in NF-mediated temporal connectivity as well (Voss et al.,

2013), suggesting a possible scaffolding effect of increased NFs on brain function as a result of exercise.

Not only does low-level PA appear to have an acute effect on brain functioning, but increases in NFs following bouts of exercise are also maintained following termination of exercise. Neeper, Gómez-Pinilla, Choi, and Cotman (1995) gave rats free access to running wheels, controlling the number of nights access was granted. Subsequent correlations between amount run and presence of BDNF showed a positive trend between distance run and level of BDNF mRNA (which signals the expression of BDNF) in the hippocampus. Consistent with the previous study's findings, even low levels of activity (e.g., as little as two nights of running) significantly increased the presence of BDNF mRNA over controls and it remained high for seven nights afterward. Notably, one rat given access to running wheels for two nights did not run at all, and showed near-control levels of BDNF mRNA. This finding has since been echoed by Abel and Rissman (2013), who not only found exercise-related increases of BDNF in adolescent male mice, but were also able to discover that levels of BDNF were correlated with notable epigenetic changes thought to affect behavior.

Overall, evidence demonstrates that exercise induces the production of various NFs, which are known to enhance neurogenesis, synaptogenesis, and angiogenesis in the brain (Hillman et al., 2008). Investigation into dose-response relationships and the specific effects of aerobic exercise versus anaerobic exercise are ongoing; however, findings continue to show utility of exercise for increasing NFs (Dinoff et al., 2016). Functionally speaking, MHPs should understand that even low levels of persistent activity can cause increases in NFs, which promote growth and reduce risk of degeneration; additionally, it is important to note that exercise does not have to be performed every day in order for levels to stay elevated in the brain. For conditions in

which brain degradation is a hallmark of the diagnosis (i.e., disorders falling under dementia and schizophrenia) and psychotherapy is not expected to yield total "healing," exercise appears to hold the most potential for improvement as a treatment of epidemiological factors.

Neurogenesis. The exercise-induced upregulation of NFs is also connected with the growth of key brain structures, signaling an increase in general brain health and the ability to modify its degradation. Among others, Erickson et al. (2011), was able to link increased levels of serum BDNF to significant increases in hippocampal volume. The study examined the relationship between aerobic exercise and hippocampal volume in 120 participants, randomly assigning half to an exercise condition and half to a stretching control group for a year's duration. Results yielded a remarkable trend in that not only did the exercise group demonstrate a significant increase in hippocampal volume, but participants in the stretching condition simultaneously displayed notable declines. Furthermore, greater gains in aerobic fitness (measured by VO_2 Max, or level of oxygen consumption during exercise) were significantly correlated with larger increases in hippocampal volume (Erickson et al., 2011), suggesting that level of fitness has a generalized effect on growth.

While exercise-induced hippocampal growth demonstrates a notable finding, of particular importance is the region of the hippocampus called the dentate gyrus, which is the only hippocampal region that has the potential for neurogenesis in the adult brain (Pereira et al., 2007). Because concrete measures of neurogenesis may only be assessed postmortem however, Pereira et al. (2007) conducted a two-phase investigation examining mice, then humans. During the first phase, a positive correlation was established between exercise-induced cerebral blood volume (CBV) in the dentate gyrus and postmortem measures of regional neurogenesis. With this in-vivo measure of neurogenesis confirmed, examination of human subjects of below-

average fitness was conducted. Following participation in an exercise program for 12 weeks, subjects underwent brain imaging that revealed a significant increase of CBV exclusively in the dentate gyrus and proportionally correlated increases in cognitive ability as well as aerobic fitness (Pereira et al., 2007). Therefore, as Pereira et al. (2007) established with the first phase of the study, findings correlate exercise with regional CBV (measured in-vivo), neurogenesis in the dentate gyrus, and subsequent benefits in cognitive functioning.

While findings from exercise studies consistently show hippocampal growth and neurogenesis in the dentate gyrus, it has been questioned whether or not exercise has a similar effect on populations exhibiting neurodegeneration. Van Praag, Shubert, Zhao, and Gage (2005) compared the neurogenesis of young and old mice assigned to cages with or without running wheels. Following an injection to illuminate newly-grown neurons and a period of voluntary exercise or sedentary behavior, comparison between controls and the aged mice who exercised demonstrated significant re-growth of previous neurodegeneration. Not only did neurogenesis take place in aged mice with previous degradation, but it also returned growth to the level of young sedentary mice. Aged, exercising mice also demonstrated faster maze completion times (suggesting faster acquisition and better memory) than mice who did not participate in exercise at all (van Praag, Shubert, Zhao, & Gage, 2005). In addition to reversal of neurodegeneration, Adlard, Perreau, Pop, and Cotman (2005) also found that voluntary exercise is capable of reducing amyloid plaques in the frontal cortex and hippocampus of mice exhibiting traditional cascades of Alzheimer's disease.

Overall, the consistency of evidence demonstrating hippocampal neurogenesis (more specifically the dentate gyrus) as a result of exercise is one of the most robust findings among exercise interventions (Hillman et al., 2008). In addition to effecting neuronal growth in healthy

subjects, it has also been shown to reverse neurodegeneration for aged and cognitively impaired individuals as well. Ultimately, this information is most salient to MHPs due to its implications for overall brain health, adult and aged populations, and its relevance to diagnostic categories involving degradation or dysregulation of the hippocampus. Patient presentations such as cognitive disorders, depression, or those associated with traumatic memories may benefit from exercise as a way to increase hippocampal functioning.

Gray and white matter. In addition to showing greater cell growth and increased volume of brain structures, studies have also demonstrated increased microstructure of gray and white brain matter following exercise, regardless of age. Using diffusion tensor imaging (DTI) to measure fractional anisotropy (FA) (i.e., patterns of molecular movement in the brain) in 9 and 10-year-olds post exercise, Chaddock-Heyman et al. (2014) found a positive relationship between physical activity and the structural quality of white matter (i.e. densely myelinated material). Specifically, an unprecedented trend was observed wherein greater structure and density of white matter was seen in more fit children, even in the corpus callosum. Since increased myelin facilitates faster neuronal connectivity and, in this case increases hemispheric communication (Chaddock-Heyman et al., 2014), it is possible that this finding suggests an explanation for increased cognitive ability with exercise (see next section). Increased density of white matter has also been observed in adults participating in a 6-month-long bicycling study as compared to "life as usual" group, who demonstrated decreases (Svatkova, 2015). Not only were white matter gains demonstrated by healthy individuals, but significant increases were also observed in participants with schizophrenia, a disorder known for degradation of white matter. Although the exact mechanism driving these findings is unknown, Smith et al. (2010) has posited that increased cardiovascular health may be associated with reduced white matter degradation

and cerebral ischemia through the reduction of risk factors (e.g., high blood pressure, arteriosclerosis) addressed by regular physical activity.

Exercise-induced growth of regional gray matter (tissue composed chiefly of cell bodies, which are unmyelinated) has also been demonstrated through various trials. Sumiyoshi, Taki, Nonaka, Takeuchi, & Kawashima (2014) noted increases of gray matter volume in the motor, somatosensory, visual, and surrounding cortices in the brains of rats who were exposed to an acute exercise period of only seven days. Notably, imaging at seven-day follow up revealed maintenance of the gains made through exercise as well.

In addition to gray and white matter effects in children and animals, research has demonstrated significant effects of ongoing physical activity on the gray and white matter of older adults as well. A study by Burzynska, et al. (2014) attempted to eliminate the bias inherent in self-reports of PA by using accelerometry to explore the relationship between white matter and level of PA. Upon examining PA levels and FA patterns of brain functioning in 88 low-fit individuals ages 60-78, significant correlations were observed. Increased levels of PA reflected significantly reduced occurrence of white matter hyperintensities (abnormalities in brain structure that often signal irregular or damaged functioning), while even low levels of PA were associated with greater structure of white matter in the temporal lobes. These findings suggest that even simply maintaining movement, although at low levels, may support healthy maintenance of white matter and greater functioning within certain regions of the brain (Burzynska, et al., 2014).

Another study by Erickson et al. (2010) examined 299 adults with a mean age of 78, who were re-examined using magnetic resonance imaging (MRI) nine years after participation in a study on aerobic health and cognition. Findings indicated that greater amounts of physical

activity (with the lower cutoff for significance being 72 blocks walked) produced greater gray matter volume. Specifically, increases were observed in the frontal, temporal, and occipital lobes as well as the hippocampus. While at initial data collection zero participants met the criteria for mild cognitive impairment (MCI) or dementia, in the interim between initial and follow-up imaging, 163 participants satisfied the baseline requirements for either diagnosis. Subsequent comparative analysis between cognitively impaired and normal participants revealed that increased walking was correlated with reduced risk of cognitive impairment (Erickson, 2010). This finding has also been echoed by numerous other studies addressing risk of developing cognitive impairment (Brown, Peiffer, & Martins, 2013), wherein greater levels of physical activity implicate reduced risk for developing cognitive disorders. Indeed, in 2014 Erickson, Leckie, and Weinstein published a review of the literature on exercise and gray matter volume, which demonstrated the consistency of the finding that exercise yields targeted increases in gray matter volume of the hippocampus and prefrontal cortex.

In sum, because the quality of gray and white matter correlate with speed and health of brain functioning, the integration of exercise by MHPs will potentially enable patients (especially those with reduced gray and white matter as a condition of their diagnosis) to attain better outcomes overall, whether in a psychotherapeutic setting or a secondary environment such as a school or workplace.

Cognitive ability. Thus far, it has been demonstrated that exercise augments many neurobiological factors in the brain. Given that these biological components signal the brain's functional attributes, it is reasonable to conclude that the brain changes discussed previously must also have an effect on more qualitative constructs of functioning (e.g., thought processes, memory, speed of reasoning, executive functions). Erickson et al. (2011) illustrated this

connection by linking aerobic exercise with significant increases of serum BDNF to hippocampal volume *and* subsequent increases in spatial functioning. This remarkable relationship demonstrates the direct translation of increased NFs and structural neurogenesis to measurable increases in cognitive ability, which suggests a neurobiological explanation for the observable changes in cognitive performance following participation in exercise programs.

Due to the wealth of studies that have focused on cognitive improvements following exercise, Smith et al. (2010) conducted a broad meta-analysis (including 29 studies and over 1000 non-control participants) on the topic to highlight trends in the research. The following are exercise-induced cognitive changes demonstrating consistency across many studies:

- Modest increases in attention and processing speed following exercise, with combined aerobic and anaerobic methods demonstrating greater increases;
- modest increases in executive functioning;
- increases in working memory when using a combined aerobic/anaerobic approach, with older samples demonstrating greater improvements than younger ones;
- modest improvements in general memory, with greater benefit to individuals experiencing mild cognitive impairment (MCI); and
- increases in IGF resulting from strength training may be mediating the relationship between increases in attention and working memory (Smith et al. 2010).

In another meta-analysis of studies conducted on older adults, Colcombe and Kramer (2003) demonstrated similar results wherein combined aerobic/anaerobic interventions were found to impact participants to a significantly greater degree than merely aerobic interventions alone; executive functions, visuospatial performance, and processing speed reliably improved beyond

controls; and increases in cognitive functioning across domains improved by half of a standard deviation.

An array of positive outcomes has also been demonstrated in samples of children. A comprehensive report published by the CDC (2010) stated that exercise enhances children's functioning in the areas of attention, attitude, behavior, and performance in school. In addition, after a review of relevant studies Chaddock, Pontifex, Hillman, and Kramer (2011) concluded that many researchers have found a significant relationship between lower levels of PA and decreased academic performance, specifically in math and reading. Furthermore, it has been shown that children of lower fitness demonstrate decreased levels of cognitive inhibition (Chaddock, et al., 2010), whereas the reverse has also been observed: higher levels of fitness are correlated with better inhibition as well (Draganski, 2008). Overall findings indicate that even if time is *taken away* from academic instruction and replaced with physical activity, children's cognitive and academic performance improves (Hillman et al., 2008).

In addition to adults and children, improvements in cognitive functioning have also been shown for populations with cognitive impairments. Parallel to the trend of increased neurogenesis in individuals with MCI and neurodegeneration, improvements in cognitive performance have been found following bouts of exercise. Specifically, Smith et al. (2013) conducted a study using 35 participants aged 60-88 years old, 17 of whom met criteria for MCI and were identified as at risk for developing Alzheimer's disease. After a 12-week exercise program, findings indicated that exercise significantly improved memory functions for both MCI and healthy groups, however greater gains were achieved by participants with MCI. Similar results were found by Segal, Cotman, and Cahill (2012) who observed acute increases in cognitive functioning in participants with MCI after they spent only six minutes on a stationary

bike. Improvements in executive functioning (operationalized by interference time on the Stroop test) have also been demonstrated in MCI populations after six-month exposure to either aerobic or anaerobic exercise (Davis et al., 2013).

Overall analysis of the research on cognitive performance and exercise demonstrates consistent associations between increases in PA and increases in cognitive ability. While all improvements in exercise-related brain functioning are relevant to clinical practice, it is arguable that these findings of the cognitive domain represent one of the research trends that is most critical to MHPs' integration of exercise. Executive functions are inseparable from the process of psychotherapy because they represent inhibition, attention, and planning capabilities, which are essential to learning, changing behavior, and the application of new insights.

Conclusion. However robust neurocognitive findings may appear to be, some concern exists with regard to the validity and generalizability of results. Although there is clearly a wealth of information supporting the efficacy of exercise for brain preservation and neurobiological generation, the field of research is still very new and more rigorous studies are required. One critique of the literature made in 2007 (Kramer & Erickson, 2007) pointed out that a majority of studies only utilize walking, swimming, running, or other purely aerobic activity as an intervention, thereby narrowing the definition of exercise. In addition, varying frequencies, durations, and intensities of exercise are also used, making it difficult to determine the exact relationship between exercise and neurocognitive trends. Cotman et al. (2007) echoes the latter concern and also suggests that operationalization of animal studies needs to be adapted for human experiments in order to observe increased relevance between findings. Smith et al. (2010) presents a warning that as a whole, the literature requires trials of increased rigor to address methodological issues and reduced generalizability of findings due to limited sample sizes.

Overall however, the wealth of studies demonstrating consistent, positive effects on neurobiological and neurocognitive functioning represent undeniable trends in the relationship between exercise and enhanced brain function. In a meta-analysis of the literature, Kramer and Erickson (2007) sum up the overall findings stating, "a plethora of molecules and molecular cascades are upregulated with exercise that influences learning and memory operations, cortical morphology, angiogenesis, and cell proliferation" (p. 345)). Amongst all of this evidence, perhaps the factor most salient to clinicians is that the effects of exercise on brain growth and enhancement of cognitive functioning are literally unprecedented in health research. To the author's knowledge, no single psychotherapeutic intervention or medication has been documented as achieving the breadth and depth of simultaneous, positive neurocognitive outcomes discussed here. Therefore, due to the inseparable relationship between psychological disorders (*all* of which have a relationship with pre-frontal and hippocampal processes in the least) and brain functioning, this should imply that the discussion of exercise as a clinical intervention is essential for *every* patient. Unfortunately, regardless of support for the physiological and neurocognitive benefits of exercise (without beginning to address mood outcomes), its importance remains underutilized and possibly misunderstood by clinicians. This is evidenced by the static gap between overwhelmingly significant research findings and a lack of integration into MHPs' current clinical practices.

Psychological mediation of stress and health. It has been established that exercise provides innumerable benefits to biological functioning on both physiological and neurological levels. Notably, many of the illnesses most highly mediated by immune responses and inflammation (and secondarily, exercise) appear to be those with the highest prevalence and associated mortality rates (e.g., heart disease, cancer, depression) (Cohen, Janicki-Deverts, &

Miller, 2007). While the connection between exercise and positive biological outcomes has become common sense, actual understanding of the influence of psychological factors on biological health is much less common. This is due, in large part, to the concept of health being rooted in the biomedical model. Although illnesses—whether of the body or brain—are typically thought to be caused by biological mechanisms, estimates relate 60-90% of primary care visits to a *psychological* construct: stress (Perkins, 1994). In fact, research on stress and illness demonstrates a cyclical relationship between "preventable" medical conditions (e.g., type II diabetes, obesity, high blood pressure, heart disease, etc.) and psychological stress (Cohen et al., 2007), with stress playing the role of a strongly mediating variable.

Notably, not only does stress mediate illness and disease, the biological sequelae of stress itself are mediated by psychological constructs—perception and appraisal of the extent to which a stimulus is stressful (McEwen, 1998). Given this mediation between illness and psychological processes, it is arguable that MHPs are among the most highly equipped to assist patients in reducing stress-related negative health outcomes (whether physical or mental). However, this requires a general understanding of stress and its associated psychobiological mechanisms, knowledge that is obscure for many clinicians. Like any series of biochemical processes, the relationship between stress, psychology, and ill-health offers an unending depth of complexity; therefore, keeping in mind the scope of the typical MHP, only foundational concepts will be reviewed here.

Of primary importance for conceptualizing the role of psychology in stress and ill-health is an understanding of the stress pathway and potential feedback loops of the brain. There are two systems that are most highly involved in producing and regulating stress hormones: the hypothalamic-pituitary-adrenocortical (HPA) axis, which stimulates the release of cortisol and

the sympathetic-adrenal-medullary (SAM) system, which releases catecholamines in response to stress. The stress response produced by these systems is summarized by Lox et al. (2003) as follows:

1. Perception of a stressful situation is registered by the cortices of the brain, which
2. signals activation of the amygdala (alternatively, the amygdala may be activated without conscious perception by the cortex),
3. which then activates the hypothalamus, facilitating the startup of both the SAM and HPA pathways by effecting the following:
    - The SAM system: the sympathetic nervous system (SNS) is activated, which in turn fires the adrenal medulla, releasing catecholamines epinephrine and norepinephrine (which are typically used for activation and effort)
    - The HPA axis: the hypothalamus releases corticotropin-releasing hormone (CRH), stimulating the pituitary gland, which then causes the release of adrenocorticotropin releasing hormone (ACTH), activating the adrenal cortex and stimulating the release of cortisol (which relates more to distress and negative affect).

If these pathways become chronically activated by excessive stress, a state deemed *allostatic load* by McEwen (1998), the SAM system and HPA axis can perpetuate a destructive feedback loop wherein further stimulation releases more glucocorticoids, thereby inducing the locus coeruleus to release more amygdala-stimulating norepinephrine, and so on (Lox et al., 2003).

The products of these processes, cortisol and catecholamines, are responsible for regulation of inflammatory responses, metabolism of macronutrients (i.e. carbohydrates, fats, and proteins), and glucose (energy molecule) generation; as well as regulatory effects of the

cardiovascular, pulmonary, hepatic, immune, and skeletal muscle systems, respectively (Cohen et al., 2007). While the induction and regulation of these systems by stress is beneficial in the short term, long-term activation leads to a wealth of negative health outcomes, such as increases in heart rate, blood pressure, adiposity, and decreases in bone density, muscle mass, immune function, memory, and cognitive health (Cohen et al., 2007; McEwen, 1998). Resultant disorders linked with these conditions include depression, anxiety, anorexia nervosa, chronic fatigue syndrome, obesity, Cushing's disease, heart disease, type II diabetes, and so on. In sum, the hormones released in response to stress contain the potential to create profound systemic dysregulation in a state of chronic activation, although they can be mediated by wellness of psychological functioning, diagnosis-specific drugs, and exercise.

With regards to treatment, exercise has been shown to reduce the physiological effects of both acute and chronic stress, even in response to social and environmental stressors (Vina, Sanchis-Gomar, Martinez-Bello, & Gomez-Cabrera, 2012). Much of the research aimed at exploring this relationship is driven by the cross-stressor adaptation hypothesis, which suggests that habituation to exercise-induced stress leads to a lower stress response overall (Sothmann et al., 1996). Indeed, many studies have supported an overall finding that fit individuals exhibit lower stress responses than their counterparts who are less fit. Fleshner (2005) demonstrated this with rats, specifically showing that more physically-active animals were more stress-resistant than sedentary ones. Examination of this relationship in more depth revealed that even following the cessation of exercise, reduced stress reactivity lasted for weeks before tapering off (Greenwood, Loughridge, Sadaoui, Christianson, & Fleshner, 2012).

Studies conducted with humans reveal similar results. Rimmele et al. (2009) found that seasoned athletes showed significantly lower heart rate and salivary cortisol measures as

compared to sedentary peers. Interestingly, amateur athletes within the same study exhibited mixed results: cortisol levels comparable to sedentary participants and heart rate responses comparable to seasoned athletes, suggesting that frequency, intensity, duration, and exposure to competitive situations may play a role in stress responses. Another study by Spalding, Lyon, Steel, and Hatfield (2004) demonstrated significantly lower heart activity (i.e. heart rate and blood pressure) in aerobically-trained individuals during and following a stressor when measured against the no-exercise control group. While measures of heart activity and salivary cortisol may seem to be distant measures of stress effects, these variables have direct implications for all of the negative health conditions discussed previously.

In addition, these factors are mediated by psychological appraisal, which in this case translates to over-activation of the amygdala during chronic stress. Re-introducing previous neurobiological factors, it is possible that exercise works to reduce this over-active amygdala activity (i.e. negative psychological stress response) by increasing the magnitude of hippocampal functioning. Recall that increased neurogenesis and functional ability take place in the hippocampus as a result of exercise, which is understood to be a structure contributing to the inhibition of the HPA axis (McEwen, 2010).

Lucassen et al. (2010) points out the importance of another correlational—yet impactful—measure of stress in inflammation, which primarily exists as a physiological healing response. In response to stress, the body produces pro-inflammatory molecules that serve a beneficial purpose for acute healing processes but elicit symptoms of generalized illness at chronic durations. As a result of this chronic inflammation, impairment in immune functions and growth factors (e.g., IGF-1) can occur, affecting both the body and brain (Cotman et al., 2007).

In fact, a remarkable correlation was found between exercise habits and immune responsiveness. Men who exercised prior to being notified of their positive HIV status showed little changes to psychological and immunological measures at follow up, whereas men who had not been exercising demonstrated significant reductions of immunocompetence (measured by natural killer cell activity) as well as increased anxiety and depression (LaPerriere et al., 1990). While a trend involving factors of such great complexity should be interpreted with caution, these findings suggest that exercise may have contributed to individuals' psychological and immunological responses nonetheless. Cotman et al. (2007) poses an explanation, stating that exercise likely helps to achieve reduced inflammation by turning on IGF-1, which lowers the presence of inflammation-producing cytokines.

In conclusion, stress contains the potential for producing negative and pervasive psychological and biological effects when it remains unchecked by intervention. Although stress is more commonly taught and understood as a biological factor, physiological consequences follow only as a result of psychological appraisal of stimuli and activation of the amygdala. As previously established, the very nature of stress as a psychological construct—as well as its contribution to myriad mental health disorders—warrants education of MHPs to enable increased intervention and integration of exercise into clinical practice.

Exercise and psychotherapy. Medical professionals might subscribe to the mental health benefits of exercise given the wealth of biological evidence presented here. However, clinical practitioners of mental health may still question the validity or appropriateness of integrating exercise as an intervention for psychotherapy. In fact, it is the author's understanding that a theory illustrating the mood-related benefits of exercise via its organizational similarities to psychotherapy has not been proposed. Therefore, it is important to establish these parallels for

questioning MHPs in order to demonstrate how similar to therapy an exercise program can be. It is arguable that organized exercise itself is inherently therapeutic, providing psychological benefits because of the many qualitative similarities it shares with the structural and functional properties of psychotherapy. While much of the following information has not been verified by specific empirical research, it is based on personal, qualitative observations gathered from approximately six years of performing psychotherapeutic intervention and working as a fitness professional.

A regular, organized exercise routine—especially one performed with a qualified fitness professional as a guide—provides the opportunity for psychological growth purely through employment of the major tenets advocated by psychotherapy (i.e., structure, stability, client-centered focus). In the case that an individual is habitually led through a workout by a fitness professional—whether in a group fitness or one-on-one setting—the exerciser is provided with goal-oriented structure, organization, behavioral reinforcement, social support, mirroring, and validation, all of which are pivotal for a successful outcome in psychotherapy. An exemplary fitness professional creates an environment very similar to therapy even in the most literal sense: a professional alliance in which reaching the client's goals of self-improvement is the shared end point. Given the large body of research that has found rapport to be the major predictor of success in psychotherapeutic situations (Horvath, Del Re, Flückiger, & Symonds, 2011), is it not possible that a strong alliance with another health professional could drive similar changes?

Consider this: the ensuing professional relationship entails validation of how the client feels deficient (specific to his or her self-concept and socially-projected image), incremental goal-setting, a series of scheduled appointments for which the client is held accountable, assisting the client in behavioral change, problem solving with the client when something is not

going according to plan, encouragement and reinforcement as the client begins to reach his or her goals, and gradually challenging the client's abilities so he or she continues to make progress. Exercise participants are also afforded modeling and mirroring of experiences by the fitness professional and other exercisers, which integrates elements of social support matching both individual and group therapy. Finally, the quality of change achieved through an exercise program is also dependent on the adjustment of other lifestyle factors, as is the case within psychotherapy as well.

In addition to characteristics of the environment and fitness professional, features required of the exerciser include many of the traits necessary for successful psychotherapy: commitment, accountability, openness, a willingness to change, and optimal effort. Parallel to the demands of therapy, the client is required to commit to a workout plan, arrive at exercise appointments when they are scheduled, demonstrate a willingness to be vulnerable, try new and uncomfortable experiences, and give optimal effort to the process.

As a result of the reciprocal demand and exchange of all aforementioned principles, exercise routines naturally breed autonomy and self-empowerment, and provide the participant a highly active role in achieving their own goals or "treatment outcomes." Overall, the pattern of psychological processes in an exercise routine yields an inherently stable, predictable, manageable, reinforcing, self-empowering, and validating experience (very similar to psychotherapy) with the client assuming the most active role in his or her outcomes.

Even without a fitness professional to act as a guide, an individual who autonomously undertakes an exercise program would benefit from secondary mirroring and modeling via social support of other exercisers as well as validation of goals achieved from peers' observations. He or she would also be able to experience increases in life structure, self-efficacy, and self-concept

(provided commitment and effort were sufficient to produce results). Notably however, some kind of social element would theoretically need to be present, whether via exercise professional or workout peers, in order to achieve some of the therapeutic parallels.

In a sense, adopting a lifestyle of healthy diet and habitual exercise acts as a kind of "subculture" that bands people together by connecting individuals of similar values and perspectives. This lifestyle subculture therefore contributes to psychological well-being by building up the construct of greater identity and validating the health-lens through which an individual experiences the rest of the world. In fact, many individuals appear to value their healthy lifestyle with passion and conviction that is similar to or greater than their spiritual engagement. This implies a level of psychological benefit that may be too abstract to quantify or measure except by observation and self-report; this suggests caution to some demands made by the research to scientifically articulate *all* underlying mechanisms of psychological benefit. Ultimately, many theorists such as Carl Rogers argue that one of the most healing, beneficial aspects of psychotherapy is the experience of profound validation by another (Thorne & Sanders, 2012). Through admittance to and immersion in the healthy lifestyle subculture, individuals' habits, social presentation, life outlook, and self-concept are continually validated and encouraged by other members of the subculture.

Unfortunately, little to no research has been conducted on the topics of social validation, guided versus independent workouts, or the healthy lifestyle subculture as they relate to the psychological benefits of exercise and long-term mood outcomes or suicide rates. Future research should focus on these areas as well as the breadth and depth of similarities between exercise and psychotherapy as a mechanism for facilitating positive mood changes. Currently,

however, there are many theoretical models that have been proposed in attempt to explain the psychological benefits of exercise under specific domains.

Theoretical Models Explaining Psychological Benefits of Exercise

In sum of the previous evidence, exercise appears to provide many of the same benefits as regular psychotherapy, only it demonstrates *added* physiological, neurological, and cognitive advantages and the opportunity for sociocultural validation as well. Over the past few decades as exercise has gained evidence and opinion-based support, various theories have been proposed in attempt to explain the consistently positive correlations observed between exercise and psychological functioning. Recent overviews analyze these links (aan het Rot, Collins, & Fitterling, 2009; Daley, 2002; Mohammadi-nezhad, 2011), proficiently summarizing the following hypothetical models that have been proposed.

Physiological hypotheses. Collectively, physiological hypotheses attempt to integrate biological effects of exercise (of requisite intensity, duration, and frequency) into etiological explanations of psychological benefits. These hypotheses operate under the primary assumption that it is the physiological changes that are directly responsible for the resulting psychological outcomes (Mohammadi-nezhad, 2011).

Cardiovascular Fitness Hypothesis. As Mohammadi-nezhad (2011) explains, an inverse relationship between level of physical fitness and poor mood has been demonstrated wherein the more fit the individual, the lower the mood symptoms. Numerous studies have also noted a positive correlation between physical fitness and cognitive functioning across the lifespan (Aberg et al., 2009). Consequently, the Cardiovascular Fitness Hypothesis proposes that as continued aerobic exercise reduces an individual's physical reactivity to increased heart rate, blood pressure, tension, and so forth, its effects likely carry over to psychological reactions,

reducing emotional stress and resultant mood symptoms (Mohammadi-nezhad, 2011). This theory is further supported by the success of exercise in treating panic symptoms of anxiety, where the physiological changes mimic those of a panic attack (e.g. sweating, increased heart rate, heavy breathing). Essentially, increased exposure to these "symptoms" under the controlled environment of exercise (which leads to increased cardiovascular fitness) reduces individuals' sensitivity to anxiety (Smits et al., 2008). Although there is a clear correlational effect, there have been multiple studies that demonstrate an increased mood effect prior to improvement of participants' cardiovascular fitness, which would call this theory into question.

Thermogenic Hypothesis. Exercise of adequate intensity produces an increase in body temperature, which generalizes to the rest of the body. Increased core body temperature has been shown to reduce muscular tension and other markers of somatic stress as well as anxiety levels, especially after bouts of exercise (Petruzzello, Landers, & Salazar, 1993). In addition, deVries, Wiswell, Bulbulian, and Moritani (1981) demonstrated that increased temperature of the brain stem can result in overall relaxation and tension reduction. Based on these assumptions, the Thermogenic Hypothesis proposes that, in relation to this physiological warming brought on by exercise, mood symptoms are reduced and a state of relaxation is facilitated. However, as confirmed by Horne and Staff (1983) skeptics of this hypothesis argue that if psychological benefits are only achieved secondary to body warming, this implies that other methods of warming (e.g., showers, saunas) may produce the same results without the presence of exercise.

Biochemical hypotheses. As Mohammadi-nezhad (2011) explains, biochemical processes specific to exercise are difficult to effectively examine in humans due to numerous methodological issues, a limitation that has led to a relative lack of progress in this area. However, there is enough understanding about biochemical processes in general that hypotheses

involving exercise-induced biochemical changes (all of which reference monoamines or the HPA axis) and related psychological well-being are considered valid.

Brain Blood Flow Hypothesis. It is understood that the brain requires constant blood flow and oxygenation in order to function properly, if not optimally. The measure of cerebral blood flow (CBF), which is correlated with cellular metabolism, is therefore thought to predict functionality of the brain (Mohammadi-nezhad, 2011). More specifically, abnormalities of CBF in regions related to emotion and regulation (e.g., the amygdala, hippocampus, prefrontal cortex, etc.) have been demonstrated in individuals with unfavorable mood symptoms like depression (Kalia, 2005). Both animal and human studies investigating CBF in relation to exercise have shown increased blood flow to various regions of the brain (Querido & Sheel, 2007), which—when taken together with correlates of abnormal CBF—is the basis the Brain Blood Flow Hypothesis. However, as Querido and Sheel (2007) suggest, increased specificity of interpretation with respect to regions of the brain has been troublesome due to methodological factors. Ultimately, skepticism still exists within research addressing this theory (Daley, 2002; Mohammadi-nezhad, 2011) and further exploration is needed.

Monoamine Hypothesis. As detailed previously, monoamines (e.g., serotonin, epinephrine, and norepinephrine) are a specific class of neurotransmitters whose dysregulation has broad implications in mood disorders (Mohammadi-nezhad, 2011). More specifically, it has been shown that that an imbalance of monoamines largely contributes to the presence and type of mood symptoms and the resulting effectiveness of psychotropic medications (Schildkraut, 1995). Exercise has been shown to yield increased levels of neurotransmitters in animals (Dishman, 1997), which illustrates the underlying theory of the Monoamine Hypothesis. It is proposed that because the availability and balance of neurotransmitters is decreased in mood disorders (Kalia,

2005), exercise-induced increases in monoamines may be the driving factor behind positive mood changes. Unfortunately, because the direct brain observation of monoamines in human subjects is exceedingly difficult and invasive (Lox, Martin, & Petruzzello, 2003) few studies of this type have been conducted. The only empirical evidence of exercise-increased neurotransmitters in humans references plasma and urine samples (Mohammadi-nezhad, 2011), yielding some doubt regarding the veracity of the Monoamine Hypothesis.

Endorphin Hypothesis. Endogenous opiods such as endorphins play a major role in various bodily systems, contributing to the function of emotional, cognitive, and sensory processes (Øktedalen, Solberg, Haugen, & Opstad, 2001). Perhaps the most well-known association regarding the neurobiological effect of exercise is that it releases endorphins and can create the effect of a "runner's high." Similar to constructs of the Monoamine Hypothesis, it has also been shown that individuals with mood disorders—specifically those who are depressed—exhibit a dysregulation in the release and fluctuation of endorphins (Mohammadi-nezhad, 2011). It is for this reason that the Endorphin Hypothesis postulates that endorphin-releasing bouts of exercise may lead to increased mood. Indeed, studies have shown an increase of endorphins in samples of the blood plasma and cerebrospinal fluid following intense exercise (aan het Rot, Collins, & Fitterling, 2009). One study used positron emission tomography on runners' brains to examine this phenomenon and found increased euphoria and opiod binding (Boecker et al., 2008). However, in part due to the inability of endorphins to cross the blood-brain barrier, some question still remains as to whether increased release of endorphins similarly affects populations with mood disorders.

HPA Hypothesis. Given the strong connection between stress, neurological and physiological health, and physical activity, the HPA Hypothesis is arguably the most plausible

theory behind the psychological efficacy of exercise. As outlined previously, the HPA axis regulates the release of various stress hormones (e.g., cortisol) in response to perceived stress. While acute stress is adaptive, chronic stress causes this pathway to become overactive, which contributes to innumerable ill-health outcomes (McEwen & Gianaros, 2010). As with other relevant hypotheses, the dysregulation of the HPA system has been demonstrated in individuals with mood symptoms, especially depression (aan het Rot, Collins, & Fitterling, 2009). In fact, chronic and severe stressors have been linked with the onset and manifestation of depression, respectively (Arthur M. Sackler Colloquia & McEwen, 2011). Exercise treats the over-activation of the HPA axis by effectively reducing its susceptibility to stress regardless of type, an effect referred to as the Cross-Stressor Adaptation Hypothesis (Lox, Martin, & Petruzzello, 2003). It is notable that this indiscriminant reduction in stress reactivity is observed both in fit individuals and with the use of antidepressant medications (Southwick, Vythilingam, & Charney, 2005). Ultimately, there is a strong body of evidence supporting the HPA Hypothesis though further research is necessary to determine the exact processes in play.

Psychological hypotheses. In addition to the strictly biological theories relating exercise to healthy mood, some psychologically-based hypotheses attempt to explain the remarkable post-exercise phenomenon of positive affect. While some of these theories reflect more traditional schools of thought predating the accumulation of physiological and biochemical data, their relevance to the complex biopsychosocial processes underlying the efficacy of exercise is still observed.

Cognitive Appraisal Hypothesis. The Cognitive Appraisal Hypothesis was proposed by Lazarus in 1988 in relation to his research on biofeedback and psychological interpretations of stressful events (Szabo, 2003). Under this model, it is believed that affective changes related to

exercise are a result of individuals' cognitive appraisals that relate their physical activity to affiliated social and psychological factors (Folkins & Sime, 1981). More specifically, exercise is conceptualized as a coping mechanism that precedes emotion, increases a person's self-regulation, and aids adaptation to their social environment (Folkins & Sime, 1981). Therefore, the Cognitive Appraisal Hypothesis proposes that this pre-conceived behavior causes immediate increases in affect post-exercise. Indeed, immediately elevated affect is a consistently-documented finding that has more recently been compared to a placebo effect due to the physiological data suggesting the beneficial effects of exercise are not acute (Szabo, 2003).

Distraction Hypothesis. The proposal of the Distraction Hypothesis occurred as a byproduct of a study by Bahrke and Morgan (1978), which found that three different conditions (physical activity, meditation, and sitting comfortably) all resulted in decreased anxiety. Therefore, with regards to exercise the subsequent conclusion was that simply engaging in exercise itself may provide a "distraction" from stressful thoughts or activities, thereby reducing mood symptoms (Daley, 2002). Although the simplicity of this model lends itself to feasibility, it requires the presence of an overt stressor and it does not account for physiological data.

Self-Esteem/Mastery Hypothesis. In general, the Self-Esteem/Mastery Hypothesis references the overarching relationship between exercise and various psychological measures involving self-evaluation (i.e., self-concept, self-esteem, self-efficacy, and sense of mastery) (Lox, Martin, & Petruzzello, 2003). More specifically, it proposes that increasing mastery of one's physical skills contributes to greater feelings of success, control, and self-efficacy, which is thought to translate to self-esteem and other parts of individuals' lives as well (i.e., management of mood symptoms) (Dayley, 2002). Indeed, a study by Lau, Cheung, and Ransdell (2008) showed that self-evaluations of simple physical attributes (e.g., strength, appearance) strongly

impacted overall self-concept rather than just physical measures. While research has shown a trend of positive relationships between exercise and self-esteem (Fox, 2000), the Self-Esteem/Mastery Hypothesis is similar to other psychological theories in that there is little biological data to support causational relationships.

Conclusions. Overall, numerous physiological, biochemical, and psychological hypotheses have been proposed in attempt to explain the overwhelmingly positive effects of exercise on mood, affect, and other psychological constructs. While most of the theories discussed here require further research in order to be considered empirically causational, there is little opposition for the HPA Hypothesis, which inherently demonstrates a bi-directional relationship between neurological and psychological factors. Notably, a theory representing the neurotrophic effects of exercise was not discussed, as an official hypothesis integrating neurological substrates such as BDNF or IGF-1 has not yet been established. This is likely because of the relative newness of such evidence and the difficulty of measuring how these factors might directly influence mood. Similarly, the Social Interaction and Anthropologic Hypotheses were not discussed because although they link exercise to healthier mood outcomes, they are highly theoretical without any substantial data to support them.

Ultimately, one of the most notable observations of commonality between these theories is that none of them integrate biological, psychological, and social factors into one unified hypothesis explaining the scope of exercise as a mental health treatment. Following a detailed exploration into the theoretical models relating exercise and mood, Mohammadi-nezhad (2011) concluded, “A model that postulates the interplay of biological, psychological, and social factors is required to explain adequately the mechanisms underlying the effects of physical activity on mental health” (p. 62).

The Efficacy of Exercise as a Mental Health Treatment

Thus far, foundational concepts underlying the physiological, neurocognitive, and stress-related benefits of exercise have been reviewed, including parallels between psychotherapy and the structure of exercise. Understanding the efficacy of exercise in treating myriad health conditions—including issues such as stress and neurobiological functioning that largely dictate mental health—is arguably invaluable to the clinical practice of psychology for MHPs who seek to utilize a true biopsychosocial approach. Still, of primary importance to MHPs is the efficacy of exercise in treating clients' presenting problems, clusters of symptoms, or long-standing diagnoses. While diagnosis-specific recommendations and guidelines for optimal exercise outcomes have yet to be solidified, the following information summarizes relevant research for diagnoses with substantial explorations.

Mental health disorders.

Depression. Perhaps the most researched relationship between mental health and PA is depression and exercise. This is evidenced by the large number of studies and meta-analyses that exist on the topic and as compared to many disorders, the fact that exercise relieves depressive symptoms has become widely accepted.

One of the most classic studies examining the role of exercise on depression was conducted by Greist et al. in 1979. Study design included individuals with minor clinical depression (as defined by study criteria) and three conditions: running (three times per week for 12 weeks), time-limited psychotherapy, and psychotherapy without time constraints. Greist et al. found that participants' improvements in the running condition matched those made in both psychotherapy treatments, and upon follow up at three weeks runners demonstrated continued improvement.

A more recent adaptation of exercise and depression research was conducted by Blumenthal et al. (1999), who randomly assigned participants diagnosed with major depressive disorder (MDD) to one of three treatment groups: exercise training (3 times per week at 75-80% max heart rate), antidepressant pharmacotherapy, and combined exercise and pharmacotherapy. Following 16 weeks, reassessment of participants indicated that they no longer met criteria for MDD, with the exercise condition exhibiting a very similar response to the other two groups (60% remission as compared to 66% and 69% respectively). While this evidence suggests the preliminary efficacy of exercise as compared to pharmacological treatments, end of treatment follow up with the same participants showed that as compared to the pharmacological (52%) or combined treatment groups (55%), the exercise group had significantly lower rates of depression (30%).

Final 6-month follow up examination of those who had previously been in remission from MDD revealed that of participants in the exercise group, only 8% had relapsed whereas participants in the pharmacological and combined groups had much higher relapse rates (38% and 31%) (Babyak et al., 2000). Another study by Blumenthal et al. (2007) that included a control group (a methodological criticism of the 1999 study design), produced significant reductions in depression for exercise conditions as well. As compared to other groups however, 1-year follow up identified ongoing exercise as a significant predictor of remission. Taken together, this evidence suggests that although the beneficial relationship between exercise and depression is not clearly defined, exercise may have better long-term outcomes on depression than medication or a combination of other treatments. Even in a shorter-term duration, however, exercise has been shown to be effective in treating depression. Although exercise is much less commonly examined in anaerobic and treatment-augmentation forms, research supports the

efficacy of these types of treatments as well. Specifically, studies utilizing anaerobic training showed significant reductions in depressive symptoms (Singh, Clements, & Fiatarone Singh, 2001; Singh et al., 2005) and in situations where exercise is being compared to psychotherapy interventions, there are no statistical significance between the two methods (Klein, 1984). Furthermore, connections have been made between outcomes in depressed populations being generalizable to bipolar populations as well; therefore, although understudied, exercise has the potential to positively impact symptoms of bipolar disorder through regulation of many life patterns including sleep, stress, and social rhythms (Ng, Dodd, & Berk, 2007; Smits & Otto, 2009).

Although there exists a wealth of evidence attesting to exercise as a beneficial treatment for depression, skeptics have still criticized the methodology of many studies, typically questioning the rigor or analyses of moderating variables within meta-analyses. To address these critiques, a number of broad reviews have been conducted. Rethorst, Wipfli, and Landers (2009) conducted a large meta-analysis of the literature on exercise and depression, including 58 randomized trials with nearly 3000 participants. Overall effect size was found to be -0.80, demonstrating that individuals showed significantly lower symptoms of depression following administration of exercise treatments. As Rethorst et al. (2009) states, this figure translates to more than three quarters of a standard deviation, representing a notably large effect on depressive symptoms. Furthermore, dropout rates were comparable to typical psychotherapeutic and pharmacological trials.

A more recent Cochrane review (Cooney, Dwan, & Mead, 2014) found a more moderate effect size (-0.62) for exercise as a treatment for depression. However, review of studies comparing exercise to standard treatments (namely, psychotherapy and pharmacotherapy)

showed that statistically speaking, exercise was comparably as effective as the traditional interventions. Furthermore, it was noted that by pooling the data from eight studies measuring long-term outcomes, a small effect (0.33) on mood was observed at follow-up.

Clearly, given the rigor and painstaking analysis of many variables, Rethort et al. (2009) and Cooney, Dwan, and Mead (2014) demonstrate the strength of the finding that exercise is effective in treating depression, even when compared to more traditional interventions of drugs and psychotherapy. Overall however, notable deficits still exist in the current understanding of dose-response relationships and how exercise treatments should be adjusted for optimal outcomes of specific populations.

Anxiety. Similar to depression, there is a large body of support for the beneficial effects of exercise in treating anxiety and anxiety disorders. While research in this realm generally encompasses generalized anxiety, social phobia, agoraphobia, and obsessive-compulsive disorder (OCD), most qualitative studies have been aimed at individuals with panic disorder (Smits & Otto, 2009). In general however, many large-scale data analyses have examined the relationship between self-reported levels of PA and likelihood of anxiety. More specifically, upon examining data from 5,877 individuals Goodwin (2003) found that—perhaps predictably—those who reported higher levels of PA showed reduced rates of generalized anxiety, social and specific phobias, panic attacks, and agoraphobia. A significant dose-response effect was also noted, wherein increased exercise frequency (e.g., regular, occasional, or never) was directly correlated with chance of having an anxiety disorder (e.g., 3.3%, 4.8%, and 8.5%, respectively for diagnosis of panic attacks). Similarly, an analysis by Landers and Petruzzello (1994) demonstrated that physically fit individuals have fewer anxiety symptoms than those who are less fit.

Clearly, being more physically active yields lower risk for anxiety issues, however the way in which exercise impacts individuals with *pre-existing* anxiety is of greater clinical importance. Lox et al. (2003) summarizes overall findings on the efficacy of exercise in treating anxiety as follows:

- exercise is associated with reduced symptoms of anxiety
- long-term exercise interventions have been found to be effective even in altering trait anxiety (as opposed to state anxiety)
- exercise is effective for males and females of all ages

On a more specific level, Broocks et al., (1998) conducted a study implementing three conditions: a 10-week aerobic exercise routine (i.e. running), drug therapy (using clomipramine), and a placebo treatment. Results demonstrated similar, significant effects for both the exercise and drug conditions, each being superior to the placebo. Instead of conducting a drug trial, Smits et al. (2008) tested exercise against the commonly-used intervention of cognitive restructuring, finding significant effects in favor of all exercise treatments. Notably, results included the discovery that the exercise/cognitive intervention condition did not produce greater results than exercise alone.

In two comprehensive meta-analyses by Petruzzello et al. (1991) and Stonerock et al. (2015) including a summation of more than 100 studies produced the finding that exercise indeed reduces anxiety and that there were no significant differences between type of exercise activity. Stonerock et al. (2015) noted that improvements were comparable to existing treatments for anxiety. Furthermore, and perhaps most relevant to clinical work, Petruzzello et al. (1991) found that acute exercise is effective in changing state anxiety while long-term exercise participation

can achieve reductions in trait anxiety (where state is related more to present experiences and trait is related to more enduring characteristics).

Interestingly, anaerobic exercise has shown slightly different treatment outcomes, wherein acute measures of state anxiety have been observed to actually increase following bouts of resistance training. Bartholomew and Linder (1998) found that light weight lifting successfully reduced state anxiety symptoms, however moderate to high-intensity weight lifting demonstrated a self-reported increase in state anxiety symptoms. However, two relevant pieces of information are essential in interpreting these results: First, methods of collecting data on state anxiety may be highly confounding, as items ask about feelings such as "being on edge" or "tense," which echo somatic experiences that are felt as a result of physical activation. Second, recall of the biological and neurological responses to exercise, including the increase of heart rate, blood pressure, and release of neurotransmitters in the brain, suggest that self-report measures may be highly accurate to somatic experiences, but not necessarily to perceived anxiety.

Overall, while the consistency of findings shows promise for exercise as a helpful intervention, one of the most notable challenges with this population may be attrition rate. Some studies that attempted to address anxiety symptoms with exercise showed notable rates of participant dropout (Broocks et al., 1998; Smits et al., 2008), which is thought to be due to anxiety-related fear and avoidance of exercise-induced, panic-like symptoms (e.g. increased heart rate, blood pressure, shortness of breath) (Smits & Zvolensky, 2006). Clinically speaking, this translates to the importance of preparing clients for the experiences of exercise, including psychoeducation regarding anxiety, somatic experiences, parallels to exercise, and the anxiety-reducing benefits of long-term exercise commitment.

Eating disorders. As an extreme form of disordered self-image that is characterized by restriction or overconsumption of food, eating disorders offer a notable challenge to the idea that exercise is a truly multidisciplinary intervention. In general, very little research has been done on eating disorders and the use of exercise as a function of due caution; however, there is some evidence that specific facets of organized exercise may offer some benefits to eating disorder diagnoses. Sundgot-Borgen, Rosenvinge, Bahr, & Schneider (2002) demonstrated that in normal-weight bulimia patients, exercise proved to be more effective than nutritional counseling or CBT in reducing pursuit of thinness and frequency of binging, purging, and laxative use. With regard to anorexia, Tokumura, Tanaka, Nanri, & Watanabe (2005) performed a rare study assessing aerobic functions of girls diagnosed with anorexia. Perhaps surprisingly, utilizing supervised exercise with recovering anorexia patients showed no adverse effects on weight gain or recovery of menstruation; rather, participants reported enjoying the PA as a stress-reliever. Similar findings were reached in a study examining whether the presence of anaerobic exercise during "refeeding" phase of treatment would negatively impact patients' ability to gain weight. Touyz, Lennerts, Arthur, and Beumont (1993) found that weight gains of the exercise group were not significantly different from gains made by non-exercisers, suggesting that resistance training is not detrimental to the treatment of individuals with anorexia.

Ultimately, although the use of exercise to treat eating disorders may be perceived as clinically dangerous, research shows significant increases in body image as a result of exercise, which suggests the need for further research Qualitatively, many one-on-one exercise clients are able to shift disordered eating styles (including bingeing and restricting), dysmorphic body image, and pursuit of unhealthy thinness as a result of exercise-related education, structure, and

acculturation to an environment where it is viewed as more socially acceptable to have muscle than be extremely thin.

Attention-Deficit Hyperactivity Disorder (ADHD). Unlike most of the research reviewed in this paper which has been conducted on adults, exercise literature also demonstrates positive outcomes for children as well, especially in the area of ADHD. Recall that exercise has been shown to stimulate neurobiological growth and neurocognitive functioning in many brain structures including the pre-frontal cortex. This is especially salient to the treatment of ADHD, which is characterized as a deficit in executive functioning. Since the neurocognitive benefits of exercise have been stated previously, a brief review of clinical studies are reviewed here.

A meta-analysis conducted by Gapin, Labban, and Etnier (2011) reached the conclusion that PA interventions have been shown to assist in the management of ADHD symptoms. Specifically, PA was demonstrated to increase cognitive functioning and scholastic performance in children while also decreasing behavioral issues (Pontifex, Saliba, Raine, Picchietti, & Hillman, 2013). Similarly, Vysniauske, Verburgh, Oosterlaan, and Molendijk (2016) performed a more recent review of the literature finding that exercise has a beneficial effect on ADHD symptoms (specifically executive functions and motor skills), with longer intervention phases yielding greater effects on functioning.

Bustamante et al. (2016) tested these findings by conducting a randomized control trial with an under-resourced urban community. Children were engaged in an after school program where they were randomized to either an exercise group or a "control" group that underwent sedentary attention control exercises. After ten weeks, results showed that the exercise group demonstrated significant improvements over controls in hyperactivity and verbal working memory; however, the sedentary, attention control participants demonstrated increases over the

exercise group in visuospatial working memory and oppositional behaviors. Authors concluded that overall, structured programming benefits children with ADHD, even in communities with low resources. Functionally speaking, exercise should be a choice treatment for school-aged children due to its availability (at home or in school), its negligible cost compared to medication, and the ease with which it can serve as an augmentation to other treatments.

Post-Traumatic Stress Disorder (PTSD). One of the disorders most recently addressed by exercise research is PTSD, though only small samples have been used. In addition to the reduction of depression and anxiety symptoms (which are frequently observed in individuals with PTSD), small sample sizes have also shown significant reductions in the symptomatology related to PTSD as well. Motta, Kuligowski, and Marino (2010) performed a limited review on exercise and PTSD, citing recent studies that all utilized 30-minute exercise periods as an intervention for adults and adolescent girls with PTSD (Diaz & Motta, 2008; Manger & Motta, 2005; Newman & Motta, 2007). All three studies found significant reductions in PTSD symptoms as well as depression and anxiety, gains that were maintained at short-duration follow up. Additionally, Hamner and Hitri (1992) performed a 10-person study on Vietnam veterans diagnosed with PTSD, demonstrating significantly higher post-exercise levels of endorphins in individuals with PTSD as compared to controls. A larger randomized-control trial with 81 participants published in 2014 (Rosenbaum, Sherrington, & Tiedemann, 2014) demonstrated that when combined with standard treatment (psychotherapy, pharmacotherapy, and group interventions) a 12-week exercise intervention yielded significant improvements of PTSD symptoms over controls, who received standard treatment alone. Unlike prior studies, participants ranged in age, included both males and females, and were not limited to a specific

source of PTSD (e.g., combat versus car accident), thereby increasing the generalizability of their findings to a larger extent.

Most recently, Whitworth and Ciccolo (2016) performed a meta-analysis reviewing studies that examined the effect of exercise on military veterans with PTSD. Though the authors noted that more research is needed to improve our understanding of relationship between exercise and PTSD, the existing evidence demonstrates an inverse relationship between exercise and PTSD symptoms. Taken together, the exercise research shows its potential value for many populations, although exercise studies specific to PTSD have generally been limited by small sample size.

Schizophrenia. Similar to other diagnoses, little exercise research has been conducted using individuals with schizophrenia. However, due to weight gain caused by antipsychotics, disease-related degradation of brain structures, and biological underpinnings of the diagnosis (making it resistant to traditional psychotherapy), patients diagnosed with schizophrenia spectrum disorders are a well-matched population for exercise interventions, provided adherence can be maintained.

To examine the utility of exercise with this population, Beebe et al. (2005) conducted a 16-week walking intervention for individuals diagnosed with schizophrenia. In contrast to the inactive control group, the walking group demonstrated significant reductions in psychiatric symptoms and body fat and increases in aerobic fitness, suggesting that even minimal PA can have a beneficial effect on severe and persistent mental illness (SPMI). Strassnig et al. (2015) also demonstrated benefits of a higher intensity (high speed resistance training) intervention with 12 overweight or obese individuals with schizophrenia or bipolar disorder. After eight weeks of performing the resistance training routine two times per week, participants demonstrated

significant reductions on scales rating depression and positive and negative symptoms. Furthermore, increases in cognitive functioning (specifically working memory and processing speed) were observed via improvements in scores on digit sequencing and symbol coding tasks. Bernard and Ninot (2012) conducted a meta-analysis on the existing literature on exercise and schizophrenia to examine overall trends of the research thus far. It was concluded that while much research needs to be done on exercise interventions for this population, in general it has been shown that exercise consistently has physical and mental health benefits for individuals with schizophrenia. Recommendations for future research noted that useful interventions should focus on ease of adherence.

While the small amount of exercise literature on schizophrenia cannot yield definite conclusions, recall of the previous discussion on increases in brain growth suggests that this population may potentially reap great benefits from exercise. Although patients with schizophrenia habitually show progressive brain degradation, utilizing exercise interventions with this population has demonstrated notable increases in hippocampal growth (Pajonk et al., 2010) and white matter (Svatkova et al., 2015). This should be regarded as a finding with remarkable implications for the clinical arena, considering brain degradation is a hallmark concern that bears a strong relationship to its difficult-to-treat symptomatology. More recent studies are beginning to examine increasingly specific aspects of physical activity; Bhatia et al. (2017) measured the combined effects of using yoga and physical exercise with treatment as usual (TAU) compared to TAU without any PA. Consistent with prior research, findings demonstrated improved cognitive processing outcomes for both PA groups beyond any improvements made with TAU. Overall, while ideal “dosage” and methods are still being investigated, studies continue to show notable benefits for patients with schizophrenia and SPMI.

Self-esteem and self-concept. Although deficits in self-esteem and self-concept are clearly mediating variables rather than actual mental health disorders, they arguably impact nearly all mental health states and there is a great body of research that exists on the relationship between exercise and these constructs. According to a meta-analysis by Fox (2000), a strong 78% of relevant studies found a positive correlation between exercise and self-esteem. Most of this data has been established by researchers who identify a specific sample, take a pre-intervention measure of all relevant data on physical attributes and self-worth measures, administer the exercise intervention, then re-assess participants for physical changes and modifications in self-esteem and self-concept. As Lox et al. (2003) and Spence, McGannon, and Poon (2005) note, studies have been conducted on a wide array of samples including obese children, adults with cancer, injured athletes, typically-functioning adolescents, and alcoholics, amongst many others. While virtually all experimental investigations have led to increased self-esteem or self-concept, a notable trend exists wherein self-concept appears to be more highly correlated with exercise than self-esteem. The reason for this finding, as well as the specific dose-response relationship for producing optimal results is still undefined (Lox et al., 2003).

Conclusions on treatment efficacy. Overall, the research on the efficacy of exercise as a mental health treatment is both broad and deep, depending on the prevalence and impact of the diagnosis. Although not included here due to limited investigation, additional disorders such as substance abuse, learning disorders, personality disorders, and many others may yet demonstrate symptomatological benefits as a result of exercise. Once again considering the parallels between psychotherapy and organized exercise (e.g., structure, stability, validation, sense of cultural belonging, etc.), even diagnoses that may not seem to be related to physical health could potentially benefit from being more highly physically active. Ultimately, MHPs' recognition of

this evidence is pivotal for optimal outcomes and case conceptualization; it may confer the most benefits on the client or clients' families who are truly in search for life-changing improvements in overall health.

Sociopolitical and cultural contexts. In addition to its proven status as an efficacious and overwhelmingly beneficial treatment, exercise holds extra potential as a valuable intervention due to its sociopolitical and cultural advantages. The importance of these types of factors is exemplified by one study conducted by Martinson, Medhus, and Sandvik (1985) on a population of hospitalized patients experiencing depression. In addition to the finding that exercise produced significant reductions in symptomology, participants indicated that of all the domains within their comprehensive care (e.g. pharmacotherapy, psychotherapy etc.) the exercise treatment they had received was the most valuable.

Although a simple example, this speaks to the importance of considering cultural and case-specific factors when choosing a treatment approach. Patients needs and preferences can often be overshadowed by the MHP from whom they are seeking guidance. Perhaps many clients prefer to engage in exercise as a main treatment approach, but they are uninformed as to the benefits of exercise or the fact that it is even an option to consider. As Smits and Otto (2009) state, the integration of exercise into mental health treatment may optimally suit clients who are hesitant about drug therapy or psychotherapy, who may be most interested in holistic and integrated approaches, or who may be concerned about the extensive financial burden or social stigma associated with traditional treatments. In addition, exercise is not limited by health insurance by a certain deductible cost or number of treatment sessions.

These considerations are especially important in informing treatment modality, or at least the discussion of treatment options in order to obtain the highest level of client-therapist alliance,

treatment adherence, and optimal outcomes. Across socioeconomic status (SES), exercise may offer a preferable intervention or augmentation. While a basic gym membership (with access to free group instruction and social support) can be purchased for a manageable monthly fee and self-monitored exercise at home or outdoors is free, weekly psychotherapy or daily drug treatments can pose a serious financial obstacle for some individuals. This challenge is especially important to keep in mind when working with individuals of lower SES or perceived social standing since McEwen and Gianaros (2010) explain that there is evidence linking the activity of the amygdala to low socioeconomic factors. Recalling the moderating role of the amygdala in the induction of stress—and therefore it facilitation of poor mental and physical health outcomes—exercise may be an exceptionally good fit for addressing the low SES factors of social strain, financial burden, and exacerbated stress of presenting patients.

Conversely, clients in with higher SES—especially those who live in affluent areas and are highly educated—may also be enthusiastic toward exercise, though for different reasons. Many adults and families of higher SES who embrace organic, natural lifestyles and prefer informed treatment options and integrated approaches to health care may embrace talk therapy but decline pharmacological treatments. Others who experience long hours in sedentary, high-stress work environments and can afford on-on-one exercise training may find the structured change of pace much more enjoyable than sitting in a clinician's office. Due to a higher level of education, this population may also be more likely to have a higher level of health-consciousness and, when provided education of the psychological value of exercise, may be more motivated to change negative health patterns.

With regard to non-SES demographics, exercise may also pose an especially salient treatment modality for women due to the elevated risk for being depressed and inactive; children,

whose rates of screen-time, sedentariness, and obesity are rising (aan het Rot et al., 2009); and men or athletes who may be more resistant to traditional therapy due to cultural norms. Battaglia et al. (2014) even performed a rare study demonstrating the positive mood outcomes of using exercise as an intervention for male prison inmates. Furthermore, in non-western cultures traditional talk-therapy or medication may be highly taboo whereas resistance to PA would certainly be a rarity. Imaginably, all cultures and subcultures have preferred games or sports as well; therefore, participation in activities such as soccer, running, football, karate, or jiu jitsu may all warrant much greater motivation and interest in clients whose cultures are reverent to those sports.

While client factors are of utmost importance for clinical MHPs, the sociopolitical value of exercise as a health treatment offers great incentives to broader health care systems and governmental infrastructure as well. As a whole, mental health disorders caused a staggering $147-billion burden to the U.S. economy in 1990 (Rice & Miller, 1998), a statistic that has likely increased according to the recent figures produced by Greenberg et al. (2003) on depression alone. In addition, the economic costs of sedentary lifestyle in the U.S. are $24 billion and the burden caused by obesity is $70 billion (Colditz, 1999). Finding overlap between mental health and PA, Brown, Wang, and Safran (2005) calculated out-of-pocket costs for individuals with mental health disorders, comparing totals between those who were physically-active and those who were sedentary. Not surprisingly, it was found that per capita, yearly expenditure for sedentary individuals with mental health disorders was approximately $3,000 higher than their counterparts who were physically active. Functionally speaking, exercising may actually help clients prevent health-related financial burden in the long-term. Furthermore, if MHPs assist their

patients with integrating exercise into daily life routines, it could have endless positive implications for national health care and sociopolitical infrastructure.

Conclusions. Contemplation of all previous evidence on the mental, physical, cultural, and sociopolitical benefits of exercise suggests a powerful intervention for addressing many health issues. Considering the fact that stress is a strong health mediator also reduced by exercise, it is safe to say that nearly *all* inflammation-related illnesses could benefit from exercise as an augmentation to typical treatment. Even if one were to argue that exercise only affects illnesses secondarily, its ability to simultaneously address biological, psychological, and social aspects of well-being still demonstrates its breadth and depth of potential effectiveness. Of notable importance is also the unique way that exercise can serve virtually any population, regardless of cultural background, personal values, or SES.

Furthermore, it is not to be disregarded that exercise—or lack of exercise—has profound effects on the nation's health and the U.S. model of health care. Although integrated models of medicine (i.e., mental health needs being addressed as part of a patient-centered medical team) are becoming more accepted, a health care infrastructure that is truly client-informed, health-promoting, and preventative is yet a distant goal that would greatly benefit from MHPs integrating exercise into clinical practice.

The Gap Between Research Findings and Clinical Practice

Call for Integration of Exercise into Clinical Practice

Despite an overwhelming availability of evidence demonstrating the role of exercise in health maintenance, a survey conducted by APA (2014) on stress and related behaviors showed that a healthy diet and exercise were both ranked lowest amongst factors people perceived to be important to well-being. This clear misperception may be permissible for individuals who have

not been educated in a health sciences field, however the ongoing discrepancy between what the research shows (an overwhelming need for increased education and practice of exercise interventions) and the dearth of integration and action by health professionals is ultimately inexcusable. In fact, it is arguable that exercise is the only health treatment with a profound empirical backing that is not put into practice as it should be. Consider a life-saving surgical method, a novel transplant procedure, or a miracle drug that is backed by research, yet is not carried into practice by health professionals. This would not only be negligent, but unethical.

In fact, nearly all publications in the field of exercise and psychological health close their discussions by calling for two things: further research on the topic and greater integration of exercise into clinical practice. Smits and Otto (2009) summarize the body of research and advocate for increased use of exercise, stating "given the obvious benefits of exercise for stress, mood, and anxiety management, combined with the benefits for physical health and well-being, there is a clear need for adoption of exercise-based interventions" (p.1). Aan het Rot et al. (2009) points out that the United Kingdom has established both exercise guidelines for treating major depression with a structured program and an official fitness referral system for patients presenting to primary care with depression. Unfortunately, the United States has neither, "even though exercise treatment has few if any adverse effects, is readily available and cost-effective, can be sustained indefinitely (unlike most other treatments for MDD), and has additional benefits for multiple aspects of physical health" (p. 210).

Other authors unknowingly reference exercise as an intervention without necessarily knowing that they are recommending it; more specifically, authors commonly synthesize relevant information into descriptions of exercise, which provides it with even greater empirical support. For example, Cohen et al. (2007) calls for "the development of interventions that can

reduce the behavioral and biological sequelae of psychological stress" (Cohen et al., 2007, p.1687), inherently describing the nature of exercise as an intervention, yet not seeming to suggest it. Similarly, Rethorst and Trivedi (2013) argue that "limited response rates for antidepressants, psychotherapy, rTMS, and ECT indicate the need for more cost-effective and accessible alternative and/or augmentation treatments for depressive disorders" (p. 204), once again referencing exercise by its valuable qualities but not by name. While addressing SES factors in mental health, McEwen and Gianaros (2010) specify qualities that will help reduce the challenges of low-SES individuals, saying:

> Interventions should focus on top-down strategies intended to alter brain function in ways that will improve allostasis and minimize allostatic load. Instilling optimism, a sense of control and self-esteem, and finding a meaning and purpose in life should be among the chief goals of such interventions (p. 22).

Interestingly, although McEwen and Gianaros are generally arguing for better social policy for low-SES individuals, they are also accurately describing exercise interventions as illustrated in this paper.

Overall, integrated medicine is growing and models with psychological staff have shown increased quality of care and reduced costs for medical providers (Novotney, 2014); the American Psychiatric Association has even included exercise in treatment guidelines for depression (Rethorst and Trivedi, 2013). However, research has been calling for the use of exercise for *decades*, suggesting that something has been amiss in the process of translation from research to practice. It is the author's position that this is due to a lack of educational requirements and corresponding curricula for programs that could be educating MHPs on the psychological factors affected by exercise. Indeed, Dayley (2002) is in agreement, stating that an

important step forward in integration would be including exercise and health-related information in the education of future mental health professionals.

Competence and Practices of Mental Health Professionals

While existing exercise research seems to be unified in demanding increased use of exercise interventions, providing specialized treatment and recommendations also means that MHPs must meet requirements for professional competence. This expectation corresponds with the standards of competence outlined by the APA ethics code, which states that psychologists are allowed to "provide services, teach and conduct research with populations and in areas only within the boundaries of their competence, based on their education, training, supervised experience, consultation, study or professional experience" (APA, 2010, para. a). Given the previous evidence that exercise interventions lack utilization, it is logical to assume that professional ethics may "reduce the likelihood of psychologists' providing activity advice or counseling if they were not confident of their competence to do so" (Burton, Pakenham & Brown, 2010, p. 295).

In order to assess this unexplored relationship between research, practice and competence, studies gauging the attitudes, practices, and education of MHPs have been performed, though they are very few. The first study, performed by Burks and Keeley in 1989, used a Likert scale ranging from 0 (never) to 5 (always) to assess members of APA Division 29 (Society for the Advancement of Psychotherapy) on various factors including demographics, education related to exercise, client populations, beliefs about utilization of exercise in a treatment setting, personal health habits, and knowledge of facts and literature for diet and exercise, among others. The average response of "psychotherapists" indicated that they discussed exercise only *sometimes* while a seemingly disproportionate 83% of the same sample endorsed

prescribing (providing a specific plan or recommendations towards achieving an identified outcome) exercise to clients. Additionally, Burks and Keeley (1989) found that a very low percentage of respondents had received any formal training in diet and exercise as psychological interventions (12.6%), yet a much higher percentage of respondents (58%) believed that education in exercise ought to be a formal requirement of graduate programs. Together, these findings suggest that there may be a significant difference between MHPs' perceived and actual competence and practices on the subject of exercise.

Although the study may have been conducted with sound methods, bias was inherent in sample selection, as surveys were only disseminated to members of a select division of APA. This factor may have skewed the data or neglected to reveal relevant relationships between subspecialties and their respective opinions or practices (e.g. health psychologists may recommend exercise more often than their peers). Additionally, there was no data reported on professionals' type of licensure (i.e. whether or not they were psychologists, marriage and family therapists, or social workers, etc.); because individuals do not need to be psychologists to be affiliated with APA, this represents a gap in the potential descriptiveness of the data. As summarized by the researchers themselves, "the theme that emerges from this study is that psychotherapists in general lack knowledge about exercise, nutrition, and mental health; yet, these same respondents believe such knowledge should be taught to clinical psychologists" (Burks & Keeley, 1989, p. 64).

Another rare study examining the clinical habits and exercise knowledge of MHPs was conducted in Australia by Burton, et al. in 2010, approximately two decades following the latter study. Given the amount of exercise literature published and the number of calls for integration of exercise since 1989, one might assume that there would be notable increases in MHPs' reports

on these subjects. However, analysis of collected data yielded nearly the same results. Prior to disclosure of these results, it is essential to note that rather than using the language "exercise," survey items and authors utilized the term "physical activity" across all study literature. This term may color interpretation of respondents' endorsements, especially since PA is less structured, less intense, and often unplanned as compared to exercise.

Overall, Burton et al. (2010) found that 53% of respondents reported recommending PA often, while an additional 30% recommended it sometimes; a scale assessing confidence in discussing activity and related issues revealed that in total 80% —a similar figure to the previous study—felt confident giving advice, providing activity options, and discussing barriers to performing PA. However, less than a third of MHPs stated that they had received some kind of activity training in their graduate education and only 10% had received PA education during undergraduate training. Once again, this data demonstrates a notable difference between the proportion of MHPs who report actively recommending exercise and those who appear to be qualified or highly knowledgeable about doing so. Parallel to Burks and Keeley (1989), nearly 75% of the sample reported that they would be very likely to attend local education opportunities on physical activity.

Unfortunately, limitations of this study threaten generalizability to exercise attitudes and practices, primarily because of the choice to operationalize the application of exercise literature through use of the term "physical activity." Furthermore, due to the exclusive use of an Australian sample, results may not generalize to U.S. MHPs, whom it appears were not surveyed more recently than 25 years ago. In both studies, the attitudes and general knowledge of MHPs were only surveyed via self-report, and no data measuring the direct acquisition of facts and research trends have been published (e.g., responses to questions such as, "what is the definition

of aerobic exercise?" or "in what region of the brain has exercise been shown to produce the most growth?"), nor have MHPs' ability to field likely patient questions (e.g. "exactly how will exercise help me if I am depressed?") been tested.

Ultimately, it appears that MHPs require a much greater presence of exercise education within their training, as well as increased opportunities to pursue ongoing education related specifically to exercise interventions. According to the APA (2010) ethics code, it is set forth that "psychologists planning to provide services, teach or conduct research involving populations, areas, techniques or technologies new to them undertake relevant education, training, supervised experience, consultation or study" (para. c).

Conclusions

Potential barriers and perpetuating factors. There are many factors that may continue to perpetuate the notable gap between research, education, and practice, a relationship that appears to be affected by discrepancies between perceived versus actual competence as well. As Vina et al. (2012) explains, for all the research that has been conducted on exercise, the optimal duration, intensity, frequency, and modality has yet to be established especially with specific client populations. This issue likely contributes to increased doubt on how to advise clients, even if one does have some education on exercise interventions.

As found by the studies investigating MHPs' practices, higher levels of exercise in clinicians' personal lives predicted higher levels of integrating exercise into practice (Burks & Keeley, 1989; Burton et al., 2010). This finding suggests that the absence of prescription or discussion of exercise may also be related to the overall sedentary nature of U.S. culture. Indeed, it would be imaginably more difficult for a primary care physician to show conviction in warning patients about smoking dangers if he or she was a smoker. Similarly, clinicians' who exercise

infrequently may have a reduced sense of conviction or increased cognitive dissonance in discussing exercise, which could also be connected to the absence of education or knowledge.

Additionally, MHPs of certain theoretical orientations may view exercise as being entirely outside their scope of psychological practice, regardless of research or competence issues. Although the convicting body of research presented here suggests otherwise, clinicians may feel that there is no place for exercise in a psychotherapy setting. This may also be due, in part, to exercise-related pop culture. Because there exists a wealth of opinion-based articles and unsubstantiated "how-to's" for exercising, the perception of exercise as a science requiring education and training may have declined to "general knowledge" status in the public's viewpoint. This factor may be particularly related to increases in MHPs' perceived confidence in discussing exercise although they have had little formal, scientific training on the topic.

Finally, it is apparent that although there may be select educational curricula or other rare opportunities for continuing education, as a whole there is a severe lack of programs dedicated specifically to teaching the definitions, research, operationalization, and methods behind integration of exercise into clinical practice. Altogether, research has shown—repetitively—that exercise is a valuable and efficacious treatment, not only for improving symptoms of mental health disorders, but also for addressing other contributing factors such as poor physical health, neurobiological components, stress, low self-esteem, and sociopolitical contributors. Indeed, Vina et al. (2012) propose that the power of exercise is so strong, it may be considered a psychoactive drug. Exercise also stands up to scrutiny as a culturally-sensitive intervention, potentially acting as a valuable treatment option for many demographic subsets of clientele who cannot afford traditional treatment or do not subscribe to pharmaceutical or therapy approaches.

Unfortunately, it also seems to the case that exercise-related discussions and recommendations on using exercise as culturally-sensitive intervention are minimal to nonexistent.

The rare studies that evaluate exercise-related attitudes and practices of MHPs reiterate the same point: MHPs feel confident in discussing exercise, are interested in continuing education, and yet have little training in this area (which is likely suggestive of competence). More specifically, both Burks and Keeley (1989) and Burton et al. (2010) state that approximately 80% of MHPs are discussing exercise with their clients. However, this presents a notable discrepancy from reported levels of exercise education, research authors' urgent calls for the wide use of exercise as an intervention, and qualitative experiences in the field of clinical psychology. It is possible that there are unknown factors within existing exercise research that explain these major discrepancies. Issues to consider include skewed samples, biased self-report factors, translation of real-life exercise properties to clinical operationalization, and notable differences between perceived and actual competence. Authors of the most recent MHP survey on exercise knowledge and practices charge future researchers with the following: "More work is now needed to examine the actual capacity of psychologists to provide physical activity advice and counseling as part of psychological treatment…" (Burton et al, 2010, p. 296).

Goals and hypotheses. Based on the evidence presented here, specifically the efficacy of exercise as a treatment, the discrepancy between data on education and data on clinical recommendations, and MHPs' perceptions of competence and practice habits, the goals of this exploration are as follows:

- Provide a data-informed understanding of MHPs' perceived and actual competence regarding exercise psychology in the United States

- Examine and describe potential factors contributing to the ongoing research-practice gap with regard to exercise psychology
- Estimate a baseline of MHPs' exercise education within the U.S. in order to inform future programs and directions of research

Primary hypotheses.

Hypothesis 1. Based on prior studies (Burks & Keeley, 1989; Burton et al., 2010) it was hypothesized that at least 70% of the sample would report confident utilization (e.g., discussion, prescription) of exercise topics within clinical practice, based on initial perceptions prior to exposure to the knowledge test.

Hypothesis 2. It was hypothesized that factual knowledge of exercise psychology would be lower than perceived knowledge, in that a significant difference would be observed between measures of perceived confidence and competence and test scores (with test scores being lower).

Hypothesis 3. It was hypothesized that fact-based competence (as measured by concrete knowledge of exercise research and constructs on the knowledge test) would be low in general. It was also hypothesized that low *fact-based* competence taken together with high levels of *perceived* competence within the sample would produce evidence of the Dunning-Kruger effect (phenomenon in which lower skill is correlated with higher perceptions of competence and higher skill is correlated with a more conservative perceptions of competence) (Kruger & Dunning, 1999).

Hypothesis 4. It was hypothesized that personal exercise habits would be related to level of exercise knowledge and frequency of using exercise within clinical practice, as observed in prior studies (Burks & Keeley, 1989; Burton et al., 2010). Specifically, it was expected that participants meeting or exceeding AHA exercise requirements would demonstrate greater levels

of exercise knowledge and would report greater frequency of utilizing exercise within clinical practice than their less active peers.

Exploratory hypotheses.

***Exploratory Hypothesis 1*.** It was hypothesized that licensure as a psychologist would be associated with increased research knowledge compared to other types of MHP, operationalized as higher test scores.

Exploratory Hypothesis 2. It was hypothesized that by providing a reference point for exercise competence, exposure to the knowledge test material would decrease participants' self-appraisal of confidence and competence. That is, it was predicted that both confidence and competence ratings would be greater at pretest than at posttest.

Exploratory Hypothesis 3. Based on previous findings (Burks & Keeley, 1989; Burton et al., 2010) it was hypothesized that participants would report a greater preference for exercise-related educational opportunities than they perceived were available.

CHAPTER III

Methods

Design

The present study was designed to examine perceived versus actual competence of mental health professionals (MHPs) on the topic of utilizing and discussing exercise interventions within clinical practice. This exploration attempted to answer the longstanding call of exercise research to optimize usage of relevant physical activity literature within a clinical setting. Permission to collect prospective, quantitative self-report data was granted by the Institutional Review Board (IRB) of the California School of Professional Psychology at Alliant International University Los Angeles (Appendix A). Collected data included information on MHP demographics; professional beliefs and practice habits related to exercise; personal and educational exposure to exercise; knowledge of broad research trends and findings within the field of exercise psychology; and perceptions of competence collected at two time points, both before and after administration of the research-based items.

As established previously, study objectives were as follows: to gather and present a data-informed understanding of MHPs' perceived and actual competence regarding exercise psychology, examine potential factors contributing to an ongoing research-practice gap, and establish a baseline of MHPs' understanding of exercise to inform future educational programs. As such, data of primary interest included demographic and practice factors correlating with utilization of exercise interventions, objective knowledge of exercise psychology, and self-evaluations of competence and awareness.

Participants

Participants were recruited by posting a link to the survey on professional listservs, professional social media pages (e.g., various chapters of American Psychological Association),

and any subsequent snowball sampling. Tracking of survey dissemination was not possible due to individuals' ability to post or forward the survey of their own accord. Inclusion criteria was as follows: English-speaking, licensed MHPs including psychologists, marriage and family therapists and social workers who are practicing in the United States.

Measures

An original, electronic survey (Appendix B) was created to measure previously studied variables (e.g., demographics, practice habits, attitudes, perceptions of confidence) as well as knowledge-based competence. The survey was used to collect relevant sample-specific data; test perceived levels of exercise competence; measure fact-based competence in the area of exercise psychology; and establish estimations for performance and attitudes regarding need for educational opportunities. For most items aside from demographic and knowledge questions, a nine-point Likert scale (Preston & Colman, 2000) was used to optimize discriminating power, test-retest reliability, ease of use, and facility of comparison between perception and knowledge data. All items were created or selected for their operational compatibility to prior studies' items or their generalizability to a basic knowledge of exercise psychology (concepts were obtained from a textbook designed for an entry-level exercise psychology course) (Lox et al., 2003). The survey was broken down into sections as outlined below (in order of appearance to participants); Cronbach's alpha was calculated for each subscale appropriate for the statistic (i.e., excluding demographic questions and variables gathering personal or educational exposure to exercise). As the survey represents an original work by the author, reliability and validity data have not been confirmed, though sample-based calculations demonstrated levels of internal consistency and reliability that were consistent with study expectations and previous research.

Demographics. Eight items were used to gather basic demographic and practice data. Information collected included age, identified gender, geographic location, type of licensure obtained, number of years licensed, areas of expertise, and primary setting of practice.

Exercise beliefs in clinical practice. Five items (measured on a 9-point Likert scale ranging from "Not at all" to "Very much") were used to measure personal attitudes and opinions regarding the appropriateness, usefulness, and validity of integrating exercise into clinical practice. Items were structured to be comparable to those of existing publications and as a whole, they approached acceptable levels of internal consistency and reliability ($\alpha = .64$). Of note, removing one item ("To what extent do you believe that exercise can be *harmful* in treating psychological issues?") that represented an opposing construct from the other items raised internal consistency to $\alpha = .70$.

Habits in clinical practice. For participants who endorsed providing direct services to clients (one item), five additional items were used to gather qualitative frequency data (a 9-point Likert scale ranging from "never" to "always") on how often exercise factors are assessed, discussed as an intervention, or prescribed with specific guidelines. Items were structured to assess what extent current practices parallel existing scientific support. Cronbach's alpha demonstrated acceptable levels of internal consistency and reliability ($\alpha = .82$).

Perceived competence. Two items (measure on a 9-point Likert scale ranging from "not at all confident/competent" to "very confident/competent") administered both pre- and post-knowledge test were designed to gauge participants' perceived levels of confidence and competence at integrating exercise into practice. Administration of these items both before and after the fact-based knowledge test was structured to detect any adjustment of participants' self-perceptions following exposure to basic exercise concepts. Items were administered as such in

order to examine suspected response patterns related to perception versus actual knowledge. Following the knowledge test, an additional item was given to gather data on participants' perceived level of test performance (i.e., the extent to which they felt as though they were guessing or knew most items outright). Internal consistency and reliability for these items were high ($\alpha = .90$).

Knowledge test. Twenty multiple-choice items assessed knowledge of clinically-relevant, basic facts and research trends that are commonly referenced in or demonstrated by the exercise literature. Specifically, items assessed knowledge of basic exercise facts (e.g., definition of aerobic versus anaerobic exercise), consistent research findings (e.g., region of the brain with most consistent and/or robust response to exercise) and concepts relating to exercise as an intervention (e.g., relevance of exercise to allostatic load; relationship between exercise and depression). Items were randomized for order per participant and scored by awarding one point for each correct answer; total "test score" was converted into a percentage (total correct divided by total possible) for facility of comparison with other data. Cronbach's alpha was low ($\alpha = .38$) for this section, which was expected. Given that the source of all test questions were based on prominent concepts from an entry level textbook (Lox et al., 2003), the fact that participant responses varied so widely is more suggestive of varying knowledge base rather than lack of internal consistency or reliability.

Exercise experience. Six items were used to measure the amount of experience participants have in the area of exercise and exercise-related interventions. Information gathered included amount of formal education, specialized training (e.g., workshops), sources of existing knowledge on exercise, and levels of personal exercise. The item gathering data on personal exercise habits was structured to separate participants who met AHA exercise guidelines and

those who did not. Cronbach's alpha was not appropriate for these items as they were formatted to yield various types of data and were not attempting to elicit related responses.

Opportunities for ongoing education. Two items (measured on a 9-point Likert scale ranging from "rarely available" to "readily available") were used to assess for any discrepancy between MHPs' *perceptions* of the availability of exercise-related trainings as compared to *preference* for availability of trainings. Cronbach's alpha was low ($\alpha = .22$) as expected, given that one of the study's exploratory hypotheses was that perceptions of available opportunities would be significantly lower than preferred availability.

Procedures

Participants in this study included MHPs adhering to self-reported inclusion criteria as specified above. Following IRB approval, recruitment via email and social media posting commenced. An explanatory email or social media post (Appendix C) was sent to chairpersons of professional listservs or posted on public-access social media pages requesting dissemination and participation in the study survey. The recruitment email and social media post included a survey link for forwarding to all potential participants or listerv members. Prior to completing the survey, participants were required to provide consent for participation, which explained the potential risks and benefits of the study as well as the voluntary and confidential nature of participation. Participants were advised to save a copy of the electronic informed consent if they wished to do so for their own records. Participants were advised that no identifying information would be obtained with one exception: upon completion of the survey, participants were given the option of entering an email address (for contact purposes only) to be entered to win a gift card for participating. Following completion of data collection, data was exported from Qualtrics to SPSS in order to run data analyses. Data was stored on a private, password protected computer

and all personal information (i.e., any email addresses collected) were destroyed after awarding of the gift card.

Data Analysis

Given the chiefly exploratory nature of this small-sample study and high number of variables (including multiple items for beliefs, practice habits, education, personal exposure to exercise, etc.), analyses were generally limited to descriptive statistics, t-tests, one-way ANOVAs, and Spearman correlations to examine general trends and hypothesis-specific relationships. Cronbach's alpha and descriptive statistics (including the mean, standard deviation, range, frequency, and percentage) were first calculated in order to summarize sample survey characteristics, demographics, exercise experience, and test scores. Measures of perceived confidence, perceived competence, test score, and discrepancies between these variables (discrepancy values) were treated as dependent variables and compared with the majority of other variables via directional and correlational analyses. All analyses were conducted using a significance level of $\alpha = .05$, wherein resulting *p*-values observed to be less than alpha will cause the corresponding null hypothesis to be rejected with a level of 0.95 confidence.

CHAPTER IV

Results

Preliminary Analyses

Sample characteristics. Due to the exploratory nature of this study, data were collected on a range of demographic, attitude, and practice variables in order to identify characteristics of MHPs that are associated with trends in exercise-related practice habits, knowledge, perceptions of competence, and personal exercise habits.

Participant characteristics. This study's data were collected from postings on various professional listservs, social media pages, and snowball sampling. Given that survey distribution was not able to be tracked, the exact source of participants is unavailable. A total of 150 participants were enrolled in the study (provided informed consent and began the survey); of those, 25 participants were excluded for not affirming licensure as an MHP. An additional 42 participants were excluded because they did not complete the survey, for a total $N = 83$ (55.3% of individuals who initiated the survey).

Participant demographics. Data from 83 individual participants were used for this study (Table 1).

Table 1

Participant Demographics (N =83)

Characteristic	*f*	%[a]
Total	83	100%
Identified Gender		
Female	74	89.2
Male	9	10.8
Other	0	0
Age		
25-29	5	6.0
30-34	16	19.3
35-39	16	19.3
40-44	12	14.5
45-49	5	6.0
50-54	8	9.6
55-59	8	9.6
60-64	7	8.4
65-69	4	4.8
70-74	1	1.8
75-79	0	0
>80	1	1.8
Total Years of Graduate School		
≤ 2	20	25.3
2 > years ≤ 4	35	42.2
4 > years ≤ 6	17	20.5
6 > years ≤ 8	7	8.4
> 8	4	4.8
Years Licensed		
0-5	50	60.2
6-10	14	16.9
11-15	9	10.8
16-20	5	6.0
>20	5	6.0
License Type		
Social Worker	16	19.3
Marriage and Family Therapist	40	48.2
Psychologist	17	20.5
Counselor	10	12.0

[a]Rounded percentages may not add up to 100% of sample

Seventy-four individuals identified as female (89.2%) and nine as male (10.8%); zero participants identified as any other gender. Ages of participants ranged from 27 to 81 years with a mean age of 44.5 (*SD* = 12.5). Ethnicity data was not collected for this study given the potential for negative categorization of participants' knowledge based on their ethnic background. Approximately half of all participants were licensed marriage and family therapists (*n* = 40, 48.2%), followed by licensed psychologists (*n* = 17, 20.5%), licensed social workers (*n* = 16, 19.3%), and licensed counselors (*n* = 10, 12.0%). Number of years licensed were reported according to the nearest half year and ranged from 0 (i.e., less than 6 months) to 38 years, with mean number of years licensed being 7.1 (*SD* = 7.6). Total years of graduate school attendance ranged from 1 to 12 years, with a mean of 4.1 (*SD* = 2.3).

Practice characteristics. The sample demonstrated a range of geographic locations with 44 participants (53.0%) from the West, 21 participants (25.3%) from the South, 10 participants (12.1%) from the Northeast, and 8 participants (9.6%) from the Midwest (U.S. Census Bureau, 2010). This sample of MHPs also identified a range of patient populations and areas of service expertise as the primary foci of their professional activities (frequency and percentage data exceed total sample size due to endorsement of multiple foci). Participants described areas of expertise as follows: children (*n* = 32, 38.6%), adults (*n* = 62, 74.7%), families (*n* = 14, 16.9%), and couples (*n* = 20, 24.1%); therapy (*n* = 76, 91.6%), assessment (*n* = 28, 33.7%), research (*n* = 7, 8.4%), consultation and advocacy (*n* = 11, 13.3%), public policy (*n* =1, 1.2%). MHPs also varied in primary work setting, with private clinic/office being the most common (*n* = 49, 59.0%), followed by community clinic (*n* = 17, 20.5%), medical setting or research facility (*n* = 10, 12.0%), academic setting (*n* = 6, 7.2%), and on site (e.g., home, school) services (*n* = 1, 1.2%) (Table 2).

Table 2

Participant Practice Characteristics (N =83)

Characteristic	*f*	%[a]
Geographic Location		
West	44	53.0
South	21	25.3
Northeast	10	12.1
Midwest	8	9.6
Population Expertise[b]		
Children and Adolescents	32	38.6
Adults	62	74.7
Families	14	16.9
Couples	20	24.1
Service Expertise[b]		
Therapy	76	91.6
Assessment	28	33.7
Research	7	8.4
Consultation & Advocacy	11	13.3
Public Policy	1	1.2
Primary Setting		
Private office/clinic	49	59.0
Academic setting	6	7.2
Community clinic	17	20.5
Medical setting/research facility	10	12.0
On site (school, home)	1	1.2

[a]Rounded percentages may not add up to 100% of sample
[b]total *n* exceeds sample size due to endorsement of multiple categories

Exercise experience. Participants reported low levels of formal education on exercise (as it relates to psychology or otherwise), with approximately one third of the sample receiving instruction as part of their undergraduate (*n* = 26, 31.7%) or graduate studies (*n* = 29, 35.4%), while about a third did not endorse any formal education on exercise (*n* =27, 32.9%). A notable majority of the sample reported that they had not attended a workshop or training module on exercise interventions in the past year as well (*n* = 62, 77.5%). Fourteen participants (17.5.1%) reported attending one exercise intervention training in the past year, while one individual (1.3%) attended two trainings, two individuals (2.5%) attended three trainings, zero individuals (0%) attended four trainings, and one individual (1.3%) reported attending a notable number of five such training opportunities. Participants reported that overall, they had received specialized training on exercise psychology from the following sources: graduate or undergraduate education (*n* = 23, 27.7%), conferences, seminars or workshops (*n* = 22, 26.5%), self-education through books or research (*n* = 60, 72.3%), advice or direction from fitness or other qualified professionals (*n* = 29, 34.9%). Six participants (7.2%) reported having received no specialized education. When asked what sources of information had most *directly* informed existing knowledge on exercise, participants identified the most credible sources of information with the highest frequency: research or peer reviewed journals (*n* = 42, 50.6%) and fitness professionals (*n* = 31, 37.3%). However, less credible sources (specifically, those more vulnerable to the effects of bias or sensationalization) were identified as accounting for nearly half (46.3%) of total responses: magazine articles or opinion commentary (*n* = 24, 28.9%) were cited most often, followed by news media (*n* = 17, 20.5%), social media or non-research websites (*n* = 14, 16.9%), and word of mouth or friends (*n* = 8, 9.6%).

Regarding personal exercise habits, participants reported varied patterns ranging from zero instances of intentional exercise of at least 30 minutes (n = 10, 12.2%) to exercising more than three times per week on average (n = 21, 25.6%). All other participants reported frequency of exercise between these two markers, with nine participants (11.0%) exercising one to two times in the past month, eleven participants (13.4%) exercising three to six times in the past month, and additional eleven participants (13.4%) exercising at least two times per week on average in the past month, and six participants (31.6%) exercising at least three times per week on average. Notably, only a quarter (25.6%) of the sample reported consistently meeting or exceeding AHA guidelines for exercise. Another 24.4% of participants met the weekly AHA requirements "on average" (i.e., half the time), while half of the sample (50.0%) (any participant exercising fewer than 3 times per week) did not approach the basic exercise recommendations prescribed for maintaining health (Table 3).

Table 3

Exercise Experience

Characteristic	*f*	%[a]
Received Formal Education on Exercise[b]		
Undergraduate	26	31.7
Graduate	29	35.4
No formal education	27	32.9
Number Specialized Trainings on Exercise in Past Year[c]		
0	62	77.5
1	14	17.5
2	1	1.3
3	2	2.5
4	0	0
5	1	1.3
Personal Exercise Habits[b]		
Meets AHA Requirements: Total	21	25.6
More than 3x per week on average	21	25.6
Does not meet AHA Requirements: Total	41	50.0
At least 3x per week on average	20	24.4
At least 2x per week on average	11	13.4
3-6 times in the past month	11	13.4
1-2 times in the past month	9	11.0
Did not meet criteria/exercise in the past month	10	12.2
Source of Specialized Training on Exercise[b,d]		
Graduate or undergraduate education	23	27.7
Conferences, seminars, workshops	22	26.5
Self-education (e.g., books, research)	60	72.3
Advice/direction from fitness or other professionals	29	34.9
None	6	7.2
Sources of Information Informing Knowledge[b,d]		
Research/peer reviewed journals	42	50.6
Fitness Professionals	31	37.3
News Media	17	20.5
Social media/non-research websites	14	16.9
Magazine articles/opinion commentary	24	28.9
Word of mouth/friends	8	9.6

[a]Rounded percentages are calculated based on valid responses and may not add up to 100% of sample

[b]n = 82; 1 missing response

[c]n = 80; 3 missing responses

[d]Total n exceeds sample size due to endorsement of multiple categories

Primary Analyses

All statistical analyses were conducted after appropriate assumptions were met. Methods used to determine scatter, normality, and homogeneity of variances included boxplots, visual inspection of data, Shapiro-Wilk test for normality (Ghasemi & Zahediasl, 2012), and Levene's Test of equality of variances. In all cases, outliers were removed prior to conducting analyses.

Hypothesis 1. It was hypothesized that at least 70% of the sample would report confident utilization of exercise topics within clinical practice, based on initial perceptions prior to exposure to the knowledge test. Descriptive statistics confirmed the hypothesis, demonstrating that basic measures of confidence match reports of previous studies with 79.5% of the sample (n = 66) endorsing high confidence levels (measured as ordinal rankings of 7, 8, or 9 on a 9-point Likert scale). This finding provides support for the Burton et al. (2010) and Burks and Keeley (1989) studies, which demonstrated that approximately 80% of clinicians report confidence in using discussion or prescription of physical activity in clinical practice.

Other items measuring more specific methods of incorporating exercise use in clinical practice were also evaluated. Specifically, four items were examined for frequency of participants who endorsed the identified exercise topic at least 75% of the time (participants who chose rankings of 7, 8, or 9 on the 9-point Likert scale). Three participants were excluded from the analysis (n = 80) because the "practice habits" module was not included in their survey after they identified that they did not work directly with clients. Results appeared to provide further support of previous findings wherein the sample demonstrated reduced endorsement of exercise interventions as survey items (i.e., exercise interventions) became increasingly specialized (see Table 4).

Table 4

Endorsement of Exercise Interventions of Increasing Specialty (n = 80)

Survey Item[a]	*f*	%
…screen your clients for the presence of physical health issues?	74	92.5
…ask clients about their exercise habits?	62	77.5
…discuss exercise with your clients in the context of using it to increase their functioning/decrease their symptoms?	62	77.5
…perform psychoeducation on how exercise can treat the biological mechanisms of psychological disorders?	48	60.0
…prescribe exercise for your clients to help increase their psychological functioning (i.e., set out specific recommendations, goals, etc.)?	39	48.8

[a]All survey items begin with sentence stem: "How often do you…"

Hypothesis 2. It was hypothesized that factual knowledge of exercise psychology would be lower than perceived knowledge. Knowledge test scores and ordinal measures of confidence and competence were each converted to percentages (e.g., 15 correct answers of 20 possible questions equals a 75% test score; an ordinal ranking of 7 out of 9 points on a Likert scale is equivalent to 75% of the total possible ranking score) for facility of data comparison (see Table 5 for example).

New "discrepancy" variables were created by calculating the mathematical difference between pretest confidence rating and test score (ConfDiscrepancy) and pretest competence rating and test score (CompDiscrepancy). For both variables, negative values represent self-appraisal that was lower than actual knowledge, whereas positive values represent self-appraisal that is higher than actual knowledge (sample in Table 5).

Table 5

Sample of Qualitative Evaluation of Discrepancies Between Measures of Competence

Participant	Competence	Test Score	Difference	Overestimate?
1	37.5	35.0	2.5	Y
2	35.0	65.0	30.0	Y
5	25.0	70.0	-45.0	N
12	75.0	75.0	0.0	N

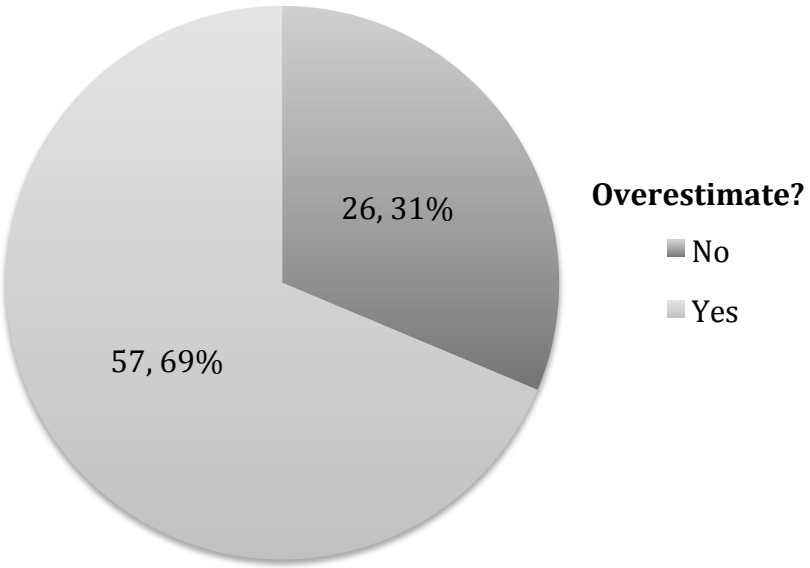
To ensure assumptions were met for a paired samples t-test, both discrepancy variables were analyzed to determine scatter and normality. Boxplots revealed one outlier for ConfDiscrepancy, which was excluded from the analysis. Data were found to be within limits of normality (Shapiro-Wilk value $p > .05$) for both ConfDiscrepancy and CompDiscrepancy variables.

Paired sample t-test (ConfDiscrepancy $n = 82$; CompDiscrepancy $N = 83$) comparing knowledge test scores to pre-test measures of perceived confidence and competence demonstrated a significant difference between test score ($M = 56.46$, $SD = 12.48$) and perceived confidence ($M = 82.01$, $SD = 18.44$), as well as between test score ($M = 56.50$, $SD = 12.41$) and perceived competence ($M = 68.83$, $SD = 23.46$). Specifically, perceptions of confidence were higher than actual test knowledge, with a mean difference of 20.55 ($SD = 20.78$), $t(81) = 11.14$, $p < .01$, 95% CI [20.98, 30.11] and a large effect size ($d = .99$). Mean difference between test score and perceived competence was 12.32 percentage points ($SD = 25.47$), $t(82) = 4.41$, $p < .01$, 95% CI [6.76, 17.88] and a medium effect size ($d = .48$).

Further analysis of participants' self-assessments yielded the finding that 57 of 83 participants (68.7% of the sample) overestimated their competence as compared to their knowledge of major research trends in exercise psychology (Figure 1).

Figure 1

Proportion of Participants Overestimating Competence



Only 26 participants (31.3%) estimated their competence as being less than or equal to their test score. As such, results confirm the stated hypothesis that perceived knowledge of exercise psychology is lower than actual, fact-based knowledge. This appears to be true according to multiple measures of perceived ability, suggesting that not only are MHPs' overestimating their awareness and application of exercise concepts in multiple ways.

Hypothesis 3. It was hypothesized that fact-based competence (as measured by concrete knowledge of exercise research and constructs on the knowledge test) would be low in general. It was also hypothesized that low *fact-based* competence taken together with high levels of *perceived* competence within the sample would produce evidence of the Dunning-Kruger effect (phenomenon in which lower skill is correlated with higher perceptions of competence and higher skill is correlated with a more conservative perceptions of competence) (Kruger & Dunning, 1999).

First, descriptive statistics and frequency data were calculated for knowledge test scores and discrepancy values. Mean test score was 11.3 (*SD* = 2.5), with a minimum score of 6 and a maximum score of 16. Scores were broken down into "grade-equivalent" measures of performance, creating two separate categories of participants—those who achieved "passing" scores and those who achieved "failing" scores (see Table 6).

Table 6

Grade Equivalent Performance of Knowledge Test Scores (N = 83)

Grade	Score	*f*	%[a]
Passing		15	18.1
A	≥18	0	0
B	16-17	6	7.2
C	14-15	9	10.8
Failing		68	81.9
D	12-13	23	27.7
F	≤11	45	54.2

Note. Score is out of 20 possible points.
[a]Rounded percentages may not add up to 100% of sample

Only fifteen participants (18.1%) achieved passing scores on the knowledge test, suggesting that more than three quarters of the sample (81.9%) do not meet basic standards for APA's definition of competence, which includes understanding and awareness of research trends as a primary factor.

Analyses using the discrepancy variables (ConfDiscrepancy and CompDiscrepancy) were conducted to determine whether participants with failing test scores reported disproportionately higher levels of competence or confidence than those with passing scores. Initial review of scatter and normality of data revealed two outliers in the Failing x ConfDiscrepancy group. Following removal of the two outliers all variables met requirements for scatter and normality with Shapiro-Wilk values $p > .05$, including Failing x CompDiscrepancy, Passing x ConfDiscrepancy, and Passing x CompDiscrepancy. Levene's test showed that there was

homogeneity of variances for CompDiscrepancy (p = .17), while ConfDiscrepancy approached the statistical limit for homogeneity of variances (p = .048) but did not meet the cutoff statistic of p = .05. As such, subsequent statistics reported for ConfDiscprepancy were calculated without the assumption of equal variances using the Welch t-test.

Independent samples t-tests confirmed the hypotheses. Analyses found significant differences between perceptions and actual knowledge, wherein failing participants indeed displayed greater discrepancy scores than passing participants (Table 7).

Table 7

Analysis of Discrepancies Between Passing and Failing Participants

Variable[a]	*n*	M	SD	*t*	*df*	95% CI	*p*
ConfDiscrepancy		19.31		-4.77	37.71	[11.06, 27.56]	.001**
Passing	15	10.5	12.58				
Failing	66	29.81	19.64				
CompDiscrecpancy		19.51		-2.79	81	[6.98, 19.51]	.006*
Passing	15	-3.67	24.94				
Failing	68	15.85	25.60				

[a]Discrepancy variable compared to test score in analyses
*p < .01. **p < .001

Mean ConfDiscrepancy score for failing participants was 29.81 points (SD = 19.64) while passing participants exhibited a mean discrepancy of 10.5 points (SD = 12.58). Mean difference between passing and failing groups was 19.31, with failing participants exhibiting higher discrepancies than passing participants, t(31.71) = -4.77, p < .001, 95% CI [11.06, 27.56]. Cohen's effect size (d = 1.17) suggested a large effect size between passing and failing participants. Mean CompDiscrepancy score for failing participants was 15.85 points (SD = 25.60), while mean CompDiscrepancy score for passing participants was -3.67 (SD = 18.20)(that is, estimates of competence were *lower* than actual, test-based knowledge; passing participants *underestimated* their competence on average). Mean difference between the two groups was

19.51 points, with failing participants exhibiting higher discrepancies than passing participants, $t(81) = -2.79$, $p = .006$, 95% CI [6.98, 19.51]. Cohen's effect size for discrepancy in competence was also large ($d = .88$). Results demonstrate that in this sample, the Dunning-Kruger effect is a plausible method for explaining prior studies' high rankings of participants' confidence with using exercise interventions, while reports of formal education or specialized training do not match perceptions.

Hypothesis 4. It was hypothesized that personal exercise habits would be related to level of exercise knowledge and frequency of using exercise within clinical practice, as observed in prior studies. Specifically, it was expected that participants meeting or exceeding AHA exercise requirements would demonstrate greater exercise knowledge (test score) and would report greater frequency of utilizing exercise within clinical practice than their less active peers.

Personal exercise habits were converted to a categorical variable with two levels, wherein participants were coded "yes" if their exercise habits met or exceeded AHA (AHA exercisers) criteria consistently and "no" if they did not (non-AHA exercisers). Both groups of participants made up two data sets without outliers (determined via boxplot analysis) and while AHA exercisers exhibited a normal distributions with Shapiro-Wilk values $p > .05$, non-AHA exercisers did not meet assumptions of normality (Shapiro-Wilk value $p < .05$). As such, a Mann-Whitney U test was conducted without assuming normal distribution of the data. The analysis ($n = 82$) did not reveal a significant difference between the median test score of AHA exercisers ($Mdn = 11.00$) and non-AHA exercisers ($Mdn = 11.00$) $U = 606.50$, $p = .72$ and did not provide support for the hypothesis that AHA exercisers would demonstrate greater exercise knowledge.

Analyses were also conducted to examine whether the two groups of participants (AHA exercisers and non-AHA exercisers) endorsed the use of exercise interventions at different rates.

Specific items analyzed were as follows: “How often do you discuss exercise with your clients in the context of using it to increase their functioning/decrease their symptoms?” (functioning item); “How often do you perform psychoeducation on how exercise can treat the biological mechanisms of psychological disorders?” (psychoeducation item); and “How often do you prescribe exercise for your clients to help increase their psychological functioning (i.e., set out specific recommendations, goals, etc.)?” (prescription item). Two participants who did not provide direct services to clients (and were not required to answer these items) were excluded from the analysis; analysis of each individual item follows.

Examination of AHA (n = 18) and non-AHA (n = 55) exercisers’ responses to the functioning item revealed two outliers in the AHA group and four outliers in the non-AHA group, all of which were removed from the analysis. Following initial removal of all outliers however, the non-AHA exercise group still exhibited three outliers that were included in the analysis. Data did not meet assumptions of normality (Shapiro-Wilk values AHA, p = 0.11; non-AHA, $p < .001$) and a Mann-Whitney U test was to assess for significant differences between the groups. Visual inspection of group distributions demonstrated that they were not similar; no significant differences were detected between AHA exercisers (mean rank = 38.28) and non-AHA exercisers (mean rank = 36.58), U = 472.00, z = -.31, p = .76 in self-reported frequency of using exercise to increase client functioning.

The item assessing practice habits involving psychoeducation contained no outliers for the AHA exercise group (n = 20) yet five outliers for the non-AHA exercise group (n = 54). After removal of the outliers, data still did not meet assumptions of normality (Shapiro-WIlk values AHA, p = .029; non-AHA, $p < .001$). A Mann-Whitney U was not significant and group distributions were not similar as assessed by visual inspection. Results indicate that AHA

exercisers (mean rank = 33.85) did not report utilizing psychoeducational exercise interventions at a statistically greater rate than non-AHA exercisers (mean rank = 38.85), $U = 613.00$, $z = .91$, $p = .36$.

The item measuring exercise prescription displayed no outliers for either group; AHA exercisers ($n = 20$) met assumptions for normal distribution (Shapiro-Wilk value $p > .05$), but non-AHA exercisers ($n = 59$) did not (Shapiro-Wilk value $p < .001$). Mann-Whitney U test was used to examine potential differences between groups due to violations of normality, however visual inspection of distributions demonstrated dissimilarity. No statistical difference was found between AHA (mean rank = 40.67) and non-AHA exercisers (mean rank = 39.77), $U = 576.00$, $z = -.15$, $p = .88$ in self-reported frequency of utilizing exercise prescription with clients. Overall, there were no significant findings to support the hypotheses that meeting AHA exercise requirements would increase knowledge and practice habits.

Exploratory Analyses

Given the exploratory nature of this study, a number of investigative analyses were performed to provide the most useful information for future research and with the aim of exploring the research-practice gap.

Exploratory hypothesis 1. It was hypothesized that licensure as a psychologist would be associated with greater research knowledge, which was operationalized as test score. Participants were grouped according to type of license: social workers ($n = 16$), psychologists ($n = 17$), marriage and family therapists ($n = 40$), and counselors ($n = 10$). Examination of boxplots confirmed the absence of outliers; Shapiro-Wilk values indicated a normal distribution for each group ($p > .05$), with the exception of the test scores of licensed social workers, which approached normality ($p = .027$); there was homogeneity of variances as assessed by Levene's

test, $p > .05$. Although one group violated the assumption of normally distributed data, its test statistic approached a standard marker of normality and an ANOVA was used due to its robustness to deviations of normality. To further accommodate for the violation of normality, however, a non-parametric statistic was also run to ensure quality of findings (discussed subsequently).

A one-way ANOVA demonstrated statistically significant differences between groups, $F(3,79) = 4.20$, $p = .008$, $\omega^2 = .11$; Tukey post hoc analysis revealed that psychologists had significantly higher test scores ($M = 12.88$, $SD = 2.37$) than marriage and family therapists ($M = 10.53$, $SD = 2.54$), with a mean difference of 2.36 points, $p = .005$, 95% CI [.57, 4.14]. There were no other significant differences between groups of MHPs (social workers, $M = 11.69$, $SD = 1.70$; counselors, $M = 11.10$, $SD = 2.38$).

As a precaution to guard against Type I error of the ANOVA, a Kruskal-Wallis test was also used to analyze test scores of each license type. Nonparametric analysis was consistent with ANOVA, demonstrating a significant difference between groups $\chi^2(3) = 9.73$, $p = .02$. Pairwise comparisons using Dunn's (1964) Bonferroni correction and adjusted p values revealed a statistically significant difference between psychologists ($Mdn = 13.00$) and MFTs ($Mdn = 11.00$) ($p = .016$), but no other significant differences between groups of MHPs including social workers ($Mdn = 11.50$) and counselors ($Mdn = 10.50$). As such, the current sample appears to provide some support for the hypothesis that psychologists have a greater research-based knowledge of exercise constructs and interventions than other types of licenses, though statistical analyses suggest that the difference may only be significant when compared with MFTs.

Exploratory hypothesis 2. It was hypothesized that by providing a reference point for exercise competence, exposure to the knowledge test material would decrease participants' self-

appraisal of confidence and competence. That is, it was expected that both confidence and competence ratings would be greater at pretest than at posttest. Examination of the differences between pretest and posttest confidence values yielded discovery of one outlier (per variable) via boxplot assessment and non-normal distribution with Shapiro-Wilk value $p < .05$. Outliers were excluded from the analysis and Wilcoxon Signed Rank test was used to assess for significant differences; assumptions were met for symmetrical distribution of difference values. Analysis showed a statistically significant median decrease (*Mdn* = 2.00) in pretest confidence (*Mdn* = 8.00) compared to post-test confidence (*Mdn* = 6.00), $z = -5.64$, $p < .001$. Similarly, competence ratings showed a significant decrease (*Mdn* = 1.00) from pretest (*Mdn* = 7.00) to posttest (*Mdn* = 6.00) $z = -4.71$ $p < .001$. These results provide support for the exploratory hypothesis that after direct exposure to research trends on exercise, participants would rate themselves as having lower confidence and competence in using exercise interventions.

Exploratory hypothesis 3. Based on previous findings (Burks & Keeley, 1989; Burton et al., 2010) it was hypothesized that participants would report a greater preference for exercise-related educational opportunities than they perceived were available. Differences between *perceived* availability of education opportunities and *preferred* availability of education opportunities were analyzed to determine whether or not this factor could play a role in the research-practice gap. Boxplot assessment revealed two outliers, which were removed from the dataset; additionally, assumptions for normality were violated (Shapiro-Wilk test $p < .05$). Analysis was conducted using a Wilcoxon Signed Rank test ($n = 81$), which revealed a significant difference between preferred availability of education opportunities (*Mdn* = 8.00) and perceived availability of education opportunities (*Mdn* = 3.00, *SD*), $z = 7.40$, $p < .001$.

Other exploratory analyses of variables. Though there were no specific hypotheses made regarding any additional relationships, exploratory analyses were conducted in order to determine whether or not any other demographic, attitude, practice habit, or personal exercise variables were related to the following: test score, pretest confidence, pretest competence, or discrepancy values (ConfDiscrepancy, CompDiscrepancy). All relationships between continuous variables were determined using Spearman's correlation and are listed in Table 8; relationships between dependent variables are noted in Table 9. All significant values met assumptions for the Spearman correlation statistic, while non-significant values demonstrate non-monotonic relationships and require further exploration outside the scope of this study. Notable findings are discussed in the subsequent section.

Table 8

Correlations Between Demographic, Attitude, Practice Habit, Exercise Experience and Confidence, Competence Variables

Variable	Knowledge Test	Confidence	Competence	ConfDiscrepancy	CompDiscrepancy
Demographic					
What is your age?	-.13	.19	.17	.24*	.23*
How many total years of graduate school did you attend?	.08	.17	.09	.12	.06
How many years have you been licensed? (Please round to the nearest half)	.07	-.06	.00	-.13	-.05
Attitude					
To what extent do you believe that exercise is relevant to psychological functioning?	.04	.23*	.26*	.18	.23*
To what extent do you believe it is appropriate for the topic of exercise to be discussed in clinical practice?	-.05	.17	.30**	.18	.29**
To what extent do you believe that exercise can be helpful in treating psychological issues?	.04	.32**	.33**	.26*	.27*
To what extent do you believe that exercise can be harmful in treating psychological issues?	.06	.04	.19	-.02	.14
To what extent do you believe that research supports exercise as an efficacious psychological intervention?	.28*	.31**	.33**	.10	.16

Table 8 (continued)

Correlations Between Demographic, Attitude, Practice Habit, Exercise Experience and Confidence, Competence Variables

Variable	Knowledge Test	Confidence	Competence	ConfDiscrepancy	CompDiscrepancy
Practice Habit					
How often do you screen your clients for the presence of physical health issues?	.02	.28*	.18	.23*	.14
How often do you ask clients about their exercise habits?	.07	.30**	.39***	.22	.30**
How often do you discuss exercise with your clients in the context of using it to increase their functioning / decrease their symptoms?	-.03	.35**	.48***	.31**	.43***
How often do you perform psychoeducation on how exercise can treat the biological mechanisms of psychological disorders?	.10	.47***	.50***	.34**	.40***
How often do you prescribe exercise for your clients to help increase their psychological functioning (i.e., set out specific recommendations, goals, etc.)?	.15	.51***	.55***	.36**	.43***
Exercise Experience					
In the last month, how often did you engage in periods of intentional exercise of at least 30 minutes?	.08	.27*	.24*	.22*	.19
Over the past year, how many workshops/trainings did you attend on exercise interventions or the integration of exercise into clinical practice?	.02	.14	.25*	.11	.21

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 9

Correlations of Dependent Variables

Variable	Knowledge Test	Confidence	Competence	ConfDiscrepancy	CompDiscrepancy
Knowledge Test	1.00	.11	.09	-.49***	-.40***
Confidence	.11	1.00	.69***	.79***	.59***
Competence	.09	.69***	1.00	.53***	.86***
ConfDiscrepancy	-.49***	.79***	.53***	1.00	.74***
CompDiscrapancy	-.40***	.59***	.86***	.74***	1.00

* $p < .05$. ** $p < .01$. *** $p < .001$.

There were insufficient data to assess any potential relationships between gender and all other variables due to a largely female sample (females $n = 74$; males $n = 9$) that invalidated the assumptions of a majority of statistical approaches. Categorical demographic variables (geographical region, practice setting, and history of undergraduate and graduate education) were analyzed for trends in test score only, due to the scope of this study. One-way ANOVA determined that there were no differences between geographical regions $F(3,78) = 2.48$, $p = .068$ or type of practice setting $F(3, 78) = 1.66$, $p = .183$ with regard to test score. Similarly, no significant differences in knowledge test performance were found when comparing participants who reported receiving exercise-specific education either in their undergraduate $t(80) = .83$, $p = .410$ or graduate education $t(80) = 1.20$, $p = .235$ to those who did not.

CHAPTER V

Discussion

The primary aim of the present study was to examine the longstanding research-practice gap regarding exercise psychology and its application within clinical work. To the author's knowledge, this is the first study to examine potential explanations for the longstanding gap within exercise psychology and the first to create and utilize a knowledge-based (as opposed to self-report) measure of competence in MHPs. Given that extant research on MHPs has only provided perplexing patterns of self-reported data, this study sought to examine the issue by exploring MHPs' level of exercise education and concrete knowledge of research trends, as they relate to perceived levels of competence. Broad study goals were to provide a data-informed understanding of perceived and actual competence levels, analyze potential factors contributing to the research-practice gap, and to describe exercise education of U.S. clinicians in order to inform future training in the usefulness of exercise as a treatment approach in therapy.

Several hypotheses were formulated based on the research of Burks and Keeley (1989) and Burton et al. (2010), who found that self-reported levels of confidence with exercise interventions was discrepant from self-reported levels of exercise education or specialization. As Burton et al. (2010) states, research examining the "actual" knowledge base of clinicians has been an area needing exploration in order to advance the field's use of exercise as a whole. As such, this study expanded on the existing research by attempting to reproduce and clarify previous findings with the addition of a concrete measure of exercise knowledge.

Preliminary Findings

Demographics. As a largely exploratory study, significant attention was paid to characterizing the sample in terms of beliefs, practice habits, and exposure to exercise in anticipation that multiple factors may play a role in MHPs utilization of exercise as an evidence-

based intervention. The sample represented a range of demographic variables with respect to age, years of graduate school, years licensed, and geographic region and lesser variation in identified gender and type of license. For nearly all demographic and practice variables, one category was endorsed as being clearly dominant over the others. For example, the majority of participants endorsed adults as their primary population, while expertise in children, families, and couples all received fewer endorsements but with nearly equal rates of reporting. As such, the most dominant demographic and practice categories emerged as: female, age 30-40, 2-4 years of graduate school, 0-5 years of licensure, marriage and family therapy license, West region, expertise in adults and therapy, and private office setting. It is possible that the current study's findings are slightly more representative of MHPs who fit these demographic categories, though the examination of any specific interactions was beyond the scope of this study.

Exercise experience. Participants' level of exercise experience (via education, specialized training, or through personal experience) was also of interest, given prior studies' reports that formal education in this area was low (Burks & Keeley, 1989; Burton et al., 2010). Current findings generally support established research. Approximately one third of participants reported having some exposure to exercise education in the course of their graduate training, while current findings yielded higher reports of exercise education in undergraduate education (approximately a third of the current sample as compared to approximately 10% of the prior studies' findings). The current sample endorsed comparable, yet slightly higher, rates of specialized training, with 22% of participants reporting that they had attended at least one training on exercise within the past year. Though these figures may be representative of increased exercise education since the last research was performed, it is also likely that that the

inherent bias of an interested, self-selected sample may report higher figures than the rest of the MHP population in general.

A similar caution is warranted in the interpretation of reported rates of personal exercise. Only 12% of the sample reported no physical activity within the past month and approximately half of the sample reported exercise levels that either approached or exceeded the AHA recommendations for maintaining health. These findings may be an accurate representation of the sample especially given participants' assumed interest in the topic. However, it is unlikely that these findings represent most other MHPs, considering the effect of desirability factors and that only 21% of adults in the general population meet AHA recommendations for aerobic exercise and muscle-strengthening activity (CDC, 2017). Previous research has demonstrated that higher levels of personal exercise predicted higher levels of integrating exercise into clinical practice (Burks & Keeley, 1989; Burton et al., 2010). As such, describing the current sample's reported exercise habits and relating them to measures of practice habits, factual knowledge, and perceived competence were viewed as central to the aims of this study.

Participants' sources of exercise information were also of interest to this study in order to better understand the nature and quality of MHPs knowledge when they have not received formal education. Given the wide availability and pop-culture nature of exercise as a topic (e.g., fast tricks, fad diets, and simple workout routines that claim to help individuals "lose weight" or "burn fat" quickly), participants were provided the option of identifying various non-research based sources of information. As surmised, nearly half of all responses regarding information source represented acquisition of knowledge from questionable sources (e.g., social media, various new media, magazine articles, or word of mouth). It is important to note that this item was administered following the research-based information on the knowledge test, which may

have actually yielded a decreased reporting rate due to desirability effects. As a method informing clinical practice in a health realm, this finding is viewed as concerning; its implications are discussed at greater length in subsequent sections.

Primary Findings

Confidence levels with exercise interventions. It was predicted that similar to previous studies, a high proportion of the sample would report confidence in utilizing exercise topics within clinical practice. The current findings support this hypothesis and confirm the reports of prior research that upwards of 75% of multiple samples identify with having "belief in oneself and one's power or abilities" in relation to discussing exercise with clients. Findings also validated another conclusion from Burton et al. (2010) by exhibiting a reduced level of endorsement for items describing increased specialty of interventions. For example, slightly more than three fourths of the sample reported asking clients about their exercise habits (the most general item), while half endorsed "prescribing" exercise to their clients (the most specialized item). This suggests that clinicians are comfortable using general exercise interventions, but that they grow increasingly less likely to use more specialized interventions perhaps because they have little formal education on the topic.

Replicating the findings of Burks and Keeley (1989) and Burton et al. (2010) was an overarching intention of this study to provide increased validation of the current study's methods, survey design, and new findings (given that results suggest *actual* knowledge levels are low). In addition, collecting ratings of confidence also served as a method for ruling out MHPs hesitancy as the primary factor perpetuating the research-practice gap. Burton, Pakenham, and Brown (2010) state that professional ethics may play a role in reducing the "likelihood of psychologists' providing activity advice or counseling if they were not confident of their competence to do so" (p. 295). However, with findings indicating repeatedly high confidence

ratings, this should be ruled out as a cause for lack of exercise integration and other explanations such as lack of appropriate education and training may be pursued.

Fact-based and perceived knowledge. It was predicted that factual knowledge of exercise psychology would be lower than perceived knowledge, given existing data that show a notable difference between measures of perceived ability and actual education. Prior studies have expressed perplexity at this discrepancy, suggesting that a more in-depth examination of factors is needed to better explain this relationship (a primary goal of the current study). Perhaps appropriately, the current findings provide evidence of a psychological effect that may begin to explain the complex relationship between confidence, competence, and formal education.

Specifically, significant differences were found between both confidence and competence ratings and test scores, wherein confidence and competence ratings were higher than participants' corresponding test scores with large and medium effect sizes (respectively). This finding confirms the assumed discrepancy between perceived and actual ability using two different definitions for perception of ability: confidence ("belief in oneself and one's power or abilities") and competence ("possession of required skill, knowledge, qualification, or capacity"). Not only does this finding replicate previous studies' measures, but it also validates the assumption that MHPs' perceptions of their own skill level are discrepant from a more concrete measure of their abilities.

As suggested by notable effect sizes of discrepancy, a very large portion of the sample—nearly 70% of participants—overestimated their competence as compared to their actual knowledge of scientific concepts and research trends. This is consistent with prior researchers' observations of MHPs' perceived ability levels, while it also appears to explain the disproportion between perceptions and reported education level on exercise topics. In sum, the current data

demonstrate that MHPs' *beliefs of ability* (confidence) and *possession of skill* (competence) about their utilization of exercise do not necessarily provide an accurate representation of their true skill level.

Given that participants performed poorly on the knowledge test, it is possible that one of the factors contributing to repetitively high measures of confidence is that clinicians are reporting on themselves more generally as interventionists, rather than their expertise with exercise interventions specifically. As previously stated, current findings suggest that lack of confidence may be discarded as an explanation for the ongoing gap in practice; future research should more closely examine factors related to perceived competence and whether there is a mediating or moderating relationship between these variables.

Low test scores and Dunning-Kruger Effect. It was predicted that fact-based competence (as measured by test score) would be low in general. It was also predicted that low *fact-based* competence taken together with higher levels of *perceived* competence within the sample would produce evidence of the Dunning-Kruger effect (phenomenon in which lower skill is correlated with higher perceptions of competence and higher skill is correlated with a more conservative perceptions of competence) (Kruger & Dunning, 1999).

Current findings confirmed this hypothesis and support the study's broad objective of examining potential factors contributing to the research-practice gap and describing exercise education of U.S. clinicians. First, analyses determined that actual competence (operationalized as test performance) was low indeed. Eighty-one percent of the sample earned grades equivalent to D's or F's on the test, answering at most 13 questions correctly out of 20. Qualitatively, 18 participants were not even able to answer half the questions correctly. A tenth of the sample earned C's, and only 6 participants were able to perform at a B grade level; zero participants

(even those who reported high levels of personal exercise or attending specialized trainings) achieved an A. To the author's knowledge, this measure is the first of its kind in the field and, assuming its increased construct validity over perception-based measures, it characterizes the exercise competence of MHPs as poor in general. As previously established, a complex relationship exists between the constructs of confidence, competence, and actual knowledge; this information indicates that the two constructs may be understood, at least within the specific topic of exercise and clinical practice, as being notably disparate amongst MHPs.

Of course, it is arguable that being an original creation of the author, the knowledge test does not have required validity for assessing knowledge in clinicians. Though all concepts were taken from broad themes in an entry-level text, more research is needed perhaps by administering the same 20 items to a group of students who have completed a course using the same text. If concerns regarding the measure's validity are demonstrated to be true, it is possible that MHPs have a higher level of knowledge than reflected here. However, an ethical obligation to practice within one's professional scope of competence suggests (by a standard method of evaluation) that these same participants (or more than three quarters of the sample) may not be utilizing specialized interventions as research dictates.

Indeed, analyses of self-appraisal discrepancies between passing and failing participants supported this sentiment. Findings showed that participants with failing test scores exhibited significantly higher discrepancies between perceived ability and actual ability, as opposed to participants with passing test scores. The effect sizes reporting on differences between the two groups were large (> .8), suggesting that even with changes in sample size and reporting trends, results would have to vary significantly to invalidate this finding. As such, current data confirm the hypothesis that the Dunning-Kruger phenomenon has played a role in the research-practice

gap observed within exercise interventions. Functionally speaking, the observation of this psychological effect suggests that "when people are unskilled in a domain (as everyone is in one domain or another), they lack the metacognitive skills necessary to realize it" (Kruger & Dunning, 2002). MHPs' high level of perceived ability combined with low factual awareness indicates that (as alluded to previously) clinicians are likely experiencing inflated perceptions of skill based on mere exposure to exercise, perhaps due to trends in popular culture. Though exercise science is a very complex field, it is plausible to assume that media portrayal of its utilization being quick, easy, or simple creates a false public impression of knowledge. This notion appears to be corroborated by the previous findings that demonstrate notable differences between formal education in exercise and confidence in utilizing it as an intervention.

For example, qualitative analysis revealed that one individual reported attending five exercise trainings in the past year, though the same participant only achieved a score of 11 out of 20 (55%) on the knowledge test while still rating competence at a nine, the highest rating that could be chosen. Though this study has several limitations, current findings provide a plausible explanation for an ongoing research-practice gap that continues to exist despite repetitive calls for exercise integration. Because the majority of clinicians have not received specialized training in exercise, the majority of practitioners with the power to change education requirements are unaware that there is an issue in the field.

Personal exercise, knowledge, and practice habits. It was predicted that increased personal exercise habits would be related to increased levels of exercise knowledge and frequency of using exercise within clinical practice, as observed by Burks and Keeley (1989) and Barton et al. (2010). Unlike previous findings, the current study did not confirm this hypothesis, finding no statistical difference between participants meeting AHA exercise guidelines and those

who did not in terms of test score or endorsement rates for utilizing exercise interventions. Of the hypotheses intended to reproduce the work of previous research, this was the only case wherein data did not support previous trends. This may be due to a number of factors, including methodological and geographical differences, sample characteristics (i.e., lack of gender variability in the current study), bias due to self-selection, self-report measures or desirability factors, or operationalization of constructs (e.g., using AHA guidelines of intentional exercise in the current study versus general inquiries regarding physical activity).

Furthermore, six rankings gauging exercise on the original survey were condensed into two groups for the statistical purposes, which may have reduced the sensitivity of the item and likely reduced the possibility of noting a graded relationship between variables. Conversely, exploratory analyses (detailed in subsequent sections) included comparisons between ordinal rankings of exercise frequency and test score and also yielded no significant differences between groups. In addition, self-selection of the sample (based on interest in exercise topics) may also account for comparable test scores and usage of exercise interventions amongst different levels of exercisers. Finally, the previously discussed desirability factor may have led to inflation of self-reported exercise frequency, skewing the sample towards increased exercise and possibly treating participants as AHA-exercisers erroneously. More research is needed with a larger, randomly-selected sample in order to clarify the role that personal exercise plays in utilization of knowledge and interventions, as well as the root cause of its influence.

Exploratory Findings

Psychologists' knowledge of exercise. It was predicted that psychologists, as compared to other MHPs, would exhibit greater research knowledge as measured by test score. Current findings partially support this hypothesis, demonstrating a statistically significant difference

between the test scores of psychologists and marriage and family therapists, but no significant differences between any other categories of MHP. That said, findings did show that psychologists had a mean test score that was qualitatively higher than all other types of MHP. It is possible that with a larger and more evenly distributed sample of MHPs, those differences could either become negligible or statistically significant.

The original hypothesis was largely postulated based on the fact that in most cases, psychologists receive more formal training in research methods and analysis than other MHPs. Given the previous finding that non-research based sources play a large role in shaping MHPs' knowledge of exercise, it is likely that psychologists are more insulated from this effect due to the extra training they receive in the areas of science and research.

On the other hand, the group sizes for each MHP were very small. Though psychologists' test scores were found to be significantly greater than MFTs using two different statistical approaches, it is very possible that with increased group sizes and a more representative sample of each MHP, other findings may emerge. Overall, further research is needed to examine license-specific factors and how they may or may not relate to clinicians' knowledge and utilization of exercise.

Posttest ratings of confidence and competence. It was predicted that by providing a reference point for exercise competence, exposure to the knowledge test material would decrease participants' self-appraisal of confidence and competence. That is, it was expected that both confidence and competence ratings would be greater at pretest than at posttest. Findings provided support for this hypothesis; ratings of both confidence and competence taken after the knowledge test showed a significant decrease from pretest ratings.

Reductions in both measures appear to be in alignment with the interpretations of all data thus far. It is feasible to expect reductions in self-perceived measures of skill following exposure to any unfamiliar material or a "test-like" situation, which was inadvertently created by the knowledge test. These scenarios are inarguably disconcerting and can reduce one's belief in their abilities especially when test material is not well within one's admitted specialization. Though this may be the cause of reduced confidence and competence scores following exposure to the exercise research, this trend also demonstrates the possibility that MHPs' self-appraisals of ability are not highly stable constructs. On the contrary, they appear to be very easily manipulated by exposure to information, which seems to support the notion that perceived ability could also increase after brief exposure to unreliable information sources (e.g., magazine articles, word of mouth, etc.). This may, in fact, offer an explanation for how MHPs' perceptions of exercise competence became much greater than their respective education and level of experience.

Taken together, it is believed that collective study findings provide a cohesive indicator that the lack of formalized education requirements on exercise is contributing to the Dunning-Kruger effect amongst clinicians. Further research should be conducted with a larger sample and a diverse collection of demographic, practice habit, and exercise variables in order to corroborate or expand upon these findings.

Education opportunities. Based on previous findings, clinicians believe exercise theory and interventions "should be taught to clinical psychologists" (Burks & Keeley, 1989) and nearly 75% of participants (Burton et al., 2010) report that they would be very likely to attend exercise-related trainings or workshops. As such, it was predicted that participants would report a greater preference for exercise-related educational opportunities than they perceived were available.

Current findings supported the hypothesis, wherein participants reported that they preferred exercise psychology trainings to be more readily available than they perceived them to be with a notably large difference (five point median difference) between items. This data appears to provide its own commentary on this study's aim to elucidate the need for educational programs for MHPs. Although a large body of exercise literature has continued to call for increased utilization for decades, MHPs continue to report that opportunities are lacking. Next steps within this domain should include work to increase: funding for exercise-related programs, quality and availability of continuing education, and efforts to ensure that exercise is made a requirement of graduate school curricula.

Participant variables and study variables. Although no further hypotheses were made regarding relationships between survey items, a number of two-variable exploratory analyses were performed in order to examine whether any significant relationships existed between demographic, belief, practice habit, and exposure to exercise variables and study variables (test score, pretest confidence and competence, ConfDiscrepancy and CompDiscrepancy). Due to the exploratory nature and number of analyses performed, it is possible that any of the significant findings were due to Type I error and they will not be discussed at length here. Following are brief discussions of select findings that appear to warrant further exploration.

Belief in supportive research and test score. Of note is the correlation between participants' endorsement of the belief that research supports exercise as an efficacious intervention and test score. Like many other items, belief in supportive research was also significantly correlated with perceived confidence and competence; however, it appears to exhibit more value than other items, being the only variable significantly correlated with test score. This relationship appears to support the broad goals of this study by suggesting that a

positive belief—specifically in exercise research—uniquely relates to a positive increase in test score. As such, it is arguable that of all clinical beliefs and practice habits examined here, awareness of exercise research positively impacts individuals' competence the most. This sentiment re-emphasizes previous discussion of what constitutes competence in MHPs'—specialized education that includes knowledge of current research trends on any given topic.

Aside from supporting the broad sentiments of the current study, the correlation between the belief that research supports exercise and actual test score suggests an indirect attestation of survey validity. That is, despite the knowledge test being an original and unvalidated survey, it appears to have some confirmed construct validity since other MHPs who endorsed a belief in research support also performed better on the knowledge test. Though the unvalidated survey presents a weakness of the study's design, this finding appears to provide some support for its internal validity. Much more research is needed, however, to truly speak to this study's survey as a tool providing use in the field.

Practice habits and perceptions of confidence, competence. Qualitatively speaking, a pattern emerged between three practice habit items (discussing exercise with clients in the context of increasing functioning/decreasing symptoms; performing psychoeducation on exercise treating biological mechanisms of disorders; and prescribing exercise to clients to increase functioning) and all confidence and competence variables (pretest confidence, pretest competence and ConfDiscrepancy, CompDiscrepancy). All correlations were significant, indicating that an endorsement of discussing exercise, providing psychoeducation, and prescribing exercise with greater frequency were related to greater estimates of ability as well as greater discrepancies with actual knowledge.

It is possible that an interpretation for this pattern may already exist in cognitive dissonance theory: if MHPs enact these behaviors within their routine practice with clients, it would create dissonance to then rate themselves as having lower levels of confidence and competence. This appears to be further explained by positive relationships with the discrepancy variables, which indeed support the notion that greater endorsement of these behaviors seems to be related to greater misjudgment of actual knowledge. Perhaps this also provides a feasible explanation for the discrepancies in previous studies' measures (between confidence and education): that MHPs do indeed perform these exercise-promoting behaviors in clinical work, which in turn produces higher reports of confidence due to cognitive dissonance rather than actual knowledge, experience, or education. Future explorations of this topic should explore this complex relationship in further depth to determine whether cognitive dissonance plays a role in clinical behaviors and personal perceptions.

Other variables. A few other significant relationships are worth comment. Personal exercise was weakly related to pretest confidence and pretest competence, but also to ConfDiscrepancy. Despite lack of support for the hypothesis that personal exercise would be related to greater *research knowledge*, these weak correlations provide support for other researchers' findings that level of personal exercise does relate to higher *confidence* ratings for utilizing exercise in clinical practice.

It is also worth noting that a demographic variable—age—was weakly related to the discrepancy variables. At least within this sample, older participants appear to have reduced ability to accurately perceive their own ability level with regard to exercise psychology. This may be a function of more traditional views on psychological intervention, or lack of up-to-date education in the area of exercise psychology, or it may be attributable to many other possible

explanations. While it is difficult to surmise the potential cause, this finding in the data presents a relationship that may warrant follow up in future research.

Discrepancy variables and test score. With regard to the purposes of this study, perhaps the most notable correlation emerged as a negative relationship between the discrepancy variables (ConfDiscrepancy, CompDiscrepancy) and test score. The finding of a negative correlation supports many of the other hypotheses of the study in that it provides further evidence of the Dunning-Kruger Effect. More specifically, the negative correlations indicate that as a sample, the better a participant performed on the knowledge test, the lower the discrepancy they exhibited with regard to estimates of their own skill level. The opposite, which upholds the broad purpose of the study, is also true: the lower an MHP's research-based knowledge of exercise psychology, the higher they ranked themselves on measures of ability. As discussed previously, this repetitive trend in the data appears to provide a salient explanation for the findings of previous researchers, who noted a difference between reports of confidence and actual exercise training.

Clinical Implications

Overall, study findings suggest that the Dunning-Kruger effect is a likely contributor of the ongoing research-practice gap in exercise psychology amongst MHPs. Together, the current and prior studies' findings collectively demonstrate high confidence and competence ratings, poor levels of training, education, and research-based skill, and a high interest in exercise-related education opportunities. This trend seems to paint a clear picture: MHPs believe in themselves and their ability to utilize interventions with their clients and they report integrating exercise interventions frequently. They have some awareness that their skill set and knowledge is lower than it should be given their competence ratings, yet the more competent they perceive

themselves to be, the less they are actually informed about research trends or scientific constructs in exercise psychology. The data also demonstrates that MHPs would appreciate the increased availability of educational programming in order to allow them to increase their competence. Unfortunately, because clinicians with less knowledge about exercise perceive themselves to be disproportionally more confident and competent in their abilities, it is possible that they may be placing themselves at risk for practicing outside their scope of competence. In order to protect clients while providing the best of care and the most comprehensive approach to improving their health, increasing the availability of educational programs on exercise interventions is urgently needed.

Limitations

Internal validity. This study has several limitations. There were some threats to internal validity, which were largely due to the exploratory nature of the study. While the general structure of the study emulates prior research by using a survey to gather data about MHPs, the survey was entirely original (though with conceptually similar items) and has no established validity or reliability as whole. However, measures of Cronbach's alpha attested to the internal consistency of survey subscales, including sets of questions measuring participants' beliefs, practice habits, and perceptions of ability. Two subcategories of the survey had poor internal consistency (knowledge test and opportunities for ongoing education), yet were expected to be low given the aims and hypotheses of the study. More specifically, poor internal consistency for these subscales actually contributes to the hypotheses of the study—that knowledge and education are not at standard or consistent levels throughout the MHP population. In addition, the survey does not claim to be measuring a sample with any specific, expected, or shared characteristics in terms of response style. Test concepts were synthesized from an entry-level

exercise psychology textbook and may be considered a consistent and reliable measure of exercise competence if administered to a clinician with formal education on exercise psychology. Furthermore, due to the exploratory nature of the study and the corresponding number of analyses conducted, Type I error was increased and may have yielded falsely positive results. More research is needed to determine whether the survey has construct validity with populations who claim to have a uniform understanding of exercise psychology concepts.

External validity. There are several factors that limit external validity as well. The author experienced a high level of difficulty gaining access to MHPs as a participant population, which made it challenging to attempt to describe and analyze practices of the field as a whole. The external validity of this study is challenged as a result and has a skewed sample that is overly representative of women, MFTs, and individuals with some personal interest in exercise. In the interest of transparency, education, and providing the highest quality of mental health treatment for clientele, it is recommended that MHPs do more to reduce difficulties in gathering data about our own practices.

Being an unfunded exploratory study, limitations to recruitment tactics and productivity yielded a relatively small, self-selected sample biased towards individuals who participate in state and national professional organizations and take special interest in exercise. As such, it is likely that the results misrepresent the target population (MHPs) by reflecting an increased level of exercise knowledge specific to individuals who are more involved in organizations, new opportunities, and perhaps continuing education. For the purposes of this study, however, the possibility of results being skewed toward greater interest and knowledge actually provide support for the study's hypotheses that knowledge of exercise theory and interventions is low in general and may be further skewed by inaccurate self-appraisal. The present findings that

indicate low levels of knowledge, formal education, and availability of continuing education opportunities suggest that population rates are even lower amongst MHPs who are not as interested in exercise or as active professionally.

Statistical analyses and specificity of findings were limited as a result of sample size as well. Adequate power for detecting differences between some variables was not present, and as such limited the scope and validity of findings. Given an increased sample size and comparable group numbers, between-subjects analyses to detect more complex patterns in the data may have yielded more specific and descriptive results. The difference between gender identities of this sample is a pertinent example of this; though the field of psychology is increasingly skewed toward the presence of women in general, the dramatic ratio of women to men in this sample makes it difficult to generalize these findings to men in the field.

***Generalizability*.** As a whole, the aforementioned issues with the sample size and selection provide a limiting factor to the study's external validity. Though there was moderate representation for nearly all categories of all variables, it is impossible to make generalizations about the whole population of MHPs given the narrow range of participants. All findings should be interpreted as belonging to a limited sample and viewed as concepts requiring ongoing exploration.

Though it was the author's intent to measure MHPs' competence using a more functional method (e.g., posing questions typical clients might ask regarding the theory and effects of exercise) a short test was only feasible method for measuring clinicians' competence given the resources available. The use of an electronic survey was somewhat undesirable and may not have captured the most accurate expression of MHPs' exercise knowledge, yet it utilized the most commonly employed form of assessment by administering a "graded" test. Ultimately, the ability

of the original survey to reproduce the findings of prior studies lends increased validity and generalizability as it is representation of other publicized research.

Strengths

Despite the limitations inherent in this study, there are several strengths as well. First, this study is the first of its kind in the following ways: it utilizes an objective measure of MHPs' competence in exercise psychology; and it offers an explanation for the longstanding research-practice gap in exercise psychology by uncovering the presence of a psychological phenomenon within the population of MHPs—the Dunning-Kruger effect. Second, this study extends the existing exercise literature by replicating general trends established by Burks and Keeley (1989) and Barton et al. (2010), and then examining the functional outcomes of these trends to determine how they relate to the broader body of exercise research. Third, this study attempts to explain a longstanding and seemingly complex issue within the field of exercise psychology literature, focusing on the functional application of the research rather than simply confirming a general trend of underutilization. Fourth, this study has reached new conclusions about a potentially alarming trend within the mental health community, which suggests that factors such as self-perceived competence and exercise education require a fresh and urgent approach—especially during graduate training.

Finally, and perhaps most importantly, this study contributes to the field as a whole by elucidating the complex nature between exercise research and its application to clinical practice. MHPs hold themselves to high standards of effective clinical care, ethical practice and competence, evidence-based interventions, and an integrated treatment approach. However, the current study's findings suggest that these standards are not being entirely upheld (at least within the domain of exercise psychology), and more needs to be done to remedy this problem. If this is

true with regard to the MHP population, there may be other subfields of psychology in which clinicians are practicing outside their perceived scope of competence. Further assessment of MHPs' knowledge and practice habits are urgently needed, and educational programming should be more responsive to these measures of skill and the need for bridging the research-practice gap.

Conclusions

The current study attempts to characterize a complex relationship between MHPs' competence and the theory and practice of exercise psychology. Consistent trends show a gap between science and practice that has heretofore remained unexplained. While the present findings have begun to characterize this relationship, further exploration is necessary to gain a full understanding of the underlying processes perpetuating a research-practice gap, as well as to elucidate the best methods for addressing it. As an exploratory study with aims to reproduce and expand upon prior findings, many potential variable relationships have yet to be examined. Based on the entirety of evidence presented here, including the efficacy of exercise as a treatment, the discrepancy between MHP's self-appraisals and actual knowledge, and data on education, there are many directions for future research to pursue.

Specifically, additional research should focus on the relationship between perceived and actual competence within broader samples of MHPs. A much larger, random sample should be recruited in order to control for issues of power and to increase complexity of statistical analyses that can be used to determine higher-order relationships between variables. Increased sample size and diversity will also provide a higher level of external validity. Regarding measurement, future research could validate the existing knowledge test and also capture in-vivo data on clinicians' approaches to using exercise interventions or answering questions with their clients. Increased understanding may also be gleaned from interviewing MHPs on their sentiments about exercise,

existing methods they use to employ interventions, and what (if any) explanations they can provide for the Dunning-Kruger effect observed here.

Based on the body of exercise research as a whole—including the few studies on its use in clinical practice and this study's conclusions—there is a strong argument to be made that exercise should be recommended and implemented on a much broader scale. Current steps that individual MHPs can take include the following:

- employing a healthy skepticism about their own knowledge with regard to exercise psychology and its corresponding research trends;
- committing to increased consumption of exercise literature and continuing education opportunities that focus on exercise psychology and its functional application within clinical settings
- and actively voicing the need for increased exercise education opportunities within leadership and professional organizations, formal education programs, and to local exercise experts.

MHPs specializing in exercise psychology should make conscious efforts to design and disseminate leaflets, handouts, and programs that will increase the research-based competence of clinicians as a whole.

On an organizational level, programs that are responsible for educating MHPs and granting professional degrees should make efforts to ensure the competence of their students by integrating exercise into their curricula in the following ways:

- incorporating relevant exercise research into standard courses such as abnormal psychology (e.g., exercise for schizophrenia), cognitive psychology (e.g., effects of

exercise on cognitive functioning), or intervention courses (e.g., functional application of exercise research in individual therapy sessions)

- creating opportunities for formal education by offering elective courses that focus on exercise and mental health
- hosting exercise psychology workshops for both students and local professionals to attend
- and facilitating student interest groups that focus on promoting personal and professional use of exercise.

While there are existing opportunities for education related to exercise psychology, they appear to be extremely limited. A Google search for "exercise psychology continuing education" yields limited resources, nearly all of which are designed for teaching fitness professionals about behavior change rather than for teaching MHPs about exercise. However, APA's Division 47 (Society for Sport, Exercise, and Performance Psychology) offers some resources via online materials, publications, and conferences. Overall however, these recommendations for MHPs to pursue their own education are of acute importance given that current findings suggest most clinicians have low levels of exercise education and are currently utilizing exercise outside their perceived scope of competence. This research-practice gap annotated by decades of research now appears to be a tangible problem with a feasible remedy.

It should be stated that the author is aware of the potentially controversial claims made within this study. It was not the intent of this study to offend or disparage any individual, group, or profession. Rather, the aims of the study, and its findings point towards improvement of the educational opportunities available to clinicians. Because exercise is such a broad and readily available topic laden with ideas often disseminated without research backing, it is essential to

delineate the difference between research-supported interventions by a trained and competent specialist from utilization of methods that are not grounded in evidence. As a group of health professionals who are bound by ethics and who are supportive of quality assurance measures, it is also in the best interest of clinicians to gain increased awareness of the research on exercise so as to ensure that they are practicing within their scope of competence and helping their clients achieve the highest level of functioning possible.

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APPENDIX A

Measure of Mental Health Professionals' Knowledge and Competence Survey

EXERCISE AND THE CLINICAL PRACTICE OF PSYCHOLOGY:

A SURVEY OF MENTAL HEALTH PROFESSIONALS'

ATTITUDES, HABITS, AND KNOWLEDGE

INSTRUCTIONS: Please complete *all* of the following items to the best of your ability. It is of utmost importance that you do not use supplemental sources to inform your responses.

INCLUSION CRITERIA

1. **Are you a currently licensed mental health professional practicing in the United States?**
    a. Yes
    b. No
2. **Is your primary language English OR are you able to conduct job responsibilities in English with proficiency?**
    a. Yes
    b. No

DEMOGRAPHICS

3. **Which of the following describes your license?**
    a. Licensed Clinical Social Worker
    b. Licensed Marriage and Family Therapist
    c. Licensed Psychologist
    d. Other

4. **What is your age?**
    Free Response, integers

5. **How do you identify your gender?**
    a. Male
    b. Female
    c. Other

6. **How many total years of graduate school did you attend?**
    Free response, integers

7. **How many years have you been licensed? (Please round to the nearest whole number)**
    Free response, integers

8. **What are your primary areas of expertise or interest? (Choose 1 or 2 from each category)**
    a. Children & Adolescents / Adults / Families / Couples
    b. Therapy / Consultation & Advocacy / Research / Public Policy /Assessment

9. **In what setting do you perform most of your work?**
    a. Community Clinic
    b. Private clinic/office
    c. Medical setting
    d. On site (homes, schools, etc.)
    e. Corporation
    f. Academic setting

ATTITUDES TOWARD USE OF EXERCISE IN CLINICAL PRACTICE

Please answer the following based on your own personal opinion.

10. **To what extent do you believe that exercise is relevant to psychological functioning?**

1	2	3	4	5	6	7	8	9
Not at All				Sometimes/ Neutral				Very Much

11. **To what extent do you believe it is appropriate for the topic of exercise to be discussed in clinical practice?**

1	2	3	4	5	6	7	8	9
Not at All				Sometimes/ Neutral				Very Much

12. **To what extent do you believe that exercise can be *helpful* in treating psychological issues?**

1	2	3	4	5	6	7	8	9
Not at All				Sometimes/ Neutral				Very Much

13. **To what extent do you believe that exercise can be *harmful* in treating psychological issues?**

1	2	3	4	5	6	7	8	9
Not at All				Sometimes/ Neutral				Very Much

14. **To what extent do you believe that research supports exercise as an efficacious psychological intervention?**

1	2	3	4	5	6	7	8	9
Not at All				Sometimes/ Neutral				Very Much

HABITS IN CLINICAL PRACTICE

15. **Do you provide direct services to clients?**
    a. Yes
    b. No

(If response is "No," participant will be instructed to skip/directed past questions 16-20, which require direct client contact)

16. **How often do you screen your clients for the presence of physical health issues?**

1	2	3	4	5	6	7	8	9
Never				Half the time				Always

17. **How often do you ask clients about their exercise habits?**

1	2	3	4	5	6	7	8	9
Never				Half the time				Always

18. **How often do you discuss exercise with your clients in the context of using it to increase their functioning / decrease their symptoms?**

1	2	3	4	5	6	7	8	9
Never				Half the time				Always

19. **How often do you perform psychoeducation on how exercise can treat the biological mechanisms of psychological disorders?**

1 2 3 4 5 6 7 8 9

Never Half the time Always

20. **How often do you *prescribe* exercise for your clients to help increase their psychological functioning (i.e., set out specific recommendations, goals, etc.)?**

1 2 3 4 5 6 7 8 9

Never Half the time Always

PERCEIVED COMPETENCE

Please reference the respective definitions for clarity of items 21-22:

***Confidence* is defined as "belief in oneself and one's powers or abilities."**

21. How *confident* do you feel about discussing exercise with your clients as a method for increasing their functioning?

1 2 3 4 5 6 7 8 9

Not at all confident Somewhat confident Very confident

(new page/screen)

***Competence* is defined as "possession of required skill, knowledge, qualification, or capacity."**

22. How *competent* do you perceive yourself to be at integrating exercise into your clients' treatment?

1 2 3 4 5 6 7 8 9

Not at all competent Somewhat competent Very competent

EVALUATION OF KNOWLEDGE

Please complete the following knowledge questions to the best of your ability, without referencing any supplemental sources of information.

23. All of the following are commonly recognized psychological hypotheses for why exercise has a positive impact on mood, EXCEPT:
    a. The Distraction Hypothesis
    b. The Cognitive Appraisal Hypothesis
    c. The Balance Hypothesis
    d. The Self-Esteem/Mastery Hypothesis

24. A comprehensive model explaining the effects of exercise on psychological functioning has been established by integrating neurobiological, psychosocial/mood, and physiological research findings.
    a. True
    b. False

25. *Allostatic load* is a term relevant to exercise psychology because:
    a. It describes the amount of weight one should lift when beginning to exercise for the first time
    b. It describes cognitive demands placed on the brain during exercise
    c. It describes a state of chronic stress that can be mediated by exercise
    d. It describes the social pressure placed on an individual to look healthy

26. Which of the following is a repetitive finding among studies examining exercise-related brain changes?
    a. Notable growth in the hippocampus
    b. Notable enlargement of gyri in the motor cortex
    c. Notable increases in striation of the cerebellum
    d. Notable reduction of density and tension of the dura mater

27. In studies that have examined the cognitive and academic performance of children, experimental groups were often removed from academic instruction in order to engage in physical activity, while control groups remained in the classroom undergoing academic instruction. According to findings, children who spent time performing physical activity instead of receiving instruction:
    a. Showed decreased academic performance compared to control groups
    b. Showed increased academic performance compared to control groups
    c. Showed no significant difference in academic performance compared to control groups
    d. Displayed scattered profiles so that a comparison with control groups was not able to be established

28. Meta-analyses on the cognitive benefits of exercise demonstrate which of the following:
    a. Increases in executive functioning
    b. Increases in attention and processing speed
    c. Increases in memory and working memory
    d. All of the above
    e. None of the above

29. What is the primary difference between *aerobic* and *anaerobic* exercise?
    a. *Aerobic* exercise involves resistance training while *anaerobic* exercise involves cardiovascular training
    b. *Aerobic* exercise involves cardiovascular training while *anaerobic* exercise involves both cardiovascular and resistance training
    c. *Aerobic* exercise and *anaerobic* exercise are two different names for the same thing
    d. *Aerobic* exercise involves cardiovascular training while *anaerobic* exercise involves resistance training

30. What are the current recommendations for the amount physical activity necessary to maintain health?
    a. 300 minutes of moderate physical activity per week
    b. 150 minutes of moderate physical activity per week, combined with moderate to high-intensity muscle-strengthening activity
    c. 150 minutes of high-intensity physical activity per week, combined with a stretching component
    d. 15 minutes per day of mild physical activity, such as walking

31. In general, research demonstrates what type of relationship between exercise and mortality (death) / morbidity (disease)?
    a. Habitual exercise reduces mortality/morbidity rates, but a proportional relationship has not been established
    b. Amount of habitual exercise is proportionally related to rates of mortality/morbidity
    c. Habitual exercise has been shown to reduce morbidity, but not mortality
    d. A relationship between habitual exercise and mortality/morbidity has not yet been established

32. What is the relationship between race/ethnicity and sedentary lifestyle (chronic inactivity) in the U.S.?
    a. African American/Black populations show the lowest rate of sedentary lifestyle
    b. African American/Black and Hispanic populations show the highest rate of sedentary lifestyle
    c. Caucasian/white populations show the highest rate of sedentary lifestyle
    d. All races/ethnicities show rates of sedentary lifestyle that are about the same

33. What is the relationship between education level and physical activity in the U.S.?
    a. Lower levels of education are associated with greater levels of physical activity
    b. Level of physical activity is low for individuals who only completed grade school, but any education beyond that shows similarly high levels of physical activity
    c. There is a positive correlation between amount of education and amount of physical activity
    d. Data do not show a correlation between education and level of physical activity

34. Studies examining long-term outcomes of exercise interventions for Major Depressive Disorder show significantly reduced relapse rates for which type of experimental group?
    a. Pharmacological treatment only (no exercise)
    b. Exercise treatment only (no medication)
    c. Groups treated with both pharmacological *and* exercise interventions
    d. All of these types of groups demonstrated about the same rate of relapse

35. Based on the research, exercise should *never* be used as an intervention for patients/clients with eating disorders because of the damage it can do.
    a. True
    b. False

36. With regard to exercise as a treatment for anxiety, which of the following are true?
        I. Exercise is a beneficial treatment, but it is significantly less effective than medication in terms of improvement of symptoms
        II. In addition to altering *state* anxiety, long-term exercise is able to alter *trait* anxiety
        III. There is a proportional, dose-response relationship between increased exercise and decreased anxiety
    a. I only
    b. I and II only
    c. II and III only
    d. I, II, and III

37. Empirical evidence demonstrates a relationship between self-concept and exercise wherein:
    a. Exercise increases self-concept for obese or overweight people only
    b. Exercise increases *self-esteem* in virtually all populations but not self-concept
    c. A dose-response relationship has been established where increases in exercise yield proportional increases in self-concept
    d. A dose-response relationship has *not* been established, but exercise has been shown to increase self-concept in virtually all populations

38. Exercise intervention appears to hold specific potential for schizophrenic populations due to its direct effect on_____. However, using exercise with this population also poses notable difficulty due to issues with _____.
    a. psychosis; adherence
    b. weight gain; adherence
    c. weight gain; medication interaction
    d. psychosis; medication interaction

39. An inverse dose-response relationship exists between frequency of physical activity and prevalence of _____, wherein greater levels of physical activity correspond directly to reduced symptomology.
    a. Bipolar Disorder
    b. Major Depressive Disorder
    c. Dysthymic Disorder
    d. All of the above

40. The HPA (hypothalamic-pituitary-adrenocortical) axis releases cortisol, which plays a major role in regulating many *biological* processes in the body. Is it true or false that this biological pathway is primarily activated by psychological constructs?
    a. True
    b. False

41. Research on the relationship between fitness level and physiological stress response (e.g., increased heart rate, blood pressure, cortisol levels, etc.) consistently demonstrates that:
    a. More highly fit individuals exhibit *lower* physiological stress responses than less fit individuals, even to social and environmental stressors
    b. More highly fit individuals exhibit *lower* physiological stress responses than less fit individuals, but only in response to exercise stressors
    c. More highly fit individuals exhibit *greater* physiological stress responses than less fit individuals because they are more primed for fight/flight
    d. Studies have not shown a significant difference in stress responses between highly fit and less fit individuals

42. What is the relationship between exercise and biological markers of stress?
    a. Acutely, exercise increases stress but long-term it reduces stress
    b. Acutely, exercise reduces stress but long-term it increases stress
    c. Exercise increases stress acutely and long-term
    d. Exercise reduces stress acutely and long-term

PERCEIVED COMPETENCE

43. How well did you know the material on the knowledge evaluation?

1	2	3	4	5	6	7	8	9
Guessed on most items				Knew some/ guessed some				Knew most items

Please reference the respective definitions for clarity of items 44-45.

***Confidence* is defined as "belief in oneself and one's powers or abilities."**

44. How *confident* do you feel about discussing exercise with your clients as a method for increasing their functioning?

1	2	3	4	5	6	7	8	9
Not at all confident				Somewhat confident				Very confident

(new page/screen)

***Competence* is defined as "possession of required skill, knowledge, qualification, or capacity."**

45. How *competent* do you perceive yourself to be at integrating exercise into your clients' treatment?

1	2	3	4	5	6	7	8	9
Not at all competent				Somewhat competent				Very competent

AMOUNT OF SPECIALIZED EDUCATION ON EXERCISE INTERVENTIONS

46. **Which sources have most directly informed your existing knowledge of *general* information related to exercise? (choose 1 or 2)**
    a. Research / peer-reviewed journals
    b. Social media / non-research websites
    c. Magazine articles / commentary
    d. News media
    e. Word of mouth / friends and family
    f. Fitness professionals

47. **What types of specialized training have you received on exercise?**
    a. Formal education, graduate or undergraduate
    b. Conferences, seminars, or workshops
    c. Self-education through reading books and research
    d. Advice/direction from fitness or other qualified professionals
    e. None

    Enter specifics if you wish: *(Free response)*

48. **Over the past year, how many workshops/trainings did you attend on exercise interventions or the integration of exercise into clinical practice?**
    Free response, integers

49. **Did you receive training on the topic of exercise in your *undergraduate* studies?**
    a. Yes
    b. No

50. **Did you receive training on the topic of exercise in your *graduate* studies?**
    a. Yes
    b. No

51. **In the last month, how often did you engage in periods of intentional exercise of at least 30 minutes?**
    a. I did not exercise / meet this criteria in the past month
    b. 1-2 times per month
    c. 3-6 times per month
    d. At least 2 times per week on average
    e. At least 3 times per week on average
    f. More than 3 times per week on average

OPPORTUNITIES FOR ONGOING EDUCATION

52. **Within the field of psychology, how available do you *perceive* exercise-related educational opportunities to be?**

1 2 3 4 5 6 7 8 9

Rarely Somewhat Readily

53. **Within the field of psychology, how available would you *like* exercise-related educational opportunities to be?**

1 2 3 4 5 6 7 8 9

Rarely Somewhat Readily

Any additional comments: (*free response)*

End of survey. Thank you for your participation.