Mindfulness-Based Interventions Improve Immune System Response and Psychological Factors: A Program for Incarcerated Youth

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Abstract

Mindfulness-Based Interventions (MBIs) have been studied extensively in their ability to ameliorate a multitude of disorders. The current literature explores various aspects of mindfulness-based training's effects on the immune system, which is an essential component to health and vitality. Furthermore, the field of healthcare is evolving to embody a more holistic and integrative system and within this frame, it is arguably the most effective route to evaluate a person as an unabridged unit. In the present theoretically-designed intervention, incarcerated adolescents represent an appropriate population for an MBI program due to their high levels of baseline stress. The literature supporting such an intervention program is extremely important, as it aims to demonstrate the directional relationship between mindfulness-based training and enhanced immune responses, as well as increased self/emotional-regulation and decreased impulsivity. The purpose of this Clinical Research Project was to provide a theoretical treatment program for incarcerated youth utilizing MBIs per their beneficial effects on immune functioning and various psychological factors.

Keywords: mindfulness-based interventions, immune system, cortisol, SIgA, incarcerated youth, impulsivity, emotion-regulation

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Introduction

The immune system is typically understood as a defensive configuration protecting an organism's body from malevolent invaders. It is an extremely complex system that aids many different functions of the body. Invaders are broken into categories varying from seemingly innocuous substances to sinister illness-causing viruses. An *antigen* is anything that causes an immune response; it can be relatively harmless such as grass or pollen, or harmful like the influenza virus. A *pathogen* is essentially a disease-causing antigen, such as viruses and parasites; simplistically, the immune system is designed to protect the body from pathogens.

There are several types of mindfulness-based interventions (MBIs) that have been developed in order to target various illnesses and/or populations of individuals. Jon Kabat-Zinn established Mindfulness-Based Stress Reduction (MBSR) in the year 1990 at the University of Massachusetts Medical Center (Kabat-Zinn, 1990). He has described mindfulness as a Buddhist-derived practice that emphasizes an intentional and nonjudgmental awareness of the present moment (1990). Mindful awareness originated in the earliest Buddhist documents, but is not religious or spiritual in nature (Grossman, Niemann, Schmidt, & Wallach, 2004). Typically, MBSR and other MBIs begin by teaching the participant to focus on their breath, bringing conscious awareness to the current time. Mindfulness brings one to nonjudgmentally and unevaluatively observe their thoughts and emotions as they arise and to passively let them flow onwards. These types of meditation practices have gained increasing traction with regard to treatment techniques beyond cognitive and emotional problems; MBIs are becoming readily recognized as therapeutic practices for physiological conditions as well.

Understanding the intricate mind-body relationship has been actively researched, as many assert that the mind has the ability to modify the body (Bedford, 2012). Thus far, researchers have sought to investigate the effects that mindfulness meditation has on the immune system, though in only very specific domains such as prostate and breast cancer patients. It is therefore critical that these effects be studied in broader populations to better understand the mind-body relationship and for generalizing the effects of MBSR on the immune system.

The field of healthcare is evolving to embody a more holistic and integrative system. This perspective emphasizes the interconnectedness of the human mind and body, which serves to present an Aristotelian perspective of holism in which the total is greater, or different depending on whom you ask, than the sum of its parts. Within this frame, it is arguably the most effective route to evaluate a person as an unabridged unit, as opposed to addressing each part of him as if each ailment is a mutually exclusive event.

Within the state of Hawai‘i, minimal research has been performed so as to further understand/investigate the relationship between mindfulness-based interventions and the immune system. This is likely due, in part, to the cumbersome and not easily accessible nature of psycho-neuro-immunology research. As immune functioning is a critical aspect of total-body wellness, furthering the understanding of techniques and interventions that serve to bolster such functioning is vitally important.

Stress, understood as “a state of mental or emotional strain or tension resulting from adverse or demanding circumstances,” (Oxford University Press, 2018, p.1106) affects close to all individuals across age groups. The deleterious effects of stress on mental and physiological health has become readily accepted information. Specifically, stress negatively impacts the immune system; organisms that suffer an acute degree of stress, consequently experience

immunosuppression or the suppression of humoral (immune) responses (Cohen, Miller, Rabin, 2001).

Incarcerated youth experience a heightened degree of stress for a multitude of reasons. These individuals face a lack freedom and autonomy, psychosocial stressors, and a limited access to nutritional foods and physical fitness. Youth in the corrections system experience global stress/stressors that can potentially overwhelm and exhaust their mental and physical resources (Le & Proulx, 2015). Furthermore, the developmentally-acquired ability for individuals to develop an objective awareness of one's own internal experience has been shown to be negatively impacted under circumstances of heightened stress (Kegan, 1982; Shapiro, Carlson, Astin, & Freedman, 2005; Le & Proulx, 2015). This is due to continued degradation of the prefrontal cortex areas, which are involved in executive functioning and improved decision making.

Mindfulness therefore corresponds with the aforementioned developmental competency by constructing and reinforcing troubled youth's capability to recognize and manage problematic thought patterns and behaviors through decoupling stimuli (thoughts, emotions) with self. Thus, incarcerated youth represent an appropriate population to receive a mindfulness-based intervention program that addresses different biomarkers (cortisol and SIgA) and various psychological factors (self-perceived stress, emotion regulation, etc.)

Purpose of the Study

The purpose of this study was to provide a theoretical treatment program for incarcerated youth utilizing MBIs per their beneficial effects on immune functioning and various

psychological factors. These individuals experience a significant amount of stress daily, which consequently affects their mental health via impulsivity and problems with self-regulation (Barnert, Himelstein, Herbert, Garcia-Romeu, Chamberlain, 2014). Per the extant literature (Le & Proulx, 2014), participants' immune, cortisol, and emotional responses were evaluated, as their stressful lifestyle, i.e. cortisol inducing lifestyle, had likely negatively affected their immune functioning. The participants were assessed for self-reported self-regulation, impulsivity, as well as perceived stress and biomarkers of stress preintervention and postintervention.

The findings of said study indicated that participants' immune functioning, impulsivity, and self-regulation had improved. Therefore, this study's intervention program is extremely important due to its goals of perpetuating the beneficial effects of MBIs on a vulnerable population, as it is empirically supported that incarcerated youth experience poor emotional, psychological, and physiological health.

Humans experience some degree of stress throughout their lives, which puts us at risk for developing illness. Previously performed studies have sought to delineate this relationship due to the copious amount of research highlighting the mal-effects of stress on emotions, cognitive functioning, and the immune system. It is becoming increasingly more understood that illness such as the flu or common cold, for instance, can closely mimic and even cause depression-like symptoms by activating the body's immune response (Hall & Smith, 1996; Smith, Thomas, Kent, & Nicholson, 1999; Capuron, Lamarque, Dantzer, & Goodall, 1999). These such symptoms include fever, fatigue, depressed mood, lack of appetite, lack of motivation, social withdrawal, poor concentration, and altered sleep patterns (Raison, Capuron, & Miller, 2006). By continuing to establish the relationship between MBIs and the immune system, future

practitioners will refine treatment techniques that's proven effectiveness can be integrated into all populations of people in order to address the interactions of mind and body. The present study has worked within the biopsychosocial and cognitive-behavioral frameworks due to the program's ability to simultaneously address biological, psychological, and social health factors and perceptual/cognitive and behavioral means of processing said factors.

Review of Literature

Mindfulness-Based Interventions

Several types of mindfulness-based interventions (MBIs) target various illnesses and/or populations of individuals. Shonin, Van Gordon and Griffiths (2013) compiled a lengthy list of MBIs that include: Mindfulness-based stress reduction for various illnesses such as anxiety disorders, heart disease, chronic pain, cancer, and psoriasis, Mindfulness-based eating awareness therapy to treat binge-eating disorders, Mindfulness-based childbirth and parenting for maternal well-being during and post pregnancy, and Mindfulness-based mental fitness training for stress and trauma resilience for military personnel. Additionally, other mindfulness techniques have been integrated into a series of "one-to-one" cognitive-behavioral techniques such Dialectical Behavior Therapy (Linehan, 1993) and Acceptance and Commitment Therapy (Hayes, Strosahl & Wilson, 1999).

Mindfulness-Based Cognitive Therapy (MBCT) is a common treatment technique that is group-based, delivered over an 8-week period, has weekly meetings, incorporates guided mindfulness exercises, includes a CD for self-practice and encourages an all-day retreat (Shonin et al., 2013). The National Institute for Health and Clinical Excellence (2009), as well as the

American Psychiatric Association (2010), advocate MBCT for the treatment of specific depressive disorders.

Mindfulness-Based Stress Reduction

Jon Kabat-Zinn established Mindfulness-Based Stress Reduction (MBSR) in the year 1990 at the University of Massachusetts Medical Center (Kabat-Zinn, 1990). He has described mindfulness as a Buddhist-derived practice that emphasizes an intentional and nonjudgmental awareness of the present moment (Kabat-Zinn, 1990). Mindful awareness originated in the earliest Buddhist documents, but is not religious or spiritual in nature (Grossman, Niemann, Schmidt, & Wallach, 2004). This practice includes "continuous, immediate awareness of physical sensations, perceptions, affective states, thoughts, and imagery" (Grossman et al., 2004). Typically, MBSR and other MBIs begin by teaching the participants to focus on their breath, bringing conscious awareness to the current time. Mindfulness brings one to nonjudgmentally and unevaluatively observe his/her thoughts and emotions as they arise and to passively let them flow onwards.

Grossman, Niemann, Schmidt and Walach (2004) argued for six assumptions that can be made following this concept and approach: (1) Humans are ordinarily largely unaware of their moment-to-moment experience, often operating in an "automatic pilot" mode; (2) we are capable of developing the ability to sustain attention to mental content; (3) development of this ability is gradual, progressive and requires regular practice; (4) moment-to-moment awareness of experience will provide a richer and more vital sense of life, inasmuch as experience becomes more vivid and active mindful participation replaces unconscious reactiveness; (5) such persistent, nonevaluative observation of mental content will gradually give rise to greater verticality of perceptions; and (6) because more accurate perception of one's own mental

responses to external and internal stimuli is achieved, additional gathered information will enhance effective action in the world, and lead to a greater sense of control.

Kabat-Zinn's MBSR is a group-based program consisting of weekly meetings, roughly three hours long, that is typically delivered over an 8-week period (Shonin et al., 2013). Group sizes vary between 10 to 40 participants. Each of the sessions covers specific exercises and topics that are explored through the mindfulness lens. Such exercises include mindfulness meditation practice, mindful awareness during yoga postures, and mindfulness during stressful situations. Additionally, mindful awareness as a skill is considered a muscle that strengthens with consistent use, thus participants are expected to carry out daily 45-minute homework assignments that include meditations practice, mindful yoga and applying mindfulness to situations in everyday life. Healthy individuals who have strived to improve their coping strategies when facing the stressors of daily life, as well as those that suffer from a myriad of illnesses have utilized this practice. It is estimated that there are over 240 MBSR programs across North America (Carlson, Speca, Patel, & Goodey, 2003).

Grossman, Niemann, Schmidt and Walach (2004) conducted a meta-analysis to examine 64 empirical studies that investigated the health effects of MBSR. They found that preliminary reports have suggested that MBSR has benefitted individuals suffering from chronic pain, fibromyalgia, cancer, anxiety disorders, depression and various stressors. The researchers found a strong level of effect sizes across samples suggesting that MBSR is a useful intervention for a broad range of chronic disorders and problems.

MBSR and Yoga

A critical component of the MBSR program is hatha yoga, which focuses on the return to the body's natural self-regulation. Hatha yoga, however, is not a western practice; it is a culturally appropriated practice which has been reinterpreted by an agenda-driven Western mindset. Kundalini yoga's Eastern heritage has been maintained through its development and is the focus of the following sections.

While yoga has been known to effectively address a multitude of problems, paradoxically, the goal of Kundalini yoga is not to reduce pain or achieve any particular health benefit. Rather, it is essentially a practice that reconnects one with the natural flow of energy; the health benefits are happy byproducts but not the intent of the practice. The root understanding of this practice is such that to strive for a particular outcome would not be mindful, thus it would be counterproductive to the practice. In simpler terms, agenda corrupts the wisdom of energy to do what it does.

The Source

The Vedas, ancient texts found in the Indian subcontinent, include Sanskrit literature, as well as the earliest Hindu scriptures (Sarvepalli, 1957). Historians estimate that such texts came into existence between 1700-1100 BC (Johnston & Bauman, 2014). Within the Vedas, there are the Tantras, Upanishads, and Pranas, which are sacred writings pertaining to science and knowledge. According to Vedic scholar, B. B. Paliwal (2006), the Vedas discuss "astrology, music, mathematics, science, religion, medicine, astronomy, cosmogony" (p.13).

Kundalini Yoga and theory are predominantly discussed in the Tantras, thus making it Tantric yoga (Scott, 2006). Generally, when one ponders *tantric* practices, sexuality comes to mind, as the history of tantric practices have been traced to the Indus Valley, where the male principle (lingam or phallus) and female principle (yoni or vulva) have been discovered

(Worthington, 1982). Worthington, a yoga historian (1982), described *tantra* "philosophically as existential. Emotionally it marked the return of the mother goddess into the religious life of India" (p. 83).

> The tantras are not accessible to traditional methods of rationalization. They deal with life as it is lived, and as life can be lived….By accepting the centrality of emotion tantra teaches the art of living. The sadhaka…embraces maya and does not reject it….The tantric formula is that yoga (discipline), and bhoga (enjoyment) can be and are the same, but it takes a vira (hero) to confront and assimilate both. Tantra dispels illusion. (p. 90)

Similarly, *Kundalini* is derived from the term *kundala,* which means "coiled up," and *sak,* meaning *having power, being able* (Jung, 1996). Additionally, yogi scholar, R. Venugopalan (2001) stated that *Kundalini* is also related to the Sanskrit word *kund*, which means "pit." He explained that the specific imagery used to symbolize Kundalini is that of a serpent. The snake is said to represent dormant energy and is located in the small triangular bone cavity of the sacrum, coiled three-and-a-half times (p. 13).

According to Eliade (1985), tantric theory, human nature is comprised of a fixed number of *nadis,* or conduits, such as blood vessels, nerves, and chakras. *Chakra*, which means "circles" is typically translated as "centers." The theory also emphasizes breath, as it is considered the vital energy that circulates through the nadis. Simultaneously, cosmic energy resides in the latent state in the chakras (p. 3). Kundalini yoga encompasses engaging in breath and *asanas,* or body movements/postures, in order to awaken the aforementioned serpent, resting at the base of the spine around the first chakra (Judith, 2004). Judith (2004) explains that, according to the Hindu mythology, as the serpent, whom is considered a goddess, awakens, she rises up through

the body, penetrating and opening the chakras. The serpent goddess' movement through the chakras "can be intense and painful, mentally, emotionally, and physically (Judith, 2004, p. 451; Gupta, 2015).

Yoga Comes to the West

Yogi Bhajan, master of Kundalini yoga, Hatha yoga, and White Tantric yoga, left India for the West in the year 1968 (Shannahoff-Khalsa, 2004). His aim was to instruct individuals whom were interested in exploring "altered states of consciousness without drugs, and to help implement novel treatment modalities for health care and the enhancement of life" (p. 91). Bhajan (1997) had since imparted close to 5000 different mediation techniques, of which many have been known to be specific for psychiatric disorders.

Shannahoff-Khalsa (2004) was trained in a particular Kundalini breathing method, which has been known to address obsessive-compulsive disorder (OCD). He formulated a series of texts that were published in the year 2001, whereby Kundalini yoga and meditation were posited to treat "anxiety, fatigue, stimulating the immune system for treating solid tumors, expanding and integrating the mind, developing a comprehensive, comparative and intuitive mind, and one for regenerating the central nervous system" (Shannahoff-Khalsa, 1991, p. 126). In his 2004 publication, Shannahoff-Khalsa addressed his specific treatment procedures for OCD, detailing four techniques, which addressed breathing, posturing and consequent effects. He continued on to introduce Kundalini yoga's beneficial impacts on several other psychological problems. The author addresses addiction disorders, depression, grief, learning disorders, phobias, and sleeping disorders. Lastly, in the conclusion section, Shannahoff-Khalsa briefly mentions that he has also been trained in various Kundalini yoga meditation techniques for the following disorders and conditions: abused children, adolescents, and adults; anger (chronic, "deep long-lasting variety");

bipolar disorders (one to resolve the condition in general); chronic fatigue syndrome; impulsive behaviors; Attention-Deficit Disorder; multiple complex personalities; mental illness in general; and nightmares (p. 100).

Immune System

The immune system is an extremely complex system that aids many different functions of the body. Most individuals understand the basic components of this expansive system, though further clarification and introductions are necessary in order to properly understand the effects of MBSR. Janeway, Travers, Walport, and Schlomchik (2001) wrote an elaborate book that details all of the many components of the immune system. The following explanations will be directly credited to these authors' writings. An *antigen* is anything that causes an immune response; it can be relatively harmless such as grass or pollen, or harmful like the influenza virus. Immediately following, a *pathogen* is essentially a disease-causing antigen, such as viruses and parasites. Simplistically speaking, the immune system is designed to protect the body from pathogens.

During fetal development, the immune system begins with blood-making or *hematopoietic* stem cells. These stem cells differentiate into the many diverse cells that make up the immune system. Interestingly, some hematopoietic cells develop into *erythrocytes* or red blood cells that are not involved in the immune system at all. A basic break down of the cells making up the immune system follows: *Leukocytes*, or white blood cells, seek out and destroy disease-causing organisms or substances found in the body. These cells are stored in the lymphoid organs, the thymus, spleen and bone marrow. Additionally, the leukocytes are stored in fatty clumps of lymphoid tissue throughout the body in the lymph nodes. These can be found near the neck, under the arms, and groin region.

There are two types of leukocytes: *phagocytes* and *lymphocytes*. Phagocytes are cells that grind up antigens or pathogens. Lymphocytes are cells that allow the body to recognize and remember previous invaders, thus allowing the immune system to detect and destroy the same invaders in the future. The chicken pox virus demonstrates this; children will typically get it only once and never catch it again.

Phagocytes and lymphocytes can be broken down further. *Neutrophil* is the most commonly identified phagocyte. Its primary job is to fight bacteria and actively devour invasive organisms. If doctors suspect that a patient has a bacterial infection, they will test their blood for high levels of neutrophil, indicating a triggered infection response. During development lymphocytes start out in bone marrow and either remain there to grow into *B lymphocytes,* or they leave for the thymus gland, where they mature into *T lymphocytes*.

The B lymphocytes are like the body's military; they seek out their targets (i.e. invaders) and send defenses to attach to them. B lymphocytes secrete special substances, called *antibodies,* into the body's fluids. These antibodies circulate throughout the bloodstream and ambush threatening antigens. Each B lymphocyte is preprogrammed to make one specific antibody; unsurprisingly there are heaps of antibody types. Antibodies belong to a family of large molecules called *immunoglobulins (Ig,)* and within this family there are five subtypes. IgG coats microbes, speeding their uptake by other cells in the immune system; IgM very effectively kills bacteria; IgA (also known as SIgA) is concentrated in body fluids such as tears, saliva, secretions of respiratory tract and digestive tract, and acts as the guards that prevent entrance into the body; IgE's natural job is to protect against parasitic infections; IgD remains attached to B lymphocytes and plays a pivotal role in initiating early B lymphocyte responses.

T lymphocytes are the individual soldiers that actively destroy the invading pathogen that has been identified and marked. These cells also signal other cells, such as phagocytes, to do their jobs. T lymphocytes' surfaces contain specialized antibody-like receptors that can identify fragments of antigens on infected cells. T lymphocytes fall within three categories: *Helper T (Th)* cells, *Killer T (cytotoxic T lymphocytes or CTL)* cells, and *Natural Killer (NK)* cells. Th cells coordinate immune responses by communicating with other cells nearby. Some of these cells signal B lymphocytes to produce antibodies, others directly attack injected cells, while another group calls upon microbe-eating cells, which will be discussed shortly. CTLs perform attacks directly on cells carrying certain abnormal or alien molecules on their surfaces. Lastly, NK cells recognize and attack other types of foreign cells.

The microbe-eating cells are called *phagocytes*, which are essentially large white blood cells that swallow and digest foreign microbes or antigens. Phagocytes are made up of *monocytes, macrophages,* and *granulocytes.* Monocytes circulate in the blood and develop into macrophages once they migrate into tissue. Macrophages are found in the lungs, kidneys, brain and liver; they play a scavenger-like role, ridding the body of old cells and other debris. Granulocytes contain tiny granules filled with potent chemicals that kill detrimental microorganisms.

Neutrophil, as mentioned, is a phagocyte and also a type of granulocyte. It uses prepackaged chemicals to break down the microbes it ingests. *Eosinophil* and *Basophil* are granulocytes that spray their chemicals onto harmful cells. *Mast cell*s are identical to basophils, except that it is not a blood cell and is found in the lungs, skin, tongue, and nose and intestinal tract lining. These cells flare up demonstrating symptoms of an allergy attack. *Platelets* are cell

fragments that contain granules; they promote blood clotting, aid in wound repair and activate some of the immune responses.

Chemical messengers called *cytokines* coordinate with other cells to activate an appropriate immune response. Cytokines include a diverse assortment of *interleukins, interferons,* and *growth factors. Interleukin 2 (IL-2)* activates the immune system to produce more T lymphocytes. Other cytokines chemically attract specific cells to engage in immune responses such as inflammation.

The *Complement System* is made up of 25 proteins that work together to aid the action of the abovementioned antibodies in destroying various antigens. The hardworking compliment proteins contribute to the warmth, redness, swelling, pain, and loss of function that typically characterize an inflammatory response. When the first protein in the compliment system series, comes in contact with an antigen, the Compliment System Cascade is set into motion, much like a domino effect. The antigen binds to the antibody IgG, which causes the protein to break apart and reattach in several forms. This cascade results in a cylindrical complex of proteins inserted into the cell wall of the antigen cell. The antigen cell swells, due to fluids and molecules flowing in and out, and eventually bursts. The complement system makes invading organisms more susceptible to phagocytes and/or beckons other fighter cells to the area.

The immune system is divided into two distinct structures: innate immunity and adaptive immunity (Janeway & Travers, 1999). *Innate*, or general *immunity* describes a fixed and unchanging subsystem in which humans are protected from harmful bacteria, viruses, etc. External barriers such as the skin and mucous membranes are a part of innate immunity, as they provide the first line of defense against pathogens and antigens. *Adaptive immunity*, also known as active immunity, develops throughout our lifetimes as we are exposed to millions upon

billions of invaders. This subsystem generates receptors for previously encountered antigens, thus allowing us to protect ourselves upon future exposures to the same germ. The adaptive immunity is said to divide further into humeral and cellular immunity (Bedford, 2012). *Humeral immunity* (B cells) works to detect foreign objects. Additionally, it is able to recognize foreign objects without any processing of the object and is then able to produce antibodies and complement to destroy them. *Cellular immunity* (T cells) discover cells of its host body that have been tainted in some way, can detect peptides, and is able to directly destroy antigens instead of having to produce antibodies or complement.

A Perception Theory in Mind-Body Medicine

There is an increasing understanding that a relationship exists between the mind and the body. Researchers have been continually investigating the effects that the mind has on the body. Post Pavlov, scientists determined that the immune system could be conditioned by the mind (Hull, 1934 & Spector, 2011); mental processes produce conditioned physical responses. They explained that by pairing a neutral stimulus, such as a scratch on the skin, repeatedly with a substance that causes an increase in white blood cells, such as the injection of bacteria, this eventually led to the neutral stimulus eliciting a white blood cell response without the immune response initiating substance. This finding demonstrated that a mental process can affect a physical one, which led to further investigation into the mind-body relationship.

In an article produced in 2012, Bedford sought to explain this mind-body interaction via a perception theory that addressed multiple components of cross-modal adaptation. She found that the mention of immune response conditioning first appeared decades ago (Hilgard & Marquis, 1940), though was deleted from later editions; years later, Ader and Cohen allegedly discovered

this relationship in 1975. An important step towards validating the relationship between the brain and the immune system was through the discovery of a mode of communication; the same neurotransmitters and receptors located in the brain were also found to exist in the immune system. Additionally, various immune system chemicals, such as interferon and interleukin-1, were found to affect the brain (Blalock, 1989; Irwin, 2008; Pert, Dreher, & Ruff, 1998). Through these and many more investigative pursuits, an interdisciplinary field has emerged that studies the relation between the mind, the nervous system, and the immune system (Vedhara & Irwin, 2005); it is called *psychoneuroimmunology.* Within this framework arises the interaction between stress and hormones. For instance, stress can increase the amount of CRH (corticotropin-releasing hormone), which results in immunodepression. This immunodepression is a process that can be curbed by the neurotransmitter GABA (ϒ-aminobutyric acid) (Irwin, 2008). A heightened focus on these types of exchanges can provide additional and holistic means for assessing and treating an inexhaustible list of ailments.

Bedford explains that the purpose of her article is to defend the preexisting claim that perceptual processes are central to mind-body interactions; she does this by introducing a new perception-based psychological theory. She asserts that the continued study of mind-body interactions "would benefit from perception's cumulative body of knowledge and its paradigms for investigating problems" (Bedford, p. 27); this would be helpful for explicating underlying psychological mechanisms. Bedford initially introduces guided imagery and mindfulness meditation as psychological manipulations that bring about positive change. Mindfulness meditation will be the singular focus, as mindfulness practices and their effects on the immune system are the central points of this paper.

According to MBSR creator, Jon Kabat-Zinn, *body scanning* is an essential component to mindfulness-based training. Body scanning is when the individual focuses attention on successive parts of the body, beginning with the left foot and eventually ending with the head (Kabat-Zinn, 2005). This exercise allows the meditator to become mindful of the precise feelings and sensations present throughout his/her entire body. Bedford explores body scanning through the perception lens, which she asserts is a practice of incorporating the body schema and proprioception. *Body schema* is a concept that involves having a mental representation of the shapes and positions of the body, as one knows where moveable parts of the body are at all times (Head & Holmes, 1911-1912). This is arguably essential in order to accurately reach for things or to avoid obstacles (Bedford, 2012). *Proprioception* is a related concept that allows the individual to construct their body schema, meaning that it involves the felt positions of body parts. Consider for a moment that when you close your eyes, you can picture exactly where your two arms are positioned without actually seeing them. Like the body schema, proprioception aids in our ability to attain and avoid objects and situations. These are important concepts when considering the mind-body relation through a perception and attention perspective and are notable through what is called *prism adaptation*, which is explained the following way:

> An observer looks at her own hand through a wedge prism with the thin end to the left. She feels the hand to be in one spatial location, but sees it in another a few inches to the left because of the prism. The perceptual system has the constraint that one object cannot be in more than one place at one time, including one's own hand (Bedford, 2004). Consequently, if it is concluded that the visual and proprioceptive input refer to the same hand then discrepancy between the seen and felt positions of the hand indicates that there is something wrong with our own perceptual machinery, and adaptation is the process by which this inferred internal error is fixed (Bedford, 1993a, 1993b, 1995, 1999, 2001):

> Either the felt position of the hand will shift to the left or the perceived visual location nudged to the right, so as to remove the discrepancy (Harris, 1965; Redding & Wallace, 1990; Welch, 1978; Welch & Warren, 1986; Bedford, p.27).

Bedford proposes the idea in which visualizing one's self as fully healed and completely healthy, while also visualizing one's immune system as detecting a problem, will cause a conflict between the modalities. According to this theory, a resolution of error will result, meaning that one of the modalities will have to correct itself.

Bedford presents a well-justified argument for the multitude of ways that the mind-body interaction can be explained through cross-modal adaptation. Cross-modal adaption is essentially the perception that involves an interaction between two or more sensing modalities, such as the sight and hearing. Bedford asserts that this perception approach explains why discerned physical change to psychological interventions is actually just another way that we, as humans, adapt based on the way that our senses perceive our environment. Through Bedford's perception theory, the argument can be made that through a cognitive process such as mindfulness-based meditation, one can identify observable physical changes in the immune system.

MBSR in relation to quality of life, mood, symptoms of stress and levels of cortisol, dehydroepiandrosterone sulfate (DHEAS) and melatonin in breast and prostate cancer outpatients

Studies performed over several years have demonstrated MBSR's efficacy in treating problems such as chronic pain (Kabat-Zinn, 1982; Kabat-Zinn, Lipworth, Burney, & Sellers, 1987), anxiety disorders (Kabat-Zinn, Massion, Kristeller, Peterson, Fletcher, Pbert, Lednerkind, & Santorelli, 1992; Miller, Fletcher, & Kabat-Zinn, 1995), fibromyalgia (Kaplan, Goldenberg, &

Galvin-Nadeau, 1993; Singh, Berman, Hadhazy, & Creamer, 1998), epilepsy (Deepak, Manchanda, & Maheshwari, 1994), psoriasis (Kabat-Zinn, Wheeler, Light, Skillings, Scharf, Crolwy, Hosmer, & Bernhard, 1998), and hypertension (Schneider, Staggers, Alexander, Sheppard, Rainforth, Kondwani, Smith, & King, 1995). Carlson et al. (2003) performed a study that investigated MBSR's effect on quality of life, mood, symptoms of stress and levels of cortisol, dehydroepiandrosterone sulfate (DHEAS) and melatonin in breast and prostate cancer outpatients. The authors theorized that mindfulness stress reduction would provide relief to those experiencing the emotional distress of a cancer diagnosis.

The primary stress hormone, *cortisol*, is known to have immunosuppressive effects (Anderson, Kiecolt-Glaser, & Glaser, 1994; Cohen & Williamson, 1991; Spiegel, Sephton, Terr, & Sittes, 1998). Cortisol is responsible for the down-regulation of the immune system, which may lead to immunodepression, ultimately resulting in illness or disease. It has also been discovered that the hypersecretion of cortisol from the adrenal glands may cause depressed mood (Sikes & Lasley, 1989; Wolkowitz, 1994). Due to the fact that elevated cortisol levels have been identified in breast cancer patients (Aragona, Muscatello, Losi, & Panetta, 1996; van der Pompe, Antoni, & Heijnen, 1996; McEwen & Sapolsky, 1995), Carson and colleagues further investigated the relationship between the stress hormone and the effects that it has on breast cancer patients. They found abnormal patterns of cortisol secretion in up to 75% of a sample of metastatic breast and ovarian cancer patients, which may be attributed to compromised hypothalamic-pituitary-adrenal (HPA) axis functioning (Touitou, Bogdan, Levi, Benavides, & Auzeby, 1996).

Meditation, in its simplest form, has been shown to decrease cortisol levels in healthy individuals (MacLean, Walton, Wenneber, Levisky, Mandarino, Waziri, & Scheider, 1994;

Sudsuang, Chentanez, & Veluvan, 1991), though Carlson et al. stated that MBSR was never formally assessed with regard to its effects on cortisol in cancer patients. They performed their research on outpatients that were diagnosed with prostate or breast cancer; the participants had a diagnosis of Stage 0, I, or II breast or early (localized to the prostate) prostate cancer at any time in the past. The participants must be 18 years or older and must be a minimum of three months post-surgery (mastectomy/lumpectomy/prostatectomy/cryotherapy). Exclusion criteria included the treatment with chemotherapy, radiation therapy, or hormone therapy (except tamoxifen or goserelin) currently or within the past three months; a concurrent DSM-IV Axis I mood, anxiety, or psychotic disorder (not in full or partial remission); a concurrent autoimmune disorder; and past participation in an MBSR group. A total of 59 breast and prostate cancer patients were enrolled in the study, though due to external circumstances, only 42 participants were able to complete the study and were available for the pre—post analyses.

The authors used several forms that determined participant demographic and medical history, health behaviors, and weekly meditation practices. The *European Organization for Research and Treatment of Cancer Quality of Life Questionnaire* (EORTC QLQ- C30) (Aaronson, Ahmedzai, Bergman, Bullinger, Cull, Duez, Filiberti, Flechtner, Fleishman, de Haes, Kaasa, Klee, Osoba, Razavi, Rose, Schraub, Sneeuw, Sullivan, & Takeda, 1993) was used to assess five functional demands of quality of life (physical, role, emotional, cognitive, and social function). Affective dimensions were assessed via the *Profile of Mood States* (POMS) (McNair, Lorr, & Droppleman, 1971). The *Symptoms of Stress Inventory* (SOSI) (Leckie & Thompson, 1979) was utilized to measure physical, psychological, and behavioral responses to stressful situations.

The MBSR training followed the formal procedure (8-week, 90-minute group sessions, with a 3-hour silent retreat on a Saturday). The program consisted of three primary components: (1) theoretical material related to mindfulness, relaxation, meditation, yoga, and the body-mind connection, (2) experiential practice of meditation and yoga during the group meetings and home-based practice, and (3) group process focused on solving problems concerning impediments to effective practice, practical day to day applications of mindfulness, and supportive interaction between group members. The authors also supplied the participants with a 52-page booklet that contained information pertinent to each week's instruction, including a bibliography for participants that wished to delve deeper into the practice. An audiotape was included as well. The participants were instructed to practice the mediation daily.

Participants were assigned to one of four types of cortisol slope profiles at each time measured: (1) normal, which represented a continual decrease across the assessment periods from morning to evening; (2) up then down (like an inverted V-shape), which means that there was an increase from morning to afternoon followed by a decrease from afternoon to evening; (3) down then up (V-shape), meaning that the cortisol levels decreased from morning to afternoon and increased from afternoon to evening; and (4) continual up, or continually increasing levels throughout the day.

The authors collapsed the three abnormal groups and compared them to the initial "normal" group using independent samples *t*-tests. The mean cortisol slopes were compared pre- and post-intervention using the Chow test, which determined whether the slops of two regression equations were different. In order to evaluate the effects of the MBSR intervention, the authors used paired-samples *t*-tests.

The average daily mean of the three cortisol values did not change from pre- to post-intervention; neither did the overall slope of the diurnal rate of change differ pre- to post-intervention. Interestingly, the participants shifted between cortisol categories. For instance, the most common switch was from the "inverted-V" pattern to the "V-shaped" pattern, meaning that by afternoon, the elevation of cortisol was less prevalent after the intervention.

Results of the present study indicate that the eight-week MBSR training program was effective in decreasing symptoms of stress and improved overall quality of life in that group of breast and prostate cancer outpatients. Though, a major limitation to the study was the lack of control or comparison group. In the absence of a control or comparison group, it is unclear whether the changes were directly related to the MBSR, or whether they were a natural part of the healing process. Additionally, the authors stated that they are unclear as to what specific mechanisms within MBSR are responsible for such changes (i.e., yoga, meditation, social support). Despite the notable beneficial effects associated with the reduction of stress symptoms, the authors did not find a significant change in hormone levels (cortisol). This is in contrast with other studies performed in a similar context.

In an additional study, Carlson and colleagues (2007) sought to investigate the ongoing effects of MBSR training on these same participants six and twelve months after the initial post-test. They assessed the effects of the mindfulness-based training on patients' quality of life, symptoms of stress, mood and endocrine function, and immune and autonomic parameters. Additionally, previously unpublished blood pressure and heart rate results have been added to the present study.

The authors administered the same measures as before to evaluate the aforementioned items. Specifically, they collected demographic and health behavior information, assessed for

quality of life using the EORTC QLQ-C30, mood using the POMS, and symptoms of stress via the SOSI. Carlson and colleagues measured immune response and cortisol levels via the same methods of their previous study (Carlson, Speca, Patel, & Goodey, 2003). Lastly, they measured blood pressure at six different times during the study using a mercury manometer (once week prior to MBSR, on the morning of the first meditation session, immediately after the last session, one week after the last session, 6-month follow up and 12-month follow up).

Carlson and colleagues used a simple mixed-effects model with a heterogeneous compound symmetry correlation structure among repeated measures (Laird & Ware, 1982) to assess the effects of the intervention pre, post, and over the follow-up. In order to determine the relationship between blood pressure and heart rate and the quality of life, mood or stress symptoms, Pearson product-moment correlations were used.

The findings were consistent with their previous study—MBSR was effective in decreasing symptoms of stress and maintaining these decreases for a year of follow-up. Cortisol levels continued to decrease and downward trends in T-cell production of pro-inflammatory cytokines were noted. The pro-inflammatory cytokines have been associated with increased stress levels (Anisman & Merali, 2003) and have been connected to patients with depression and heart disease (Joynt, Whellan, & O'Connor, 2004; O'Connor & Joynt, 2004). Many studies have found that pro-inflammatory cytokines have been linked to depression, possibly through altering the HPA axis reactivity, down regulating serotonin precursors, and impairing processes of neurogenesis (Raison et al., 2006; Hayley, Poulter, Merali, & Anisman, 2005; Hayley & Anisman, 2005; Schiepers, Wichers, Maes, 2005).

The critical limitation of this follow-up study is the lack of a control group. Future research would benefit from comparing a similar sample to a randomized control group to allow

for proper comparison. However, the author's findings suggest a strong relationship between MBSR and various emotional and physiological aspects of wellbeing amongst breast and prostate cancer patients.

MBSR for Older Adults: Executive Function, Frontal Alpha Asymmetry & Immune Function

Moynihan, Chapman, Klorman, Krasner, Duberstein, Brown, and Talbot (2013) performed an extensive study exploring the effects that MBSR has on executive function, frontal alpha asymmetry and immune function in older adults. The authors stated that much research has been done with regards to younger adults, though older adult samples are lacking. It is critically important to assess immune functioning in older adults, as aging is associated with decreased immune system operation (Franceschi, Bonafe, & Valensin, 2000; Ginaldi, Loreto, Corsi, Modesti, & De Martinis, 2001; Franceschi, Capri, Monti, Giunta, Olivieri, Sevini, Panourgia, Invidia, Celani, Scurti, Cevenini, Castellani, & Salvioli, 2007). A recent small trial performed by Creswell, Irwin, Burklund, Lierberman, Arevalo, Ma, Breen, and Cole (2012) found that proinflammatory gene expression decreased in association with decreased loneliness in the group receiving MBSR training.

The authors conducted a randomized controlled trial to determine MBSR's effects in individuals 65-years of age and older. The effects of the MBSR were compared to a waiting list control (WLC) group on specific objective measures of: emotional approach orientation in regard to the left prefrontal brain activity; executive function via the Trail Making Test; depression, perceived stress, and mindfulness, subjective responses; and humoral, adaptive immunity, as assessed by the immunoglobulin G (IgG) antibody response when challenged with the protein antigen keyhole limpet hemocyanin (KLH). Moynihan et al. selected KLH, as they theorized

that the antigen would be novel to the subjects, thus meaning that preexisting antibodies would be unlikely. They hypothesized that the MBSR participants would demonstrate a significant enhancement in each of the measured areas, as compared to the WLC participants.

They recruited men and women from the community via advertisements in local newspapers, as well as from the University of Rochester Strong Health- associated primary care offices using flyers. The authors were able to recruit a total of 228 subjects that met appropriate criteria. All but three (1 aged 63 years, 2 aged 64 years) were 65 years or older and were randomly assigned to an 8-week program of MBSR or a WLC condition. In regard to the immune reaction to the KLH antigen, a trained nurse injected the protein intradermally into the deltoid muscle of the nondominant arm. Varied amounts of the KLH substance was administered to participants, allowing the authors to hypothesize about group differences in antibody responses. Subjects were immunized with a range of doses, from 8 to 1,000 μg of KLH. Blood samples were collected immediately prior to immunization, and three- and twenty-four-weeks following immunization. The anti-KLH antibody levels in serum underwent a series of measurements and alterations, eventually resulting in appropriate measurements taken via an Opsys MR Microplate Reader.

The results of the KLH antibody response ran in the opposite direction than hypothesized; the authors had expected the baseline antibody levels to KLH (presumably a novel antigen), to be low to undetectable, though this was not the case. Surprisingly, significant preexisting anti-KLH antibody levels were present in both the MBSR and WLC groups at the time of challenge (time 2). Significantly greater baseline levels (time 2) of anti-KLH antibodies were observed in the MBSR group, which the authors speculated could explain the lower antibody count at follow-up in that group versus the WLC group. Preexisting antibodies can lead

to faster antigen clearance following immunization and in turn, can lower subsequent levels of antibodies following a challenge (Sasaki, He, Holmes, Dekker, Kemble, Arvin, & Greenberg, 2008). In regard to this claim, the authors stated that they are unable to definitively affirm that this process occurred, though they consider it a plausible explanation.

As discussed, several sections prior, Davidson et al., found increased levels of antibodies when challenged by the influenza vaccine in young adults. Moynihan and colleagues' observations contrasted those of Davidson et al.; the authors of the present study theorized that future studies should test whether the differences between findings were attributed to the antigens chosen for challenge (flu vaccine vs. KLH), as well as the subsequent cell-mediated versus humoral immune responses.

The authors offered that a possible explanation for the preexisting antibodies in the time 2-challenge might be due to the participants' ages and the plausible likelihood that they encountered the KLH protein previously. Moynihan et al. referenced the study performed by Smith, Vollmer-Conna, Bennett, Wakefield, Hickie, and Lloyd (2004) in which they documented good baseline proliferative responses to KLH in 7/21 students between the ages of 18 and 30 years. Additionally, Smith et al. found considerable variability in the baseline antibody response to the KLH antigen. Moynihan et al.'s observations of a null effect could be explained by "the unexpected presence of baseline antibody responses to an antigen that had been presumed to be novel" (p.41).

Alterations in Brain and Immune Function Produced by Mindfulness Meditation

Davidson, Kabat-Zinn, Schumacher, Rosenkranz, Muller, Santorelli, Urbanowski, Harrington, Bonus, and Sheridan (2003) sought to investigate the enduring effects and changes

that mindfulness meditation has on baseline brain function, as well as brain activity in response to emotional challenges. They argued that due to substantial evidence supporting mindfulness meditation's effects on anxiety and increased positive affect (Kabat-Zinn, Massion, Kristeller, Peterson, Fletcher, Pbert, Lenderking, & Santorelli, 1992; Miller, Fletcher, & Kabat-Zinn, 1995; Teasdale, Segal, Williams, Ridgeway, Soulsby, & Lau, 2000; Teasdale, Segal, & Williams, 1995; Beauchamp-Turner & Levinson, 1992), it is necessary to investigate the relationship between left-sided activation, which is attributed to positive affect, and mindfulness meditation. The authors hypothesized that because meditation decreases anxiety and increases positive affect, participants that practiced meditation should demonstrate increased left-sided activation in several anterior regions, compared with a wait-list control group.

Fascinating studies have recognized that greater left-sided brain activation at baseline is associated with enhanced immune function (Kang, Davidson, Coe, Wheeler, Tomarken, & Ershler, 1991; Davidson, Coe, Dolski, & Donzella, 1999). These studies measured NK activity, which are the cells that identify and attack foreign bodies. Davidson and colleagues sited past research that emphasized the negative impact of stressful life events on antibody titers in response to the influenza vaccine (Kiecolt-Glaser, Glaser, Gracenstein, Malarkey, & Sheridan, 1996). In addition to evaluating left-side activation, the authors of the present study investigated the relationship between mindfulness mediation and an immune response when faced with the influenza vaccine. They hypothesized that the meditating subjects would demonstrate greater antibody titers in response to the vaccine compared with the wait-list control group. Lastly, the authors predicted that the extent of change toward greater relative left-sided activation would be associated with a larger increase in antibody titers in response to the vaccine.

Forty-eight right-handed participants were recruited from their place of employment, a biotechnical corporation in Madison, Wisconsin. Of the 48 participants, 41 completed some of the measures for at least two of the assessments. The subjects had an average age of 36, ranging from 23 to 56 years. The subjects were randomly assigned to either a meditation group ($N = 25$; 19 female) or a wait-list control group ($N = 16$; 10 female). Following the final assessment, the wait-list control group received an equivalent 8-week meditation training program.

Davidson and his fellow researchers measured electrical brain activity before (Time 1) and after (Time 2) subjects were randomly assigned into one of two groups; the electrical activity was measured once more (Time 3) four months after the meditation training period ended. The researchers measured the brain activity via EEG and EOG (for correcting EEG for eye movements). The EEG was taken from 27 sites distributed across the scalp and referenced to ears for 8 1-minute baseline trials, four with eyes open and four with eyes closed. A measurement was also taken during a 1-minute period before and the 3-minute period after subjects wrote about one of three of the most positive and negative experiences in their life (the events were listed on a questionnaire administered to the participants before the start of the entire protocol). The authors continued on to explain the process of administering and recording the EEG and the logarithm utilized to evaluate activation in the brain.

Following the writing activity, each subject took the *Positive and Negative Affect Scale* (PANAS) (Watson, Clark, & Tellegen, 1988) in trait form and the *Spielberger State-Trait Anxiety Inventory* in trait form (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The members of the meditation group were urged to submit daily reports of the frequency and number of minutes and techniques of formal meditation practice.

In regard to assessing antibody titers' responses to the influenza vaccine, blood draws were taken at 3 to 5 weeks and at 8 to 9 weeks post vaccination. The researchers used the hemagglutination inhibition assay (Kiecolt-Glaser et al., 1996).

The meditation training (MBSR) was administered by Jon Kabat-Zinn, which met weekly for two and a half to three-hour sessions. Kabat-Zinn also incorporated a seven-hour silent retreat that was held during the course's sixth week. The participants were instructed to perform home practices that involved formal and informal meditative exercises. The home practices were to be performed for 1 hour each day, 6 days per week, led by directive audiotapes.

Davidson and colleagues briefly explained their statistical techniques: the analysis focused on the interactions between groups and time. As mentioned, the first assessment took place prior to the intervention, the second occurred immediately after the 8-week meditation training, and the third assessment occurred four months after the intervention ended. MANOVAs were computed for each of the four anterior asymmetry measures contributing to the left-sided activation regions. The authors also noted that linear trends were tested, as were follow up ANOVAs on the separate time periods. The authors could have provided a bit more detail when recounting their statistical procedures.

The results section provided segments that addressed each variable assessed (Affect and Anxiety Measures, Brain Electrical Activity Measures, Influenza Vaccine Antibody Titers, and Relations Among Measures). Of particular importance was the Influenza Vaccine Antibody Titers subsection, which stated that the mediators displayed a significantly greater rise in antibody titers from the fourth to the eighth week blood draw (compared to the control groups). In order to assess the relation between the magnitude of increase in left anterior activation and the magnitude of antibody titer rise in response to the influenza vaccine between the fourth to

eighth blood draw, the authors compared a change score for each subject across the change in activation asymmetry. This was done from Time 1 to Time 2 and Time 3, followed by a correlated change in activation asymmetry with the rise in antibody titers. Among the participants within the meditation group that demonstrated a greater increase in left-sided activation from Time 1 to Time 2 displayed a larger rise in antibody titers. There was no significant relation between these variables within the control group. Interestingly, the authors also compared the frequency and duration of reported practice and changes in the self-report and EEG measures that presented significant Group by Time interactions, as well as antibody titers to influenza vaccine, and found no significant associations. This suggests that there was no notable significance between the amount of practice and any of the biological or self-report measures.

The authors asserted that the findings from the present study are the first to suggest that meditation can actually increase left-sided anterior activation, which is associated with reductions in anxiety and negative affect, as well as increases in positive affect. Davidson and colleagues explained that the increases found in left-sided activation is part of a growing literature suggestive of neural bases of emotion regulation; left-sided anterior activation is associated with more adaptive responding to negative and/or stressful events. This is important, as is presents a seemingly new direction for future researchers to investigate a different component to the immune system in relation to brain activation.

Davidson et al. presented several limitations of their study. They stated that their relatively small sample size limited the statistical power; several of their hypothesized effects fell within the predicted direction but failed to reach a significant value. Next, they explained that the study was delivered in a demanding work environment and that future research should be conducted in a "conducive learning environment." Lastly, Davidson and colleagues admitted

that their measurements of brain function were relatively "crude." They suggest that future studies should examine the impact of MBSR using more neuroanatomically informative measures of brain function such as functional magnetic resonance imaging.

Comparison of Mindfulness-Based Stress Reduction and an Active Control in Modulation of Neurogenic Inflammation

Rosenkranz, Davidson, MacCoon, Sheridan, Kalin, and Lutz (2013) conducted an extensive study that sought to investigate the ability of mindfulness training to buffer the effects of psychological stress and dermal neurogenic inflammation in healthy individuals. According to the authors, although MBIs are becoming commonplace in various domains of treatment, there is relatively little known about the actual mechanisms or specificity of their effectiveness. Therefore, the Rosenkranz and colleagues produced an intricately detailed study that compared MBSR to an active comparison condition that matched MBSR in non-specific factors that promote wellbeing.

Evidently, all of the past research done on MBSR has done an adequate job describing its use as an intervention tool, though no study has primarily focused on MBSR's efficacy relative to other treatments or mindfulness' specific mechanism of change. These studies have attended to the effectiveness between pre- and post-training changes and wait-list or no treatment comparison groups, though these investigations do not provide an explanation in terms of whether MBSR is superior to other treatments or, more importantly, whether mindfulness is the active component that ultimately leads to change (MacCoon, Imel, Rosenkranz, Sheftel, Weng, Sullivan, … Lutz, 2012).

The authors of the present study highlighted psychological stress' ability to trigger inflammation (Welk, Herforth, Kolb-Bachofen, & Deinzer, 2008; Steptoe, Hamer, & Chida, 2007; Pace, Negi, Adame, Cole, Sivilli, Brown, Issa, & Raison, 2009), thus causing a substantial number

of individuals whom suffer from chronic inflammatory conditions, to seek out stress reduction treatments such as MBSR. As we've previously discussed, the brain interacts with the immune system in such a way that produces an effective immune response when an antigen has been identified. Neural regulation of inflammation is very important in barrier tissues such as the skin and the gastrointestinal, respiratory, and urogenital tracts, as they are the first line of defense against an invader (Kupper & Fuhlbrigge, 2004; Cua & Tato, 2012; Hart & Kamm, 2002; Arck, Slominski, Theoharides, Peters, & Paus, 2006; Liu, Coe, Swenson, Kelly, Kita, & Busse, 2002). Rosenkranz and colleagues continue on to explain the specific components and reactivity of the skin and its relationship to the immune system. They stated that certain sensory nerves are sensitive to capsaicin, the substance that makes peppers spicy, which in conjunction with local sympathetic nerves and mast cells, have been identified as critical contributors to the relationship between psychological stress and symptom expression in inflammatory skin diseases (Rosenkranz et al., 2013). Therefore, the authors created a capsaicin-induced inflammatory response and an acute laboratory stressor to investigate the interaction between the two.

The *Trier Social Stress Test* (TSST; Kirschbaum, Pirke, & Hellhammer, 1993) was used to activate stressors of day-to-day life (work-related, financial, travel-related, social/peer pressure). Rosenkranz and associates selected MBSR as the mindfulness-based intervention and hypothesized that in measures of neurogenic inflammation and physiological stress, the randomized MBSR training group would demonstrate a smaller post-training stress response than the randomized group that received the active comparison condition. Furthermore, they predicted that time spent practicing MBSR, but not the active comparison condition should predict the relative reductions in these measures. The active comparison condition, Health Enhancement

Program (HEP) matched MBSR in structure, instructor expertise, and content, though these qualities are not unique to mindfulness.

Forty-nine participants (10 male) were recruited through advertisements in local newspapers and were screened for exclusion criteria such as: significant previous experience with meditation or other mind-body techniques (e.g. tai-chi, Qigong), remarkable exercise habits (engagement in moderate sport or recreational activities > 5 times per week; engagement in vigorous sports or recreational activities > 4 times per week; inability to walk), use of psychotropic or steroid drugs, night-shift work, diabetes, peripheral vascular disease or other diseases affecting circulation (e.g. Raynaud's disease), needle phobia, pregnancy, current smoking habit, alcohol or drug dependency, inability to attend weekly class and full-day group sessions. The participants were randomly assigned to the aforementioned groups (MBSR or HEP).

The subjects were given the TSST test to induce psychological stress; a local, neurogenic inflammatory response per a topical capsaicin (.1%) cream as applied to their forearms; and two self-report measures that assessed psychological and physical symptoms: Symptom Checklist-90-R (SCL-90-R; Derogatis, 1983) and Medical Symptoms Checklist (MSC; Travis, 1977). The researchers created suction blisters on the participants' forearms and soon after, collected samples of the fluid and froze them. The capsaicin cream was applied to the perimeter of the blisters and removed after 45 minutes. Finally, the remaining fluid of the blisters was extracted roughly 30 minutes following the TSST and was frozen as well.

An enzyme-linked immunosorbent assay (R & D Systems, Minneapolis, MN) was used to quantify the levels of tumor necrosis factor alpha and interleukin-8 in the fluid. These two cytokines were chosen because of their sensitivity to psychological stress (Glaser, Kiecolt-Glaser, Marucha, MacCallum, Laskowski, & Malarkey, 1999). Cortisol levels also, in order to assess the

magnitude of the stress response. The statistical analyses used were paired sample t-tests to determine if inflammation was successfully induced, repeated measures of analysis of variance (ANOVA) to determine the effect of MBSR and HEP interventions, blister fluid cytokine levels and cortisol response to stress, diurnal cortisol slope, total daily cortisol output, and self-reported physical and mental symptoms from test 1 to test 2.

In regard to the results found, the paired t-tests verified the effectiveness of the experimental manipulations. The repeated measures of ANOVA found a significant main effect of time and a significant group by time interaction on flare size. However, the magnitude of increase was not constant across groups, as MBSR and HEP groups were the same at T1, then MBSR slightly increased at T2 and was significantly smaller than that of the HEP group. Repeated measures of ANOVA revealed a significant main effect of challenge on blister fluid levels of IL-8, though no significant effects of time, group, or interactions among challenge, time, or group were observed. A significant main effect of time for cortisol response was revealed and the self-report measures demonstrated a main effect of time as well. Multiple regression analyses were used to determine if practice was a good predictor of change in the outcome variables in response to either MBSR or HEP. The analyses did not produce a difference with the amount of practice reported. Secondary analyses were performed as well.

The researchers were able to determine benefits of MBSR that may be unique to mindfulness-based practices. Additionally, the present study demonstrated that MBSR might reduce the development of cutaneous neurogenic inflammation. Importantly, MBSR trained subjects presented with a smaller potentiation of the flare response and a steeper diurnal cortisol slope post-training, relative to the HEP group; these participants actually had a flattened cortisol slope. The relationship between practice and blister-fluid cytokine levels varied substantially

between groups; greater time spent in MBSR training demonstrated lower blister-filled cytokine levels, whereas the HEP group showed the opposite pattern.

The cortisol slope pattern is very important, as steeper decline slopes are salubrious with positive mental and physical health; therefore, MBSR can be attributed to these positive outcomes. Alternatively, a flattened cortisol slope has been associated with psychological and physical problems. Rosenkranz and colleagues did not find a difference between groups in terms of change in cortisol reactivity to the TSST. This lack of change may have been attributed to a habituation to the stressor between pre- and post-training.

Although the researchers predicted an attenuated response at T2 for the MBSR group and no change for the HEP group, post-hoc examination demonstrated that the observed potentiation for the HEP group reflects such degree of skin irritability that accompanies colder, drier winter weather (Uter, Hegewald, Kränke, Schnuch, & Pfahlberg, 2008). The weather may have presented as a possible extraneous variable that impacted the findings.

The authors provided an elaborate explanation for the neurogenic inflammation, or flare response, and the interaction between the skin, nervous system, and norepinephrine (NE). They posited that a potential limitation for their study was the fact that they did not measure local release of NE, therefore their conclusions about specific mechanisms of relative flare attenuation is not complete. Another limitation was that the participants were healthy, thus clinical assumptions cannot be made for individuals suffering from inflammatory conditions. Lastly, the authors omitted a stress condition in the absence of inflammation and an inflammation conditions in the absence of stress. This is important because the authors are unable to determine the interaction between stress and inflammation, as well as the impact of the interventions on this interaction.

Intensive Meditation Training, Immune Cell Telomerase Activity, and Psychological Mediators

Other studies have explored the multifaceted relationship between MBIs and physiological components, looking beyond MBSR specifically. Jacobs, Epel, Lin, Blackburn, Wolkowitz, Bridwell, Zanesco, Aichele, Sahdra, MacLean, King, Shaver, Rosenberg, Ferrer, Wallace and Saron (2010) performed a very interesting investigation exploring the effects that intensive meditation has on immune cell telomerase activity. Jacobs and colleagues argued that stress is commonly found in circumstances in which the individual feels out of control and an affinity for negative affectivity; they dubbed this dynamic "neuroticism" and compared it to perceived control. The authors operationally defined "intensive meditation" as a 3-month retreat of which mindfulness is emphasized. They also assessed whether meditation increased Mindfulness and Purpose in Life.

Thinking back to high school biology class, we can remember that telomeres are protective DNA sequences at the ends of chromosomes that ensure genomic stability during cellular replication. Telomerase is the cellular enzyme primarily responsible for telomere length and maintenance. Telomere length has recently been proposed as a helpful indicator of the link between stress and disease (Epel, 2009). Several studies have proposed that shortened telomere length and reduced telomerase predict a series of health risks and diseases (Blackburn, 2000; Serrano & Andres, 2004; Lin, Epel, & Blackburn, 2009b). More recently, researchers have found that the changes in telomeres and telomerase have been impacted by psychological stress, stress appraisals, and well-being (Epel, Blackburn, Lin, Dhabhar, Adler, Morrow, & Cawthon, 2004; Epel, Daubenmier, Moskowitz, Folkman, & Blackburn, 2009a; Ornish, Daubenmier,

Weidner, Epel, Kemp, Magnanua, Marlin, Yglecias, Carroll, & Blackburn, 2008). The authors of the current study explained that telomeres shorten each time the cell divides and shorten a bit more under conditions of oxidative stress. This process continues until cell division can no longer occur, unless counteracted by telomerase action (Blackburn, 1991). With greater perceived stress, greater negative affect, and stress-related cardiovascular risk factors, lower telomerase activity is predicted (Epel et al., 2004, Epel, Lin, Wilhelm, Wolkowitz, Cawthon, Adler, Dolbier, Mendes, & Blackburn 2006). Jacobs et al. sought to investigate whether meditation has an effect on the aforementioned telomerase activity via psychological stressors.

They predicted that the treatment group, as compared to the matched control group, would exhibit greater post-retreat telomerase activity and demonstrate increases in mindfulness, purpose in life, and perceived control and larger decreases in neuroticism. Additionally, the authors hypothesized that group differences in post-retreat telomerase activity would be mediated by meditation-influenced increases in mindfulness, purpose in life, and perceived control, and decreases in neuroticism. Lastly, they predicted that meditation-induced increases in mindfulness and purpose in life would mediate retreat-related increases in perceived control and decreases in neuroticism.

Sixty men and women were recruited based upon certain demographic information and meditation experience and were randomly assigned to either an on-site, 3-month meditation retreat, or a wait-list control group. The meditation focused on attentional skills (awareness and mindfulness) and benevolent mental states (compassion, empathy, and equanimity); the retreat was located at an isolated setting where the participants were able to practice for three full months.

Blood samples were collected from all participants prior to the retreat. Quantification of telomerase activity was measured from the extract using the *Telomeric Repeat Amplification Protocol* (TRAP) (Kim & Wu, 1997). Three psychological measures were administered pre- and post-retreat; the initial tests were given two days prior to the blood draw. The authors used the *Five Facet Mindfulness Questionnaire* (FFMQ) (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006), the *Well-Being Scale* (Ryff, 1989), and *The Big Five Inventory* (John, Donahue, & Kentel, 1991; John & Srivastava, 1999) to assess various aspects of personality types, including neuroticism.

In regard to statistical procedures, the authors used age as a covariate for analyses of psychological variables, and age and post-retreat BMI as covariates for analyses involving telomerase. Initially, ANCOVA and post hoc *t*-tests were used to identify significant differences between groups. Next, regression-based meditation analyses were used to determine whether any found change in any psychological measures mediated group differences in telomerase activity, as well as whether retreat-related changes in Mindfulness or Purpose in Life mediated group differences in changes in Perceived Control or Neuroticism.

The authors found that the retreat participants presented with greater telomerase activity, as compared to the wait-list control group. However, they did not find significant differences between post-retreat psychological measures and post-retreat telomerase activity in the combined groups. They hypothesized that this may be due to the potentially lower measurement error associated with the within-subject change scores as compared with the single post-retreat time point. The data suggest that increases in perceived control and decreases in negative affectivity contributed to an increase in telomerase activity. This is critical, as the telomerase activity has documented implications for telomere length and immune cell longevity. Also, the Purpose in

Life factor was found to be influenced by meditative practice and directly affects both perceived control and negative emotionality, which indirectly affects telomerase activity.

Although this study is not directly parallel to the research previously explored, it is critical in that it presents a different but equally important measure of mindfulness-based meditative approaches and its effects on the immune system. Future investigations will likely identify additional relationships involving MBIs and the infinitely complicated immune system.

Tying it Together

Circling back to Bedford's (2012) article that which described a perceptually focused means for evaluating the mind and body relationship, she highlighted some very important points that will likely lead to enhanced assessment and intervention techniques. In a section titled, *Is psychology lagging behind?* Bedford explains that several problems present as barriers between the growing psychoneuroimmunology field and psychological practice. For instance, she describes how psychological interventions such as imagery only work on medical conditions by creating an expectation of success (Kirsch, 1985). Bedford asserts that expecting something to succeed does not guarantee its victory; she provides the example of expecting her manuscript to be accepted but after several months, it has yet to be. She continues on to state that stress reduction/relaxation is similar, as it has been offered as an explanation of successful psychological methods on health, such as mindfulness-based meditation. Although stress has been proven to affect the immune system, as has been previously thoroughly discussed, a proper psychological theory of explanation for this dynamic interaction has not been explicitly defined. Bedford states that until such relationship has been properly explained through a psychological theory (i.e., psychological hypotheses), it cannot be examined. This makes complete sense when

considering her following example: Shapiro, Carlson, Astin, and Freedman's (2006) psychological theory of mindfulness meditation proposes that the mechanism for healing is "reperceiving." This essentially means that one must essentially alter their perception of a given situation, which lends its self to four further mechanisms (self-regulation; values clarification; cognitive, emotional, and behavioral flexibility; and exposure). This is done through the individual's intention and attentional openness, thus yielding the four resulting mechanisms, which ultimately lead to change and positive outcomes.

The previous example does not match Bedford's perception theory, which presents as a problem because the psychological theory does not explain why the mindfulness-based intervention worked. Further research in the field of mind-body interactions must connect what we understand on a biologic level with a psychological theory that can explain it.

Unfortunately, the MBSR training did not affect the level of cortisol found, though it did alter its pattern in regard to when it increased and decreased throughout the day. This is critically important, as it provides insight into the complexity of the relationship, as well as the fact that it leaves room for future research to better examine the hormone trend and its relationship with the immune system among individuals experiencing significant stress.

Incarcerated Youth and MBIs

A series of researchers have found that delinquency, substance use, and mental health concerns comorbidly occur due to fundamental factors associated with chronic stress and unskillful responses to stress (Bornovalova, Tull, Gratz, Levy, & Lejuez, 2011; Cisler, Olatunji, Feldner, & Forsyth, 2010). Such factors include high impulsivity, low distress tolerance, and poor affect regulation. Dishion, Felver-Grant, Abdullaev, and Posner (2011) discovered an

observable link between poor self/emotional regulation with delinquency and substance use. In fact, Broderick and Jennings (2012) found that difficulties in emotional-regulation have been considered a principal aspect in numerous adolescent-onset behavioral and emotional problems. Further, Bornovalova and colleagues (2011) identified a significant connection between suicide attempts and problematic impulsive behaviors under distressing circumstances.

Research that focuses on the effects of meditation and other MBIs on the incarcerated youth population is very limited; however, the extant literature proposes positive results (Childs, 1973; Flinton, 1998; Himelstein, 2009; Himelstein, Hastings, Shapiro, & Heery, 2012; Le & Proulx, 2014). Childs (1973) performed a pilot study on the use of meditation on juvenile offenders. The results indicated significantly lowered anxiety and drug use, as well as a higher degree of self-regard. In the year 1998, Flinton assessed the effects of an 8-week meditation course on incarcerated youth and found that the individuals experienced significantly reduced anxiety and increased internal locus of control. Another study investigated the effects of a 10-week meditation intervention on incarcerated adolescents (Himelstein, 2009). The researcher found that the meditation program improved the youths' levels of self-regulation and decreased their perceived stress levels. Himelstein, Hastings, Shapiro, and Heery (2012) performed a similar study involving a 10-week mindfulness-based intervention, which showed a significant increase in self-regulation and significant decrease in perceived stress.

In the year 2013, Thao N. Le of the University of Hawai‘i at Manoa and Jeffrey Proulx of Oregon State University conducted a study that explored the effects of mindfulness practices on incarcerated, mixed-ethnic Native Hawaiian/Pacific Islander adolescents (Le & Proulx, 2014). Le and Proulx sought to provide a concrete example of mindfulness-based training and its effects on immune functioning, stress levels, and various aspects of psychological wellbeing (Le &

Proulx, 2014). Specifically, thirty-six youth participated in the mindfulness program at the Hawai‘i Youth Correctional Facility (HYCF), under Office of Youth Services (OYS) and administratively placed within the Department of Health Services. The training program was conducted twice per week, over the course of five weeks. The data collected included biomarkers for immune function (SIgA) and stress levels (cortisol), and self-report measures in survey form that assessed impulsivity, self-regulation, and perceived stress.

A sample of 36 incarcerated youth participated in a 5-week mindfulness-based training program, which attempted to increase self-regulation and SIgA, and decrease impulsivity and cortisol levels. These individuals served as an excellent population to assess, as they have heightened baseline stress levels and therefore, impacted immune functioning. Specifically, the participants were recruited by unit staff members based upon their anticipated duration of incarceration at the facility. Eligible participants were between the ages of 14-18 and had a 3-month minimum sentence. Staff members referred the 36 youth, as they demonstrated acceptable behavioral conduct and level of achievement; adolescents who presented with unstable medical or neurological conditions, or who were considered to be disruptive or noncompliant were not considered. Demographics of 34 adolescents included: 76% male, 60% Hawaiian/Part Hawaii, 12% Mixed, 12% Pacific Islander, 8% Caucasian, 6% Filipino, and 2% African American.

Le and Proulx (2014) used various measures to assess background/social history, salivary cortisol and SIgA levels, perceived stress, impulsivity, self-regulation, mind-wandering, and mindfulness. The salivary cortisol and SIgA levels were measured by collected samples via Salimetrics oral swabs (Salimetrics, State College, PA). Sample were shipped on dry ice to

Salimetrics and were assayed for SigA and cortisol using an FDA-approved enzyme immunoassay (Salimetrics, State, College, PA).

To assess perceived stress, the authors administered a 10-item self-report measure that requests participants to indicate the degree to which they felt stressed during the last month using a 5-point Likert scale ranging from 0 (never) to 4 (very often) (Cohen, Kamarck, & Mermelstein, 1983). Examples include, "How often have you felt nervous and stress" and "How often have you felt that you could not cope with all of the things that you had to do." According to Cohen et al. (1983), the scale has strong alpha coefficient and test-retest reliability. Impulsivity was measured using four items of the *Teen Conflict Survey* (Bosworth & Espelage, 1995). This measure asks about lack of self-control, difficulty sitting still, and trouble finishing things. The Teen Conflict Survey has adequate internal and test-retest reliability among school-aged ethnic minority populations (McMahon & Washburn, 2003). The authors administered the *Self-regulation* (HRS; West, 2008) measure that questioned participants about their ability to regulate their thoughts, emotions, and behaviors. It includes 12 items with a 6-point Likert scale ranging from 1 (almost never) to 6 (almost always). Examples include, "My anger comes too fast for me to stay in control," and "I am known to lose my temper." Mind wandering was assessed using a 2-item measure that assesses lack of mindfulness; the items being, "How often, in the past week, did you think about something other than what you were doing?" and "How often, in the past week, were you focused on what you were doing?" (items were reverse scored). Responses ranged from 1 (rarely), 2 (sometimes), and 3 (always/frequently). Le and Proulx (2014) noted that these items were previously used by Epel, Puterman, Lin, Blackburn, Lazaro, and Mendes (2013) to study the association between telomere aging, a biomarker of stress, and mindfulness. Lastly, the authors measured mindfulness by administering the *Child and Adolescent*

Mindfulness Measure (Greco, Baer, & Smith, 2011). This 10-item assessment explores several facets of mindfulness such as acting with awareness and acceptance. The participants were asked to rate how often each item is true for them via a scale ranging from 0 (never) to 4 (always true).

In Le and Proulx's (2014) study, the instruments described above were collected 1 week prior to the mindfulness intervention and 1 week after the mindfulness intervention. They described the procedural steps as followed: during data collection, (a) youth were asked to provide a sample of his/her saliva by placing a cotton swab under their tongue for 2 minutes as they looked at several food item slides; (b) immediately thereafter, the participants were asked to complete several demanding cognitive tasks (Stroop, Flanker, Go-no-Go) on a laptop that lasted about 15 minutes. (This was a timed performance task with right and wrong answers and was used to evoke stress); (c) participants were asked to provide a second sample of their saliva by placing another cotton swab under their tongue for 2 minutes, 10 minutes after the performance task. The saliva samples were collected between 2:00 and 5:30 p.m. Following completion, the samples were immediately placed in a cold cooler during data collection and frozen thereafter until sent to Salimetrics in Pennsylvania.

All data collection was administered and collected by trained graduate research assistants. At the end of each session, the participants were given a personal reflection journal where they were to write their responses to two questions: "What did you learn about today's session?" and "How do you feel right now?" Their journals were then collected afterwards and kept by the first author (Le). The participants responses were subsequently typed into a word document for qualitative data analysis.

The authors measured changes in cortisol and SIgA output in each individual by using measures of area under the curve with respect to ground (AUCG). They measured changes between t1 to t3, which indicates the time distance between measurements, and changes between m1 to m3, which represent individual data points of biomarker measurements. By utilizing this measurement technique, the authors were able to determine baseline cortisol levels and reactivity between measures and take advantage of the information provided from cortisol measures while avoiding the loss of degrees of freedom associated with estimating each individual cortisol/SIgA parameter. Additionally, the authors used one-tailed t tests set at .05 due to hypotheses in direction of the two analyses conducted.

To account for missing data, the authors used paired t tests and were restricted to valid (nonmissing) values of cortisol/SIgA for mean comparison. Similarly, the authors used paired t tests to analyze the survey data for participants with completed pre- and post-data. Lastly, personal reflections were analyzed using a modified grounded theory approach (Corbin & Strauss, 1990: Charmaz, 2006).

Upon examination, the results of the case file review discovered that 58% of the participants have a family member with a major substance abuse disorder; 31% have a family member with a major mental health disorder; 42% have at least one family member who was sentenced to jail/prison; 36% have a record of suspected/reported history of abuse/neglect; 22% have a record of documented/substantiated abuse/neglect history; 89% have a documented mental health problem (majority including anxiety and/or depression); 97% have a substance use record; 31% were suspended one or more times from school; 14% were expelled; and 69% failed most classes. The primary types of crimes with which participants were charged and placed into HYCF were nonviolent offenses (e.g., probation violation, status offense, drug possession,

breach of peace, about 62%). About a quarter had a history of escape, predominately from out-of-home placements (e.g., foster care, residential treatment).

Results of the paired t tests with regard to survey measures from preintervention to postintervention revealed tendencies in the expected directions of the psychological factors examined. Specifically, they observed greater mindfulness and self-regulation, and less mind wandering and impulsivity; however, these findings did not reach statistical significance. Impressively though, perceived stress was statistically significant, with participants reporting lower perceived stress at postintervention compared to preintervention.

With regard to cortisol and SIgA levels between preintervention and postintervention, the authors found significant differences in overall mean levels; as anticipated, the direction in mean change was in opposite directions for cortisol and SIgA. The one-tailed repeated measures t tests indicated that overall cortisol levels, as were measured in the area under the curve, were lower at postintervention as compared to preintervention. For SIgA, the mean overall levels were higher at postintervention as compared to preintervention. Both demonstrated small effect.

Very interestingly, three main themes emerged from the qualitative analyses—positive emotions, ideas about mindfulness, and knowledge of self. These emergent themes were also consistent across both genders. With respect to *positive emotions*, participants reported feeling calm and love, and they were also able to connect these positive emotions to their own cultural values of *pono* (goodness, righteous) and *kokua* (extending love, aloha). They illustrated such things via a quote, “What can I do with what I learned is to always kokua and give from the heart to help others it doesn’t matter on amount as long as me or my resources can help benefit one another in a positive way.” The youth demonstrated ideas reflective of mindfulness per their reports of learning how to breathe and by keeping the mind clean. Lastly, under the theme of

knowledge of self, the participants mentioned becoming more aware of their own thoughts, as well as knowing how to recognize their feelings "but not attaching to or identifying with their feelings." Le and Proulx explained that the youths' ideas were similar to emotional regulation, as is illustrated by the quote, "I tend to get angry and upset when I'm disrespected. but I can just watch 'em now and not be'm."

Overall, the mindfulness-based intervention appeared to be beneficial for the participants, and although post hoc power analyses revealed limited power to detect statistical significance, the absence of zero in the confidence intervals for pre- and postintervention differences on cortisol and SIgA suggest that there was sufficient power to reject the null hypothesis.

The authors mentioned some limitations of the study as well. First, due to practice effects of a repeated measure design, it is possible that the study's validity was threatened, as exposure to the survey measures could have enhanced performance. Another possible limitation is that the small sample size and missing data in the postintervention condition could have affected the statistical analyses and results. Thirdly, a lack of a comparison or control group might be cause for concern as well, as the authors were unable to determine whether the observed findings were due to the actual intervention or to other factors. Similarly, due to the voluntary basis of the study, it is possible that the participants experienced a placebo effect to the intervention, as they knew that they were receiving services and attention from various adults. Another possible limitation is that the mindfulness measure itself might not entirely valid itself. Fifthly, there was no follow-up assessment and given the small effect size, it is unclear whether the intervention would yield long-term results. Lastly, due to the mixed-ethnic sample of predominantly Native Hawaiian/Pacific Islander youth, the effects/intervention might not be generalizable to other cultures/ethnicities/backgrounds.

Conclusion

The review of the available literature demonstrated that a directional relationship does exist between the stress hormone, cortisol and its effect on the immune system. More importantly, MBIs have been found to affect the levels of cortisol produced in the body, as well as various aspects of an immune response. Specifically, MBIs have been found to increase the activation of numerous immunoglobulins (antibodies), which serve as protective forces to fend off pathogens.

Although limited research has been performed on the effects of various types of MBIs on the immune system, cortisol levels, and other psychological factors with regard to the incarcerated youth population, the extant literature suggests that a relationship does exist and that it yields positive results. It is important to note, however, that majority of the abovementioned studies do not seem to utilize a complete or complex mindfulness-based intervention; rather, they focus almost exclusively on meditation. Nonetheless, juvenile offenders have been deemed at-risk in terms of their baseline levels of perceived stress, increased cortisol levels, and susceptible immune systems, thus making them a crucial population for a mindfulness-based intervention program.

Mindful Moments: A Mindfulness-Based Training Program for Incarcerated Youth

Introduction

As has been discussed, incarcerated youth experience a heightened degree of stress on a daily basis, and as is being increasingly better understood, elevated stress levels have deleterious effects on the immune system, causing immunodepression. The majority of incarcerated youth have been found to lack critical competencies as well, such as self/emotional regulation, impulse control, and distress tolerance (Loeber & Farrington, 2000). In adolescence, humans experience significant neurobiological changes such as increased limbic reactivity (i.e., increased activation of brain's emotional center), development of reasoning, and amplified self-conscious perceptions (Casey & Caudle, 2013; Luna, Paulsen, Padmanabhan, & Geier, 2013; Somerville, 2013). However, with individuals experiencing a pattern of heightened stress levels, their brain regions responsible for such changes, namely the prefrontal cortex areas, are negatively affected. This impacts their ability to appropriately regulate emotions and make healthy decisions. Due to these factors, incarcerated youth represent a vitally important and well deserving population to receive a mindfulness-based intervention program.

The purpose of this Clinical Research Project was to provide a theoretical treatment program for incarcerated youth utilizing MBIs per their beneficial effects on immune functioning and various psychological factors. As was formerly stated, this study's intervention program is extremely important, as it aims to perpetuate the beneficial effects of MBIs on a vulnerable population.

Theoretical Foundations

The theoretical foundations of the program, Mindful Moments: A Mindfulness-Based Training Program for Incarcerated Youth, are based on the extant literature indicating that MBIs

serve to improve various aspects of psychological, emotional, and physiological health. This program utilizes various components of formerly established and evaluated mindfulness-based interventions. Such components include meditation, body scanning, relaxation, yoga, breathing exercises, journaling, and supportive interactions between group members.

Mindful Moments assumes that by utilizing components of reputable MBIs, similar benefits will be detectable in the recipients. Specifically, the incarcerated youth that receive this intervention will assumedly experience lower levels of cortisol, self-perceived stress, and impulsivity, and higher levels of SIgA and self/emotion-regulation. In order to evaluate the effectiveness of said program, as well as to monitor participants' progress, certain evaluative assessments will be utilized.

As the extant literature has illustrated, MBIs have been consistently recognized as effective means for treating a myriad of physiological and psychological disorders; however, the exact mechanisms for change have yet to be determined. That being said, a probable explanation for Mindful Moment's process of change is that previous studies focusing on MBSR have found a decrease in symptoms of stress, which was maintained following a one-year follow-up. More specifically, they found that cortisol levels decreased and a downward trend in T-cell production of proinflammatory cytokines was apparent. As has been formerly discussed, pro-inflammatory cytokines have been associated with increased stress levels (Anisman & Merali, 2003) and have been connected to patients with depression and heart disease (Joynt, Whellan, & O'Connor, 2004; O'Connor & Joynt, 2004). Thus, reductions in pro-inflammatory cytokines are linked with decreases in the aforementioned maladies. However, it is important to note that the Mindful Moments program is not an exact replica of MBSR, so the effects might be slightly different.

Although this is the case, Mindful Moments utilizes the identified key pieces of MBSR that which make it an effective intervention tool.

Considering the process of change for the various psychological factors mentioned previously, mindfulness-based interventions have been found to increase and reinforce experiences of mindful-awareness, relaxation, and emotion-regulation. The mechanism of change for these improvements appears to be due to an objective and nonevaluative awareness of one's internal and external experiences. Once this awareness has been harnessed, the individual's prefrontal cortex, which allows for executive functioning skills, is more accessible. This accessibility will likely engender improved decision-making, organization, and emotion/self-regulation skills.

Rationale for Mindful Moments Program

Ample research has been performed on the relationship between MBIs and various aspects of psychological and physiological health. These investigations continue to delineate the beneficial effects of such interventions, as well as highlight the importance for future research and utilization of past findings.

When considering the incarcerated youth population specifically, otherwise considered "at-risk" youth, important information has been generated. As has been discussed formerly, researchers have found that delinquency, substance use, and mental health concerns comorbidly occur due to fundamental factors associated with chronic stress and unskillful responses to stress (Bornovalova et al., 2011), observable links have been identified between poor self/emotional regulation and delinquency and substance use (Dishion et al., 2011), and difficulties in emotional

regulation have been considered a principal aspect in numerous adolescent-onset behavioral and emotional problems (Broderick & Jennings, 2012). Perhaps most troublesome, a significant connection has been found to exist between suicide attempts and problematic impulsive behaviors under distressing circumstances (Bornovalova et al., 2011).

Considering these alarming discoveries, it is vital that empirically supported interventions be utilized and disseminated, so as to change and ultimately improve the lives of these individuals, their families, and the community at large. Furthermore, little research has been done in this area, as has been noted previously, thus by creating a structured program for incarcerated youth, future investigations can be more easily facilitated.

Program Fundamentals

The structure of the Mindful Moments intervention closely mimics the empirically-supported Mindfulness-Based Stress Reduction program with regard to length, session protocol, and supplemental activities/engagements.

Mindful Moments takes place over the course of eight weeks and is taught by certified trainers/facilitators. Each week, the intervention program provides 90-minute group sessions, as well as a 3-hour silent retreat on a Saturday; this retreat will take place between weeks six and seven. It is important to note that although some MBSR protocol call for 2.5-hour weekly session and a 7-hour silent retreat, a brief procedure is likely better suited for individuals experiencing impulsivity and assumedly shorter attention spans. Homework will be provided each day, which takes roughly 45-minutes to complete.

This program targets the following subject areas/topics: body scanning, mindfulness meditation, simple yoga postures, and problem-solving skills. Each subject area is provided via in-person and audiotaped verbal instruction by certified trainers.

Body scanning is the first prolonged formal mindfulness technique taught during the initial four weeks of the program. As was previously detailed, body scanning entails quietly sitting or lying and focusing one's attention on successive parts of the body, beginning with the left foot and eventually ending with the head (Kabat-Zinn, 2005). This exercise allows the meditator to become mindful of the precise feelings and sensations present throughout his/her entire body.

The mindfulness meditation portion of Mindful Moments focuses specifically on attentional skills, such as awareness and mindfulness, as well as on benevolent mental states including compassion, empathy, and equanimity. In attending to such altruistic conditions, participants develop/foster prosocial skills, which serve to engender/perpetuate empathy and helping behaviors. Mindful awareness as a skill is considered a muscle that strengthens with consistent use, thus participants are expected to carry out daily 45-minute homework assignments that include meditations practice, mindful yoga and applying mindfulness to situations in everyday life.

Yoga is an important component of mindfulness-based interventions; thus, it plays a critical role in the Mindful Moments program. Kundalini yoga was selected due to its efficacious ability to reconnect one with their natural flow of energy, while also serving to improve various aspects of health and well-being. The yoga techniques that are incorporated into Mindful Moments focus on mindful awareness, breathing, and stretching via select yoga postures. Specially, Mindful Moments will utilize the following Kundalini yoga poses: Cross

Crawl; variation of Downward-Facing Dog Pose; Cobra Pose; Yoga Crunch; Stretch Pose; Child's Pose; Savasana. The aforementioned postures were selected because of their easy-to-perform natures, as well as their effective body-mind activation. Pose descriptions are available in Appendix A.

Lastly, engaging in Mindful Moments in a group atmosphere provides the opportunity to develop problem solving skills in a supportive environment. The group setting provides the youth participants a space for learning to effectively mitigate situations and problems and build prosocial skills. Formal MBSR trainings highlight the group process as focusing on solving problems concerning impediments to effective practice, practical day-to-day applications of mindfulness, and supportive interactions between group members. Mindful Moments' group sessions attend to similar issues and the participants will therefore benefit from the tangible skills training and social development aspects.

Membership of Mindful Moments

As has been discussed in detail, Mindful Moments is appropriately tailored for incarcerated youth. There is extensive literature depicting the risk factors specifically experienced by this population of individuals, ranging from physiological and medical conditions to various elements affecting emotional, psychological, cognitive, and behavioral functioning. Mindfulness-based interventions in general have been an effective means for addressing similar health issues, particularly through the focus on mindful awareness, improvements to immune functioning, and emotion-regulation. The risk factors found to affect the incarcerated youth population would be both directly and indirectly addressed via a structured mindfulness-based

intervention program. Importantly, this program would additionally target emotion/self-regulation and prosocial skills.

To gain the most from the Mindful Moments program, eligibility requirements for participants are such that they must be between the ages of eleven and seventeen, serve a sentence of at least ten weeks, and have undergone a formal forensic assessment to determine diagnosis, history, current functioning, and safety issues. Individuals whom are not eligible for Mindful Moments are those that are under the influence of a controlled substance, actively psychotic, experiencing present suicidal and/or homicidal ideation, and are uncontrollably aggressive/violent towards themselves or others.

The screening process for determining eligible participants requires the involvement of multiple entities. Primarily, the correctional facility staff must perform a formal psychological assessment in order to determine if the individual is suitable. With the staff's consent and participant's assent, the adolescent will then complete various self-report measures to assess self-perceived stress levels (10-item measure using 5-point Likert scale to indicate stress levels; Cohen *et al.*, 1983), impulsivity (Teen Conflict Survey; Bosworth & Espelage, 1995), self-regulation (HRS; West, 2008), and mindfulness (Child and Adolescent Mindfulness Measure; Greco *et al.*, 2011). Regardless of the results indicated via the aforementioned measures, youth meeting the eligibility requirements are appropriate recipients of the Mindful Moments program. Outcomes of the measures serve as evaluative tools for determining the effectiveness of the program, thus they will also be administered following the completion of the intervention.

Role of Facilitator

The program facilitator's general responsibility is to help participants across the Mindful Moments training through the use of assessment and intervention delivery skills. Specifically, the facilitator must assess the varying abilities, personalities, and safety and ethical issues of the youth participants on an ongoing basis. The facilitator's role is like that of a teacher, rather than a therapist or interventionist—meaning, the facilitator provides instruction, explanation/clarification, encouragement/support, and disciplinary action when necessary.

He/she/they are expected to possess strong competencies in interpersonal relations, creativity, technological skills, and attention to detail. The facilitator is expected to travel to a variety of work sites, to deliver training and skills development workshops, and generally work 40 hours each week.

Facilitator Training

Mindful Moments focuses on physiological and psychological health and wellness via a myriad of treatment approaches, thus, the duties of the facilitator require extensive education and training. He/she/they must have, at minimum, a graduate degree in behavioral/psychological sciences, or education, and experience working in a facilitator position and/or with incarcerated youth.

A candidate for the facilitator role, as stated, must go through extensive training. Primarily, facilitators would be trained in and must adhere to the clinical psychology's ethical principles and codes of conduct. Training for a facilitator position involves a strong emphasis on mindfulness, meditation, body scanning, and the incarcerated youth population, particularly the various risk factors impacting these individuals. Other topics addressed are stress and cortisol,

immunology, and Kundalini yoga. It is encouraged that prospective facilitators engage in a formal mindfulness-based training program, such as Mindfulness-Based Stress Reduction, prior to commencing.

Ethical Issues

Unsurprisingly, working with children/adolescents and incarcerated individuals presents an abundance of possible ethical concerns. A pertinent issue specifically is that of assent versus consent. Those under the age of 18 are unable to provide consent, as they are under the legal responsibility of their parents or guardians. Similarly, those in the corrections system are legally represented by the state in which they are incarcerated. Mindful Moments by nature, serves a doubly sensitive population, as the recipients are both underage and wards of the state. As was previously stated, the correctional facility staff provides assent for the youth's involvement, if the eligibility criteria are met. It is important highlight, however, that continued involvement in Mindful Moments is left to each participant, thus should the individual at any point no longer wish to remain, he/she/they are welcome to terminate their enrollment/participation.

Facilitators must work within their scope of competence and appropriately mitigate situations in which proper delegation is necessary. Safety is of the utmost concern for participants and facilitators. Many of the recipients of Mindful Moments likely have a history of trauma, thus additional precautions must be made. For instance, facilitators must refrain from making personal contact with all participants. It is also likely that numerous participants have a history of violent behavior and/or a conduct-related disorder. These types of factors present lots of opportunities for ethical situations to occur, thus careful attention must be made throughout the program's entirety.

If an ethical issue were to arise, the program facilitator would take immediate action to rectify the situation. Documentation would be instantaneously pursued, as would any necessary consultation with other professionals, facility staff, or legal representatives. Mindful Moments sessions would solely take place in supervised locations on the correctional facility grounds, so as to further safety measures for participants and program facilitators.

Program Evaluation

The CIPP Evaluation Model, developed by Daniel Stufflebeam and colleagues in the 1960's, is a comprehensive framework for guiding evaluations of programs, projects, products, and so forth (Stufflebeam, 2007). CIPP is an acronym for Context, Input, Process, and Product Evaluation and was developed to provide an analytic and rational basis for program decision-making. The four components of the CIPP acronym address, What needs to be done? How should it be done? Is it being done? Did it succeed?

The model's complete checklist is aimed at assessing a program's efficacy and implementing its long-term sustainability. However, for the purposes of evaluating Mindful Moments, as a program that's need and beneficiaries have already been delineated, only select parts of the original CIPP Evaluation Model will be utilized. Said components are included in this Clinical Research Project for reference and future utilization.

Mindful Moments will employ the evaluation criteria/checklist that concentrates on the "Is it being done?" and "Did it succeed?" questions. By monitoring the program continuously, the decision-makers are able to learn how well it is following the plans and guidelines, conflicts that arise, staff support, strengths and weaknesses of materials, and delivery and budgeting issues

(Stufflebeam, 2007). Thereafter, in observing and measuring the outcomes, the decision-makers are able to better determine the program's future with regard to necessary modifications and its overall effectiveness (Stufflebeam, 2007).

An additional method for evaluating Mindful Moments is to reassess the youth's functioning following the program's completion. As was discussed formerly, each participant completed various self-report measures at the outset of the program; these scales assessed self-perceived stress levels (10-item measure using 5-point Likert scale to indicate stress levels; Cohen *et al.*, 1983), impulsivity (Teen Conflict Survey; Bosworth & Espelage, 1995), self-regulation (HRS; West, 2008), and mindfulness (Child and Adolescent Mindfulness Measure; Greco *et al.*, 2011). These screeners will be re-distributed once the youth have completed the Mindful Moments program in order to measure any possible changes and/or improvements. This is a helpful and necessary means for evaluating the program, largely because the results come from the participants rather than a stakeholder, whose intensions could be compromised.

Summary

Previous sections outlined the elemental breakdown of Mindful Moments: A Mindfulness-Based Training Program for Incarcerated Youth, its sole purpose being to provide a treatment program for youth in the corrections system, which employs MBIs to address psychological, emotional, and physiological health. As we have come to appreciate, the incarnated youth population are subject to a myriad of biopsychosocial risk factors and thus, it is imperative that empirically supported interventions be utilized and propagated, in order to improve the lives of these individuals, their families, and the community.

The 8-week program applies meditation, body scanning, relaxation, yoga, breathing exercises, journaling, and prosocial skill building via group sessions to lower levels of cortisol, self-perceived stress, and impulsivity, and raise levels of SIgA and self/emotion-regulation. Once the correctional facility staff provides assent for an individual's involvement per the eligibility requirements, he/she/they engages in 90-minute group sessions, a 3-hour retreat, and weekly homework assignments.

Due to the highly sensitive nature of the recipient population, the facilitators must be highly trained and equipped to manage the various safety and ethical concerns listed above. These facilitators, once deemed qualified, will undergo extensive training on the many aspects of the Mindful Moments program, and as noted, will be expected to be well-versed in the ethical code of clinical psychologists, so as to appropriately mitigate safety and ethical issues. After all, the purpose of this program is to improve the lives of these youth and to keep them safe.

Following the program's completion, it is important to evaluate its effectiveness and long-term sustainability. These issues will be assessed via the CIPP Evaluation Model (Stufflebeam,2007) and by re-administering various self-report measures to the youth participants.

Discussion

Discussion of Findings

The Mindful Moments program, intended to holistically address the health needs of incarcerated youth, is a theoretically-designed intervention based on the extant literature around mindfulness-based interventions, immunology, stress-related illnesses, and the risk factors

affecting adolescent prisoners. Due to its hypothetical nature, the findings of Mindful Moments are also grounded in what is known and understood about the aforementioned topic areas.

In referencing the research performed on MBIs and their effects on the immune system, cortisol levels, and psychological factors such as self-perceived stress, the Mindful Moments program will likely serve to improve various aspects of psychological and physical health. Looking at immune function, the antibody or immunoglobulin called SIgA, which is concentrated in body fluids such as tears, saliva, secretions of respiratory tract and digestive tract, and acts as the guards that prevent entrance into the body, will increase. The significance of this increase is that in the face of illness, the body's natural defense team will be better able to ward off invaders. This is very important when attending to the mal-effects of stress on the body.

The primary stress hormone, cortisol, has been found to have immunosuppressive effects—it is responsible for the down-regulation of the immune system, which may lead to immunodepression, ultimately resulting in illness or disease. It has also been discovered that the hypersecretion of cortisol from the adrenal glands may cause depressed mood. Therefore, it is brutally apparent just how important this relationship is with regard to whole-body wellness, and the necessity of an intervention for a group of people that live under extremely stressful life circumstances.

Of similar importance, the current literature has shed ample light on "at-risk" populations, namely incarcerated youth, with regard to the comorbidity of delinquency, substance use, and mental health concerns with chronic stress and unskillful responses to stress. These individuals also struggle with poor emotion regulation and consequent elevated rates of suicidality. Given the improvements that MBIs have on various psychological factors, it can be

expected that the recipients of the Mindful Moments program, will likely experience improvements in emotion/self-regulation and lowered self-perceived stress levels and impulsivity. It can also be presumed that the youth participants will develop prosocial skills due to the supportive and dynamic nature of the group sessions.

Clinical Implications

The perpetually important clinical implications of the Mindful Moments program are immense and far-reaching. In the following paragraphs, the various stakeholders in the Mindful Moments intervention will be examined closely, as the consequences of such program impact a myriad of individuals, as well as the psychological field in totality.

As has been mentioned several times before, receiving an effective treatment approach, that addresses various aspects of mind and body wellness, would greatly improve the lives of the youth themselves, as well as their families and their communities. It frequently seems to be the case that conduct disorders in adolescents/children is a broader systemic issue. Meaning, impudent behaviors often occur in families that have a history of problematic actions such as substance use, domestic and/or sexual abuse, and so forth. These maladaptive patterns continue to typically perpetuate through generations, thus constituting a systemic problem. By instituting an empirically-based intervention that's shown effectiveness can improve many aspects of the aforementioned cycle, the participants/youth themselves will experience a significant improvement in overall functioning; plus, this improvement will serve to improve their family systems and communities as well.

With safety at the forefront of clinical and ethical practice, improved functioning for at-risk adolescents will subsequently lessen the safety concerns for the participants and others. Considering the correlative relationship between poor emotion-regulation and high rates of suicidality, providing these individuals with more adaptive coping skills, better physiological tolerance of stress, and community support will presumably decrease self-harm behaviors. Similarly, imparting such elements will also improve the safety of our communities, as dangerous behaviors like violence and substance use subside.

Treating providers in the mental health field are expected to continually further their knowledge of evidence-based practices. *Evidence-based practices/treatments* in psychology focus on the research aspects of treatment and case formulation, as well as on clients' values and culture (Levant & Sperry, 2016). In providing such treatments, providers must utilize *clinical expertise,* which sets the precedence that practitioners must manage their personal biases and filters, so as to prevent motivated reasoning and unfairness. Clinical expertise also encompasses a collection of proficiencies such as, diagnostic competence, case formulation, and treatment planning; clinical decision making, treatment implementation, and monitoring of progress; interpersonal skills; continual self-reflection and incorporation of new knowledge and skills; and understanding the influence of individual and cultural differences on treatment (Levant & Sperry, 2016, p. 21).

Evidenced-based practices are arguably important, as they promote the integration of available research, clinical expertise, and monitoring and modifying treatments as appropriate. These types of interventions have been proven to employ a collectivistic approach by accounting

for underserved and underrepresented groups via the focus on the best available research and clinical expertise.

Multiple types of research designs have been utilized to formulate evidence-based treatments, which include clinical observation, qualitative research, systematic case studies, single-case experimental designs, epidemiological research, ethnographic research, process-outcome studies, cost-effectiveness, cost-benefit analysis, treatment utilization, effectiveness research, efficacy research, and meta-analysis (Levant & Sperry, 2016, p. 20).

Due to the fact that the Mindful Moments Program has been based upon empirically-supported interventions, it meets all of the aforementioned criteria with regard to an emphasis on research, bias management, emphasis on safety and patient care, and cultural sensitivity. As providers, there is a professional and ethical responsibility to offer patients treatment methodologies that have been found to be effective, and Mindful Moments delivers such an approach.

Recommendations for Future Research

It is important to further research-driven literature, as new discoveries are constantly being made. Much investigation has been performed on the effects of mindfulness-based interventions with respect to various aspects of health, and yet, heaps of unmapped domains endure. Explicitly, little research has focused on MBIs with regard to the incarcerated youth community, and even less attention has been given to the long-term sustainability of such effects.

Because Mindful Moments is a structured program and has been specifically developed for individuals who will presumably remain monitored by corrections staff or state agencies for

several months post-program, future research ought to survey any lasting impressions. It is essential that forthcoming investigators explore the participants' physical and psychological functioning in order to determine the enduring effects of this treatment model.

Another crucial aspect for future research to address is the training methods that the facilitators undergo. This is a conceivable limitation that the Mindful Moments program presents, as it is impossible to deem beforehand the appropriate training and qualifications necessary for facilitators to be the most effective in deliverance. Thus, future attention can be given to the "best" types of training, previous qualifications, and facilitator temperament/personality when working with incarcerated youth and providing a structured mindfulness-based program.

Conclusion

The purpose of this study was to provide a theoretical treatment program for incarcerated youth utilizing MBIs per their beneficial effects on immune functioning and various psychological factors. As the available research has consistently demonstrated, these individuals experience a significant amount of stress daily, which consequently affects a myriad of biological, psychological, and emotional factors. Given the successes of similar programs, Mindful Moments: A Mindfulness-Based Intervention Program for Incarcerated Youth will presumably reveal comparable benefits with regard to enhanced immune function, lowered stress levels per self-report and biomarker assessment, decreased impulsivity, improved self/emotion-regulation, and increased prosocial behaviors.

Developing a structured program that is empirically-supported meets the needs of an "at-risk" population of individuals. The dynamic elements of mindfulness-based interventions have been extensively evaluated and consistently shown to be effective treatments for a multitude of psychological and physical conditions. Mindful Moments will provide a helpful tool for treating a vulnerable group, as well as contribute to the perpetually advancing body of psychological knowledge.

Although this program has its limitations, these shortcomings provide opportunities for future research. Currently, the available data investigating the long-term, sustainable effects of MBIs on incarcerated youth is extremely limited, which is also the case with the present study. Thus, upcoming researchers will prospectively examine these aspects of a structured mindfulness-based program in order to continually advance their efficacy. Likewise, future research might also further survey the facilitators' qualifications and training protocol with respect to their ability to effectively and appropriately lead the Mindful Moments intervention. As previously stated, the current body of psychological knowledge will continually advance just as consistently as new voids in data are discovered. The Mindful Moments intervention program provides the following: an opportunity for therapeutic help for its recipients; a valuable contribution to the psychological field of research; and through such contribution, boundless possibilities for future exploration.

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Appendix A

Kundalini Yoga Poses

Pose #1 Cross Crawl

Lie down on back, with legs out in front and arms by sides. Inhale and bend left knee into chest while bringing right arm up over head. Exhale and straighten left knee, lowering leg and right arm back to the floor. Switch sides and continue to alternate, using long, deep breaths, for three minutes.

Pose #2 Downward-Facing Dog Pose, Variation (Adho Muhka Svanasana, Variation)

Come into a variation of Downward-Facing Dog Pose with thumbs touching and fingers angled slightly out (place hands shoulder-distance apart if experiencing shoulder injury). Keep feet hip-distance apart. Engage the core to draw the hips up and back and lift weight out of the shoulders. Take long, deep breaths for three minutes. (This pose, essentially an inversion, allows energy to flow toward the brain.)

Pose #3 Cobra Pose (Bhujangasana)

Lie on belly. Place hands under shoulders, fingers spread wide; grounding down through the pelvis and the tops of the feet, firm legs and reach the tailbone toward the heels. Inhale and lift

the chest, keeping a slight bend in the elbows, the chest open, and the shoulders relaxed. Hold for two minutes, taking deep breaths. (This pose draws energy toward the spine and opens the chest.)

Pose #4 Yoga Crunch

Lie on back, bend knees, and place feet on the floor hip-distance apart. Interlace hands behind the head with elbows spread wide. Exhale and count to six while moving into a crunch, pulling the low belly in. Inhale to the count of six while slowly lowering back down. Repeat for two minutes.

Pose #5 Stretch Pose

Extend legs forward, arms resting by sides; lengthen back of neck. Lift upper chest, head, and arms off the ground and draw the chin in. Direct fingers and gaze at toes. Keep lower back flat against the floor while lifting legs six inches off the floor, toes pointed. (If experiencing lower back problems, keep the heels lightly resting on the ground or place hands underneath the sacrum or sitting bones.) Hold for two minutes while doing the *Breath of Fire*: First inhale by relaxing the upper abdominal muscles, allowing air to fill the lungs. Then exhale by quickly drawing the navel point and solar plexus in and up toward the spine while forcing breath out. Take even

inhales and exhales and build two to three cycles per second. (Do not do Breath of Fire if pregnant or menstruating.) (Stretch Pose with Breath of Fire can be calming and rejuvenating.)

Pose #6 Child's Pose (Balasana)

Press back into Child's Pose with knees together, hips on heels, and forehead on the ground. Extend and rest arms in front with hands shoulder-distance apart. Relax here for one minute, returning to natural rhythm of breath. Then, bring arms alongside body; relax here for one minute, letting breath return to normal.

Pose #7 Savasana

Lie on back with legs extended forward. Let palms turn up and arms and legs relax. (This pose allows the body to integrate energy of the practice and resets the nervous system.) Stay in position for five to seven minutes.

Appendix B

CIPP Checklists

4. PROCESS EVALUATION Process evaluations monitor, document, and assess program activities. (Is it being done?)	
Evaluator Activities	**Client/Stakeholder Activities—Managing and Documenting**
Engage an evaluation team member to monitor, observe, maintain a photographic record of, and provide periodic progress reports on program implementation.	Use the process evaluation findings to coordinate and strengthen staff activities.
In collaboration with the program's staff, maintain a record of program events, problems, costs, and allocations.	Use the process evaluation findings to strengthen the program design.
Periodically interview beneficiaries, program leaders, and staff to obtain their assessments of the program's progress.	Use the process evaluation findings to maintain a record of the program's progress.
Maintain an up-to-date profile of the program.	Use the process evaluation findings to help maintain a record of the program's costs.
Periodically draft written reports on process evaluation findings and provide the draft reports to the client and agreed-upon stakeholders.	Use the process evaluation findings to report on the program's progress to the program's financial sponsor, policy board, community members, other developers, etc.
Present and discuss process evaluation findings in feedback workshops.	
Finalize each process evaluation report (possibly incorporated into a larger report) and associated visual aids and provide them to the client and agreed-upon stakeholders.	

5. IMPACT EVALUATION Impact evaluation assesses a program's reach to the target audience. (Did it succeed?)	
Evaluator Activities	**Client/Stakeholder Activities—Controlling Who Gets Served**
Engage the program's staff and consultants and/or an evaluation team member to maintain a directory of persons and groups served; make notations on their needs and record program services they received.	Use the impact evaluation findings to assure that the program is reaching intended beneficiaries.
Assess and make a judgment of the extent to which the served individuals and groups are consistent with the program's intended beneficiaries.	Use the impact evaluation findings to assess whether the program is reaching or did reach inappropriate beneficiaries.
Periodically interview area stakeholders, such as community leaders, employers, school and social programs personnel, clergy, police, judges, and homeowners, to learn their perspectives on how the program is influencing the community.	Use the impact evaluation findings to judge the extent to which the program is serving or did serve the right beneficiaries.
Include the obtained information and the evaluator's judgments in a periodically updated program profile.	Use the impact evaluation findings to judge the extent to which the program addressed or is addressing important community needs.
Determine the extent to which the program reached an appropriate group of beneficiaries.	Use the impact evaluation findings for accountability purposes regarding the program's success in reaching the intended beneficiaries.
Assess the extent to which the program inappropriately provided services to a nontargeted group.	
Draft an impact evaluation report (possibly incorporated into a larger report) and provide it to the client and agreed-upon stakeholders.	
As appropriate, discuss impact evaluation findings in feedback sessions.	
Report the impact evaluation findings to the client and agreed-upon stakeholders.	

6. EFFECTIVENESS EVALUATION Effectiveness evaluation documents and assesses the quality and significance of outcomes. (Did it succeed?)	
Evaluator Activities	**Client/Stakeholder Activities—Assessing/Reporting Outcomes**
□ Interview key stakeholders, such as community leaders, beneficiaries, program leaders and staff, and other interested parties, to determine their assessments of the program's positive and negative outcomes.	□ Use effectiveness evaluation findings to gauge the program's positive and negative effects on beneficiaries.
□ As feasible and appropriate, conduct in-depth case studies of selected beneficiaries.	□ As relevant, use the effectiveness evaluation findings to gauge the program's positive and negative effects on the community/pertinent environment.
□ Engage an evaluation team member and program staff to supply documentation needed to identify and confirm the range, depth, quality, and significance of the program's effects on beneficiaries.	□ Use the effectiveness evaluation findings to sort out and judge important side effects.
□ As appropriate, engage an evaluation team member to compile and assess information on the program's effects on the community.	□ Use the effectiveness evaluation findings to examine whether program plans and activities need to be changed.
□ Engage a goal-free evaluator4 to ascertain what the program actually did and to identify its full range of effects—positive and negative, intended and unintended.	□ Use the effectiveness evaluation findings to prepare and issue program accountability reports.
□ Obtain information on the nature, cost, and success of similar programs conducted elsewhere and judge the subject program's effectiveness in contrast to the identified "critical competitors."	□ Use the effectiveness evaluation findings to make a bottom-line assessment of the program's success.
□ Compile effectiveness evaluation findings in a draft report (that may be incorporated in a larger report) and present it to the client and agreed-upon stakeholders.	□ Use needs assessment data (from the context evaluation findings), effectiveness evaluation findings, and contrasts with similar programs elsewhere to make a bottom-line assessment of the program's significance.
□ Discuss effectiveness evaluation findings in a feedback session.	
□ Finalize the effectiveness evaluation report and present it to the client and agreed-upon stakeholders.	
□ Incorporate the effectiveness evaluation findings in an updated program profile and ultimately in the final evaluation report.	

7. SUSTAINABILITY EVALUATION Sustainability evaluation assesses the extent to which a program's contributions are institutionalized successfully and continued over time. (Did it succeed?)	
Evaluator Activities	**Client/Stakeholder Activities: Continuing Successful Practices**
□ Interview program leaders and staff to identify their judgments about what program successes should be sustained.	□ Use the sustainability evaluation findings to determine whether staff and beneficiaries favor program continuation.
□ Interview program beneficiaries to identify their judgments about what program successes should and could be sustained.	□ Use the sustainability findings to assess whether there is a continuing need/demand and compelling case for sustaining the program's services.
□ Review the evaluation's data on program effectiveness, program costs, and beneficiary needs to judge what program activities should and can be sustained.	□ Use the sustainability findings as warranted to set goals and plan for continuation activities.
□ Interview beneficiaries to identify their understanding and assessment of the program's provisions for continuation.	□ Use the sustainability findings as warranted to help determine how best to assign authority and responsibility for program continuation.
□ Obtain and examine plans, budgets, staff assignments, and other relevant information to gauge the likelihood that the program will be sustained.	□ As appropriate, use the sustainability findings (along with other relevant information on the program) to help plan and budget continuation activities.
□ Periodically revisit the program to assess the extent to which its successes are being sustained.	
□ Compile and report sustainability findings in the evaluation's progress and final reports.	
□ In a feedback session, discuss sustainability findings plus the possible need for a follow-up study to assess long-term implementation and results.	
□ Finalize the sustainability evaluation report and present it to the client and agreed-upon stakeholders.	

8. TRANSPORTABILITY EVALUATION

Transportability evaluation assesses the extent to which a program has (or could be) successfully adapted and applied elsewhere. (This is an optional component of a CIPP evaluation. It should be applied when the client or some other authorized party desires and arranges for such a study. Sometimes such a transportability evaluation is an apt subject for a doctoral dissertation.) (Did it succeed?)

Evaluator Activities	**Client/Stakeholder Activities—Dissemination**
□ Engage the program staff in identifying actual or potential adopters of the program by keeping a log of inquiries, visitors, and adaptations of the program.	□ Use the transportability evaluation findings to assess the need for disseminating information on the program.
□ If relevant, survey a representative sample of potential adopters. Ask them to (1) review a description of the program and a summary of evaluation findings; (2) judge the program's relevance to their situation; (3) judge the program's quality, significance, and replicability; and (4) report whether they are using or plan to adopt all or parts of the program.	□ Use the transportability evaluation findings to help determine audiences for information on the program.
□ Visit and assess adaptations of the program.	□ Use the transportability evaluation findings to help determine what information about the program should be disseminated.
□ Compile and report transportability evaluation findings in draft reports.	□ Use the transportability evaluation findings to gauge how well the program worked elsewhere.
□ Discuss transportability evaluation findings in a feedback session.	
□ Finalize the transportability evaluation report and associated visual aids and present them to the client and agreed-upon stakeholders.	

Stueber, Kyla Effects of Mindfulness Based Interventions on the Immune System & Psych Factors

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