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An Exploration of Neurofeedback Treatment

in a Sample of Men Arrested for Domestic Violence

with Correlates of Anger, Aggression, and Stress

by

Linda Irene Larson

A dissertation

submitted in partial fulfillment

of the requirements for the degree of

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College of Nursing

Idaho State University

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Committee Approval

To the Graduate Faculty:

The members of the committee appointed to examine the dissertation of LINDA IRENE LARSON find it satisfactory and recommend that it be accepted.

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March 28, 2017

Linda Larson-Spagon
School of Nursing
MS 8101

RE: regarding study number IRB-FY2017-99 : Neurofeedback treatmetn in Response to Veterans Arrested for Domestic Violence with History of Traumatic Brain Injury: A Pilot Study

Dear Ms. Larson-Spagon:

Thank you for your responses from a previous full-board review of the study listed above. These responses qualify for expedited review under OHRP and FDA guidelines. This is to confirm that I have approved your application.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

You may conduct your study as described in your application effective immediately. The study is subject to renewal on or before Mar 28, 2018, unless closed before that date.

Please note that any changes to the study as approved must be promptly reported and approved. Some changes may be approved by expedited review; others require full board review. Contact Tom Bailey (208-282-2179; email humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

Phone: (208) 282-1336 • Fax: (208) 282-4723 • isu.edu/research

Dedicated to my daughter—Tonya Larson.

Her courage is my inspiration.

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Dissertation Abstract—Idaho State University (2019)

Domestic violence (DV) continues to be a complex and significant public and social health problem. This crime has particularly devastating consequences for women and traumatic effects on children and families. DV offender intervention programs have grown nationwide but with disappointing results. Recidivism rates for DV remain high— estimated at 39%—and one-size-fits-all court-ordered DV educational programs have shown limited to no success in reducing DV recidivism. There is a need for innovative and integrated treatment for males arrested for DV. The purpose of the present study was to evaluate the outcomes of neurofeedback—a noninvasive form of biofeedback intervention—on recognized contributing factors to DV (anger, aggression, and stress) and to evaluate pre- to post-changes in brain map indicators based on current standard of care. Twenty-one males arrested for misdemeanor DV and court-ordered to attend a DV offender intervention educational program volunteered to participate in this study and were randomly placed in a treatment or control group. Sixteen completed the study. A series of dependent sample *t* tests compared pre-scores to post-scores on self- report instruments for anger, stress, and aggression, as well as qEEG brain maps. The qEEG paired sample *t* test for neurofeedback treatment suggested significance at EC (eyes closed) T4 (temporal right side) for High Beta frequency. Results from the self-report instruments measuring anger, stress, and aggression did not indicate significance. Results indicated a difference in pre-post neurofeedback treatment versus nontreatment for High Beta wave frequency, which presents exigence for further research. Future research with an increased sample size and additional neurofeedback treatment sessions may contribute to the current and

limited evidence base regarding potential alternative or combined treatment options for offenders in this damaging and devastating crime.

Key Words: neurofeedback, domestic violence, aggression, anger, stress, domestic violence offenders

An Exploration of neurofeedback Treatment in a Sample of Men Arrested for Domestic Violence with Correlates of Anger, Aggression, and Stress

Domestic violence (DV), also referred to as intimate partner violence (IPV), is recognized as a complex and significant public and social health problem (Breiding, Chen, & Black, 2014; Campbell, Neil, Jaffe, & Kelly, 2010; Corvo & Dutton, 2015; Farrer, Frost, & Hedges, 2012; Garcia-Moreno, Jansen, Heise, & Watts, 2005). According to Breiding et al. (2014), "intimate partner violence includes physical violence, sexual violence, stalking, and psychological aggression (including coercive tactics) by a current or former intimate partner" (p. 1). The Center for Disease Control and Prevention (2014) describes IPV as sexual violence, physical violence, stalking, and psychological aggression. IPV offenders can be current or former spouses, boyfriends/girlfriends, dating partners, or sexual partners. Physical violence might include being slapped, pushed, or shoved as well as severe violence, including being raped, having one's hair pulled, being hit with a fist or a hard object, and being kicked or choked (Breiding, et al, 2014). In spite of the high prevalence of this crime—estimated at 8.7 million women victimized annually—there remains limited understanding of factors contributing to IPV that contribute to perpetration of intimate partner violence (Roberts & Roberts, 2005). Some of these factors include developmental, cognitive, personality, and environmental influences that may play a role in IPV (Neighbors et al., 2013).

The incidence of male perpetrators in domestic situations is estimated in the United States at 85%, which outnumbers females, estimated at 12% (Rennison & Welchans, 2000). Catalano, Smith, Snyder, and Rand (2009) did a study of 16 large counties in the United States and found female IPV victims at 86% and male victims at 14% of DV incidences. This crime has particularly devastating consequences for women (Day, Chung, O'Leary, & Carson, 2009;

Hovmand & Ford, 2009; Renauer & Henning, 2005; Swan & Snow, 2002), children, and families, affecting quality of life in communities and societies worldwide (Campbell et al., 2010; Garcia-Moreno et al., 2005; Rothman, Cerdá, & Butchart, 2003).

Established Links to Domestic Violence Perpetration

Research on factors contributing to domestic violence suggests stress, anger, and aggression are recognized risk factors for IPV (Bodenmann, Meuwly, Bradbury, Gmelch, & Ledermann, 2010; Norlander & Eckhardt, 2005). Distressed individuals or those with elevated stress levels may become further energized when conflict is introduced by another individual. According to Norlander and Eckhardt (2005), the already-energized individual will also exhibit higher levels of anger arousal. The cause of this additional stress may be misattributed to a partner and, in turn, motivate an aggressive response toward that partner. Norlander and Eckhardt (2005) conducted a meta-analytic review of 33 studies of male IPV perpetrators and found stress and anger may be linked to aggression, consistent with other predictors of IPV.

Anger involves a myriad of physiological alarm responses, including escape and attack behaviors, and current definitions regard anger as a multidimensional construct. Berkowiz (1993) found that anger plays a causal role to aggression, and, according to Anderson & Bushman (2002) anger was found to reduce inhibitions in multiple ways. First, anger sometimes provides justification for aggression, and, second, anger may also interfere with higher-level cognitive processes normally used for reasoning and judgment decisions. Anger also allows a person to sustain aggressive intentions over time, and it may energize behavior by increasing arousal levels (Anderson & Bushman, 2002). Aggression as an outcome of anger can be described as psychological in nature (including coercive tactics) or as physical violence causing harm, death, disability, or injury (Center for Disease Control, 2016).

Stress linked to anger has a significant connection to aggressive behavior, and it may lead couples to engage in IPV (Anderson & Bushman, 2002; Bodenmann, 2005; Nordland & Eckhardt, 2005). Communication studies have shown stress among couples to directly deteriorate marital interactions and to increase anger and hostility (Repetti, 1989). Bodenmann (2005) found a 40% decrease in couples' quality of communication when stress was introduced.

A recent study by Hortensius, Schutter and Harmon-Jones (2012) suggested angry-aggressive processes in the brain are likely the result of increased left frontal cortical activity (activity involving approach) and decreased right frontal cortical activity (activity involving inhibition). When this psychophysiological process occurs, anger is likely to lead to aggression. Increased left frontal cortical activity suggests an angry-aggressive process with an aggressive behavior response (Hortensius et al., 2012). Anger and aggression have also been linked to these brain regions in people who have experienced a traumatic brain injury (TBI). Anger, stress, and aggression have established links to DV (Anderson & Bushman, 2002; Bodenmann, 2005; Nordland & Eckhardt, 2005; Center for Disease Control, 2016) and also have been associated with head injury (Howard, 2011). Many individuals that are arrested for DV have a history of head injury; however, this is often not addressed by the judicial system (Howard, 2011). A meta-analysis found prevalence of traumatic brain injury among DV offenders at approximately 54% to 60% (Farrer et al., 2012).

Traumatic brain injury (TBI) or mild TBI (mTBI) can result in disruption of brain function and disturbance of consciousness and may impact behavior such as aggression, impulsivity, irritability/rage, and apathy (Tinney & Gerlock, 2014). Most head injuries are mTBIs; however, the ability to self-regulate the strong emotions of anger and aggression may be impaired when either a TBI or a mTBI has occurred (Pinto et al., 2010; Tinney & Gerlock,

2014). DV's relationship to TBI is a construct worth exploring in the IPV offender population.

Background

Changes in law enforcement and domestic violence.

In recent decades, changes in systematic responses, including mandatory arrest laws and pro-arrest policies, have placed emphasis on law enforcement determining primary aggressors and making arrests in response to intimate partner violence (Hamberger, 2008). These initiatives were actualized to support victim safety, hold offenders accountable, and remove discretion from responding officers. These laws and policies were also implemented in an effort to take pressure off victims having to initiate and support follow-through with criminal charges (Labriola, Bradley, O'Sullivan, Rempel, & Moore, 2010). Some prosecutors have instituted a "no-drop" policy regarding all DV charges, further removing the burden of responsibility for conviction from the victim. These nationwide laws and policies have resulted in an increasing number of men in the system and in the proliferation of batterer [also referred to as offender] treatment [intervention] programs (Hamberger, 2008; Labriola et al., 2010). The referral rate for men entering DV treatment programs in the United States doubled within the first-year after mandated DV arrest policies were initiated, and these numbers continue to increase (Hamberger, 2008).

Changes in response to violence: The last decade.

Domestic violence offender programs.

Offender intervention programs have been growing nationwide in response to the rise of domestic violence (DV; Hamberger, 2008). These programs vary in terms of stated purpose, delivery methods, theoretical underpinnings, and core understanding of the nature of domestic violence (Day et al., 2009). Most DV programs are delivered in a group format, and behavioral change is the desired outcome (Feder & Wilson, 2005).

A primary goal of offender intervention programs is to reduce the reoccurrence of criminal acts; however, recidivism (DV re-arrest) remains persistently high, estimated at 39% even with court-mandated programs in place across the United States (Bowen, Gilchrist, & Beech, 2008; Dutton & Corvo, 2006; Herman, Rotunda, Williamson, & Vodanovich, 2014; McClure, 2013). Most group offender intervention programs focus on violence as a choice, with cognitive behavioral activities directed toward male perpetrators and the patriarchal desire to coerce or control women (Buttell & Carney, 2006; Dutton & Corvo, 2007). Other goals of DV-mandated group programs include increasing offender accountability, promoting positive responsible behavior, increasing safety for victims, and helping to eliminate DV through counseling, treatment, and education. The influx of male offenders into the criminal justice system has prompted several states to standardize DV programs, and nationally, as of December 2013, 45 states have implemented mandatory standards for DV offender programs (Batterer Intervention Services Coalition Michigan, 2013).

One of the earliest DV programs was established in 1981 by the Duluth Domestic Abuse Intervention Project (DAIP) and was implemented for men who assaulted their female partners (Pence & Paymar, 1993). A group of activists in the battered women's movement developed the Duluth model curriculum. Paraprofessionals designed this program to deliver intervention in court-mandated DV groups. The DAIP program stresses that violence is used as power and control; in fact, the "power and control wheel" has become an insignia of the program (Pence & Paymar, 1993). The DAIP program is focused on the male privilege that exists in patriarchal systems and does not address the psychological issues or emotions of the men, as the focus is on males as perpetrators and females as victims. A problem with the Duluth program, as noted in the literature, is that it is a political model based on a radical form of feminism that is

incongruent with psychological and biological models (Dutton & Corvo, 2006). Research has found the Duluth DV court-mandated programs have little to no effect on recidivism, and controversy continues, given that the effectiveness of this court-mandated program is not supported by literature (Dutton & Corvo, 2006; Dutton & Corvo, 2007). Theoretical debates about crime accounts create challenges for intervention programs to design and deliver programs that result in measurable change (Day et al., 2009).

The State of Idaho has established standards for DV offender intervention programs that require treatment providers to apply for program approval status through the Idaho Council on Domestic Violence and Victim Assistance (ICDVVA; Idaho Council on Domestic Violence and Victim Assistance, 2015); however, a troubling concern is that research suggests current DV-mandated group offender intervention programs have a slight, if any, impact on recidivism nationally (Babcock, Green, & Robie, 2004; Buttell & Carney, 2006; Corvo, Dutton, & Chen, 2008; Day et al., 2009; Feder & Wilson, 2005; Hamel, 2012; Washington State Institute for Public Policy, 2013). The current literature calls for revisiting how domestic violence is addressed and moving beyond the one-size-fits-all approach that is common in DV offender intervention programs nationwide (Cantos & O'Leary, 2014).

Changes in the judicial systems.

In the last decade, the criminal justice system has significantly changed its response to domestic violence. Rising domestic violence caseloads in both criminal and civil court have created a need for more innovative approaches to address this problem (Gover, MacDonald, & Alpert, 2003). As a result, specialized Domestic Violence (DV) courts have emerged to increase coordination among criminal justice entities, to connect criminal justice entities with social service agencies more effectively, to hold offenders accountable, and to support the safety of

victims. These DV courts are similar to other stipulated courts (i.e., drug or family court), with an emphasis on responding to the problem of DV with a structured approach and specialized process. Men arrested for misdemeanor MD DV will be placed in a DV court when the county of arrest has one available. DV court systems, in most cases, order men to a state-approved DV offender program that is monitored through the court. The DV court system has shown promise of positive change, similar to the restorative aspect of drug courts (Gover et al., 2003).

In response to domestic violence, interventions within DV courts are intended to be restorative. The goals of a restorative justice approach are to promote treatments and interventions that "restore" victims, offenders, and communities (Mills, Barocas, & Ariel, 2013). Some of the interventions include therapeutic approaches—such as innovative offender treatment programs, counseling and supervision, and regular review hearings to evaluate progress (Kindness, Kim, Edwards, Parekh, & Olson, 2009). Over 200 DV courts currently operate in the United States with the shared goals of victim safety and offender accountability (Labriola et al., 2010). Since 2010 DV courts continue to expand. Although DV courts exhibit wide variation in policies and protocols, these courts retain similarities: to implement the goals of victim safety and offender accountability among others (Labriola et al., 2010). Domestic Violence courts offer a collaborative model that supports the increased effectiveness of criminal justice response, a response focused on monitoring offender behavior and implementing swift sanctions for violence recidivism. An advantage of DV courts is their coordinated response connected to the community with a restorative approach (Kindness et al., 2009).

Traumatic brain injury.

Current literature reflects a need to consider new and innovative models for addressing domestic violence given expanding research on contributing factors to this crime (Howard, 2011).

Recent studies suggest there may be a link between brain trauma, aggression, anger, and the use of violence (Farrer et al., 2012; Kwako et al., 2011; Saout et al., 2011; Walling, Meehan, Marshall, Holtzworth-Munroe, & Taft, 2012). Traumatic brain injury (TBI) disrupts the brain's pathway for self-regulation (Walling, Meehan, Marshall & Holtzworth-Munroe, 2012; Warnken, Rosenbaum, Fletcher, Hoge, & Adelman, 1994). TBI is defined as an alteration in brain function or other evidence of brain pathology caused by an external force (Menon, Schwab, Wright, & Maas, 2010). The definition of mild traumatic brain injury (mTBI) includes traumatic brain injury (TBI) alterations and specifically when symptoms appear to resolve in a few weeks (Menon et al., 2010). Brain injury in the form of TBI or mTBI is associated with possible damage to temporal, frontal, and parietal lobes, resulting in residual symptoms (Duff, 2004). Some symptoms of TBI are impulsivity, anger and rage outbursts, impaired planning and problem-solving, concrete or rigid thinking, dissociation between thought and action, lack of insight, personality changes, and inability to self-regulate emotions (Duff, 2004). Turkstra, Jones and Toler (2003) found that violent crime correlated with a history of brain injury. Studies of intimate partner violence (IPV) perpetrators with a history of head injury, especially in the prefrontal cortex, have shown that the perpetrators have a significant inability to self-regulate strong emotions and to use adaptive response options. There also appears to be a lack of cognitive flexibility in these perpetrators that leads to altered behavior, and the perpetrators often solve unsettling situations by resorting to violence (Corvo, 2014; Damasio, 1995; Hoaken, Allaby, & Earle, 2007).

A valid concern is the effect of head injury on male DV offenders' ability to cognitively control emotions and on their behavior resulting from neurobiological conditions associated with brain trauma**.** Head injury often prevents conceptual learning integration and can inhibit positive

behavioral change. In light of current TBI literature and the impact TBI has on emotions and behavioral control, it is important to investigate the TBI factor further in efforts to effectively respond to and address domestic violence (Corvo & Dutton, 2015; Farrer et al., 2012; Howard, 2011; Kwako et al., 2011; Saout et al., 2011; Walling et al., 2012; Warnken et al., 1994).

Emerging fields for assessment and treatment.

Current research suggests the need to explore other types of assessment and intervention in response to domestic violence (Howard, 2011; Langlands, Ward, & Gilchrist, 2009). Studies of DV perpetrators have found that DV perpetrators have consistent difficulties with emotional and behavioral self-regulation, suggesting a biological connection (Pinto et al., 2010). In light of these findings, neurofeedback has been explored as a possible treatment in working with men who perpetrate domestic violence (Howard, 2011). Neurofeedback uses electroencephalography (EEG) to provide real-time displays of cortical brain activity (van Oustem, 2011). A computer-based program displays brain activity while an individual is connected to strategically placed electrodes (sensors) on their scalp to measure the frequency and amplitude of different brain waves (Thompson & Thompson, 2015; van Oustem, 2011). This process is usually understood as a form of operant or classical conditioning with reward. In the application of neurofeedback treatment, the reward is a generic movie that will continue to play when the individual's designated brain map areas are functioning efficiently. The movie stops or dims when there is brain wave dysfunction. In other words, the generic movie continues to play when cortical brain activity change occurs in the desired direction (van Oustem, 2011).

The initial point of assessment is a map of normal brain waves compiled from a large normative database of brain maps (Thatcher, 1998). The aggregate outcomes of a specific norm are then compared to the individual's brain map in a process of treatment indicating any standard

deviations from that specific norm compared to z-scores from a large database (Thompson & Thompson, 2015). Z-score neurofeedback methods have the goal of modifying the brain toward greater homeostasis and inhibiting extreme and unstable states (Thatcher, 2016). “Same age”, “left- or right-handedness”, and “eyes-open” or “eyes-closed” dictate the norm for the comparative brain wave map (Thornton & Carmody, 2009).The expected change is measured by comparing the pre- and post-brain maps showing the z-scores from an average of the specific established norm. Positive change as a result of neurofeedback treatment results in a reduction in z-scores toward the norm or efficient function of the individual’s brain map. The z-scores are derived from a large database of collected brain maps (Thatcher & Lubar, 2008). Diminished activity in the left frontal cortical area of the brain is an expected outcome of such neurofeedback treatment given that other studies have shown that anger leading to aggression has an effect in this area of the (Hortensius, et al., 2012).

Initial research findings have shown that traumatic brain injury rehabilitation with quantitative electroencephalography (qEEG) guided neurofeedback treatment can result in improvement of cognitive challenges such as problem-solving (Thornton & Carmody, 2009). This specific therapy has been found to positively affect thinking and emotional responses to negative cues, providing an option for offenders to alternatively choose constructive behavior rather than use violence toward a partner (Cornet, de Kogel, Nijman, Raine, & van der Laan, 2014; van Oustem, 2011). The qEEG brain map pre- and post-measures the shift to the norm and specifically compares the left frontal cortical and the right frontal cortical areas of the brain, a relevant method given that research suggests anger activity in left frontal area of brain is likely to lead to aggression (Hortensius, et al., 2012). The qEEG brain map indicates the shift or movement toward a normal optimizing performance for more efficient brain functioning

(Thompson & Thompson, 2015). Neurofeedback treatment, then, may improve an individual's brain functioning toward normal brain wave patterns, resulting in positive behavioral change (Heinrich, Gevensleben, & Strehl, 2007).

Interprofessional team approach.

An interprofessional team approach to IPV has been shown to provide effective support and to reduce costs (Leppäkoski, Flinck, Paavilainen, & Ala-aho, 2013). The interprofessional team approach, utilizing varied treatment modalities and the clinical expertise of multiple disciplines, is focused on treating both biological and cognitive issues, further facilitating the goal of cognitive behavioral change. The interprofessional team approach represents an innovative response to IPV; however, IPV response methodology remains primarily in the hands of the criminal justice system. Linking this type of response to IPV into the healthcare realm may provide opportunity for enhanced intervention and improved outcomes as its impact on health and health-related issues is well documented (Breiding et al., 2014).

The need to explore these innovative options with an interprofessional team approach for IPV is indicated as research has shown the current one-size-fits-all approach alone to have little to no effectiveness with offender intervention programs in response to DV (Cantos & O'Leary, 2014). A lack of interprofessional collaboration overall may well explain discrepancies within our current approaches (Cantos & O'Leary, 2014). DV courts have evidenced some progress in coordinated response to IPV and in facilitating focused and sensitive treatment for individuals arrested for domestic violence and entering the criminal justice system. A multifaceted team approach could combine the missing link of biological assessment and treatment with group intervention based on cognitive behavioral change as a potential comprehensive approach to informed IPV treatment.

Operational Definitions

Aggression

As an outcome of anger, can be described as violence that is psychological in nature or violence that is physical and that causes harm, death, or injury (Center for Disease Control and Prevention, 2016).

Anger

A myriad of physiological alarm responses, including escape and attack behaviors; a multidimensional construct (Norlander & Eckhardt, 2005).

DV/IPV Offender

A former spouse, boyfriend, girlfriend, dating partner, or sexual partner (Center for Disease Control and Prevention, 2014).

IPV Violence

Includes physical violence, sexual violence, stalking, and psychological aggression (including coercive tactics) inflicted by a current or former intimate partner (Breiding et al., 2014).

Neurofeedback

The frequency and amplitude of different brain waves recorded by small electrode sensors placed on the surface of the scalp; data is recorded and fed back to the individual to support conscious change in brain wave functions (Thatcher & Lubar, 2008; Thompson & Thompson, 2015).

Stress

The physiological reaction caused by the perception of aversive or threatening situations that may elicit a particular reaction or stress response (Carlson, 2010).

Limitations

The purpose of this research was to investigate the outcomes of neurofeedback (z-score) treatment and change in contributing factors of anger, aggression, and stress in a male sample arrested for misdemeanor domestic violence and court-ordered to complete a state-approved offender intervention program.

The present study measured the variables of anger, stress, and aggression, and qEEG Brain maps in a sample of men arrested for misdemeanor DV (court-ordered to DV treatment programs) as compared to men not receiving neurofeedback following arrest for MD DV and court-order to attend a DV intervention program.

Study limitations included the nature and size of the sample population. Males arrested for DV and court-ordered to complete a state-approved offender intervention program represent a potentially unpredictable population, leaving the study open to attrition. The present study did not include additional treatment or other financial incentive to prevent said attrition, as is possible with such open DV court-ordered programs. A larger sample size may have afforded statistical significance for generalization.

Research Hypotheses

Hypothesis 1.

Male DV offenders receiving neurofeedback treatment will show a significant shift in positive number of deviations from the norm between qEEG pre- and post-brain maps following neurofeedback compared to those who did not receive neurofeedback.

Hypothesis 2.

There will be a significant decrease in self-reported anger among male DV offenders receiving neurofeedback compared to those who did not receive neurofeedback.

Hypothesis 3.

There will be a significant decrease in self-reported feelings of aggression among male DV offenders receiving neurofeedback compared to those who did not receive neurofeedback treatment.

Hypothesis 4.

There will be a significant decrease in self-reported stress among male DV offenders receiving neurofeedback treatment compared to male DV offenders who did not receive neurofeedback treatment.

Significance of the Study

The present study was focused on investigating neurofeedback treatment in interprofessional response to domestic violence in a male sample arrested for DV. This is an emerging area of treatment for dysregulated brain electrical functioning and may be important to risk reduction in men who have a history of DV perpetration. The present study moved beyond one-size-fits-all responses to IPV and measured outcomes of neurofeedback treatment in a sample of males arrested for DV entering into a DV court and court-ordered to attend a Domestic Violence state-approved offender intervention program. The variables studied were anger, stress, and aggression, contributing factors to DV. Neurofeedback was explored as a modality to enhance the ability to self-regulate emotions and, thus, to support positive behavior change.

If the courts continue to treat DV male offenders with a one-size-fits-all treatment, then it is possible that harm will be inflicted on the offenders as needs are not being assessed and met (Cantos & O'Leary, 2014). New avenues must be explored to address this problem. In a comprehensive review of the literature, no research was found on neurofeedback treatment in response to IPV; however, limited research regarding neurofeedback use in the case of TBI

shows promise (Thornton & Carmody, 2009). Brain dysregulation is found to effect self regulation of emotions such as anger, aggression, and stress, which contribute to the perpetration of DV (Saoût et al., 2011). Neurofeedback is a potential treatment option to address brain dysregulation and potentially effect these contributing factors to domestic violence.

Conclusion

The heartbreaking waste of human potential and the enormous expense of DV are plagues in our communities and in the world. The Russian philosopher Dosteyovsky (1821- 1881) suggested that a society should be judged not by how well it treats its outstanding citizens but by how well it treats its criminals. At the national level and in Idaho, DV male offenders are commonly required to complete a year of a cognitive one-size-fits-all DV offender intervention program, resulting in many offenders having limited or no ability to effectively develop enduring positive behavioral changes, as evidenced by the current literature on outcomes of these types of programs (Corvo & Dutton, 2015; Farrer et al., 2012; Howard, 2011; Kwako et al., 2011; Pinot et al., 2010; Saout et al., 2011; Walling et al., 2012; Warnken et al., 1994).

Expanding treatment options for male DV offenders offers opportunity for improved response to IPV and, hence, improved outcomes. A qEEG brain map assessment followed by guided neurofeedback treatment may be an option for men arrested for DV given that current (although limited) research suggests an outcome of positive impact on behavior (Howard, 2011). The present study investigated the effectiveness of this innovative treatment modality in an interprofessional approach among a sample of men arrested and charged with misdemeanor (MD) DV who had entered the criminal justice system and who were required to complete an offender intervention program. Behavioral change is a key goal of DV treatment programs, and this study explored benefits of an interprofessional approach that included emerging fields for

assessment and treatment. Neurofeedback treatments may impact brain function and enhance the ability to self-regulate emotions (Thompson & Thompson, 2015). Behavioral change may be enhanced with the increased ability to self-regulate emotions such as anger, stress, and aggression.

Chapter II: Literature Review

Domestic violence (DV), also referred to as intimate partner violence (IPV), has been extensively studied and investigated in recent years. A literature review indicates that domestic violence as a national and global major public health and social problem is not disputed (Breiding et al., 2014; Campbell et al., 2010; Garcia-Morena et al., World Health Organization, 2005). Costs for domestic violence crime are estimated at 5.8 billion (National Center for Injury Prevention and Control, 2003). The vast majority of DV crimes in the United States are against women (85%; Rennison & Welchans, 2000). According to The National Intimate Partner and Sexual Violence Survey (2014), one in four women has experienced severe physical harm from a partner or ex-partner during her lifetime. The Idaho State Statistical Analysis Center (2013) issued data from 2007–2012 indicating 32,570 incidents of DV, almost one third (31.7%) of total violent crimes.

Healthcare and, in particular, nursing organizations such as the American Association of Colleges of Nursing (2016) and the American Nurses Association (2016) recognize DV as a significant health concern. Nurses should be aware of assessment methods and nursing interventions that will interrupt or prevent the cycle of violence (American Association of Colleges of Nurses, 2016). According to the Emergency Nurses Association (2016), emergency department nurses and forensic nurses can initially assess and provide assistance for suspected DV as well as identification of patients experiencing IPV (International Association of Forensic Nurses, 2016).

Even when properly assessed and identified, DV is not being effectively remediated. Based on current research, there has been limited success with offender intervention programs' stated objectives, particularly on recidivism; however, DV offenders continue to be mandated

into the one-size-fits-all, 26–52-week programs, or to a specific number of sessions in these group intervention settings (Cissner et al., 2015; Gover et al., 2003; Kindness et al., 2009). Relevant research has only begun to address disparate correlates and the need for more individualized treatment plans.

Stress, Anger, and Aggression Linked to IPV

A study on the effects of work stress and the spread into marital communication based on objective indicators found that stressed partners either withdrew or expressed more anger and hostility at home (Repetti, 1989). This is consistent with supporting literature on stressors governing strong negative emotions in intimate relationships (Bodenmann et al., 2010). Bodenmann (2005) found that stress was directly related to deterioration of martial interaction, and data observations revealed the quality of communication between couples decreased by 40% after stress was introduced. Frye and Karney (2006) reported both women and men were more likely to engage in physical or verbal aggression when stressed. Only men, however, were more likely to engage in physical aggression (IPV) under chronic stress conditions, especially when experiencing high levels of acute stress (Frye and Karney, 2006). Recognizing the link between stress and its effect on intimate partner relationships is an important consideration in IPV (Bodenmann et al., 2010).

The role of anger arousal in IPV seems obvious; logically, anger and aggression are causally linked (Tavris, 1989). Imagining a scenario in which an abusive male becomes intensely angry and assaults a female partner is not unthinkable (Anderson & Bushman, 2002); however, literature on anger and IPV is mixed. Advocates and researchers have warned against focusing on anger as a cause for IPV and have advocated for standards that explicitly outlaw or strongly discourage treatments that include anger control or anger management for DV offenders

(Gondolf, 2002). A segment of the literature suggested that anger management interventions would imply victim blaming and not account for abuse meant to exert power and control, giving communities a reason to not take responsibility for IPV and to perpetuate the batterer's denial. It has also been suggested that an anger focus would give DV offenders' new tools for coercing and controlling women and may put females at further risk for violence (Gondolf & Russell, 1986). These sentiments were echoed by the battered women advocates and state DV coalitions who lobbied successfully against the use of anger control treatments for mandated DV offender programs (Healey, O'Sullivan, & Smith, 1998).

Anger has been shown to interfere with spousal relationships (Repetti, 1989). Eckhardt, Samper, and Murphy (2008) conducted a study of 190 men recruited from a DV court who had been convicted of DV and mandated to complete a DV offender intervention program. The program participants completed a pretreatment questionnaire based on the emotional anger state. Eckhardt et al. (2008) reported data outcomes suggesting that intervention programs for partner-abusive men should consider anger; a sizable percentage of male offenders (estimated at one third) reported significant levels of anger concurrent with dysfunctional strategies for expressing anger. Such individuals have a complex profile of presenting problems, and their attrition from DV programs is a higher risk (Eckhardt et al., 2008). Anger alone is not an indicator of probable IPV; however, anger among IPV perpetrators has been studied, and the literature review indicates anger *is* a marker for an array of traits that should be considered in DV intervention programs (Bodenmann et al., 2010; Eckhardt et al., 2008). According to Anderson and Bushman (2002), anger plays a significant role in determining aggressive behavior. Research suggests that understanding the links among stress, anger, aggression, and IPV may provide effective options for DV offender treatment programs (Anderson & Bushman, 2002; Bodenmann et al., 2010;

Eckhardt et al., 2008).

Stress, the physiological reaction caused by the perception of aversive or threatening situations, has been shown to influence anger and possible aggressive reaction in men who perpetrate IPV (Norlander & Eckhardt, 2005). According to McCraty and Shaffer (2015), an individual under stress and anger will experience reduced or limited capacity to self-regulate and adapt to changing environments such as conflict.

Changes in Law Enforcement Response to Domestic Violence

Research shows that significant changes in DV response have co-occurred in law enforcement and in the judicial system (National Institute of Justice, 2009). Hamberger (2008) reviewed 25 years of IPV cases, specifically analyzing offender treatment, batterer characteristics. Mandatory arrest, according to Hamberger (2008), was one of the most important systemic changes to affect batterer treatment; it resulted in doubling the number of men arrested in the first year of policy employment and continued increasing arrest numbers for the following two years assessed. A community of 85,000, in an urban area saw an increase from one to three offender treatment programs put into place in the span of three years. In five years, the community saw an increase from three to five existing programs enrolling men for mandated offender intervention (Hamberger, 2008).

The US Judicial system continues to mandate DV offender intervention programs that are typically 26-52 weeks or a court-ordered number of sessions in length. DV programs, overall, are self-paid and based on a group interaction process. These offender intervention programs have proliferated in the United States as a result of mandatory and pro-arrest policies with marginal effectiveness, according to current research (Corvo et al., 2008; Dutton & Corvo, 2006; Feder & Wilson, 2005; Gondolf, 2011; Hamberger, 2008; Labriola et al., 2010; Murphy & Ting, 2010).

Many of these programs are based on cognitive behavioral change models. In a review of programs currently in place in the United States as of December 2013, 45 states have mandated DV programs with state-approved standards guiding implementation (Batter Intervention Services Coalition Michigan, 2013).

In an effort toward positive change, DV courts were constructed across the United States. They were meant to build on the reported success of drug courts and to address domestic violence and offenders of the crime. These courts were designed to keep victims safe, to hold offenders accountable, and to implement a coordinated community response among criminal justice entities and social agencies (Gover et al., 2003). Several studies analyzing DV courts have demonstrated small to modest benefits focused on a restorative approach such as offender intervention, among other options for treatment (i.e., individual counseling).

A study of 24 DV courts in New York indicated their modest positive impact on recidivism through the implementation of specific policies to increase victim safety, holding offenders accountable, and ordering offenders to group DV intervention programs (Cissner, Labriola, & Rempel, 2015). The same study of the 24 criminal DV courts during their first two full years of operation in New York State included 9,292 DV cases that were randomly selected from 37,174 available DV court cases (Cissner et al., 2015). As a comparative control group, DV cases from two full years prior to the opening of the DV courts were randomly selected. Individual cases from both groups were matched in propensity score and subdivided into four strata: New York City site, suburban sites, upstate mid-size cities, and upstate small city/semi-rural and rural sites. Three years post-conviction analysis revealed a slight positive effect on DV recidivism of 29 percent for DV court cases compared to 32 percent of non-DV court cases. In addition, processing time for DV cases was significantly reduced at 6.5 months compared to 8.6

months (Cissner et al., 2015).

Gover et al. (2003) conducted a quantitative analysis review of DV courts in Southern Carolina in a time-series analysis: 34 months before the DV court was established compared to the first 26 months after the DV court was implemented. Gover et al. (2003) found a significant positive effect on DV-related arrests increasing by 5.57 percent per month. Gover et al.'s (2003) study included an analysis of recidivism and was completed on 200 randomly selected DV court cases compared to 200 traditional court cases using a logistic regression model. Gover et al. (2003) also found that cases processed through the DV court system were significantly less likely to recidivate at 50 percent compared to 77 percent. Overall results from the logistic regression model provided strong evidence for the effectiveness of the DV court system (Gover et al., 2003). An analysis by Kindness et al. (2009) evaluated the pre- and post-adjudication behavior of 220 male DV offenders prosecuted in a DV court. The goal of identifying possible predictors for continued criminal behavior found that a significant predictor of DV recidivism was more than one report of treatment noncompliance—with 78 percent recidivating. Comparing seven-time offenders to offenders who had none, Kindness et al. (2009) found that law enforcement reports of two or more incidents were the strongest predictor of recidivism. This illustrates the importance of monitoring multiple dimensions of offender behavior, an advantage of the specialized DV court system (Kindness et al., 2009).

Victim Safety Response and Keeping Families Together

Current and long-term responses to domestic violence have focused on victim safety as a foremost goal. Providing safety for victims, and the desire of victims and offenders to keep families together, suggests the importance of DV offender assessment for recidivism risk factors as well as of evaluation regarding danger and lethality risk (Bradley & Gottman, 2012; Corvo et

al., 2008; Goodlin & Dunn, 2010). Using National Crime Victimization Survey data (1992-2004), Goodlin and Dunn (2010) analyzed the effects of household variables, victim characteristics, and incident characteristics of family violence patterns including single victimization, repeated victimization, and co-occurring victimization. Eighty percent of 4,331 family households experienced one victimization, 15% experienced repeat victimization, and 5% experienced co-occurrence of victimization (Goodlin & Dunn, 2010). Low risk for repeat victimization and the desire of victims and offenders to keep the family together and remain in the relationship were reviewed. An outcome of the research was a recommendation to IPV service providers to take into account factors affecting women's (victims') choices to sever or remain in their relationships (Messing, Ward-Lasher, Thaller, & Bagwell-Gray, 2015).

DV Offender Intervention Programs

Research has contributed to an increase in controversy regarding court-mandated DV offender assessment and treatment programs in contrast to the existing evidence of DV court effectiveness (with a presence currently estimated at 208 such courts in the United States; Labriola et al., 2010). There are little to no significant research findings related to mandated DV offender intervention programs decreasing IPV (Cissner et al., 2015; Gover et al., 2003; Kindness et al., 2009). In stark contrast, there is a significant amount of research substantiating a *lack* of effectiveness for mandated offender intervention programs (to which men arrested for DV are ordered, often through the DV court system).

Numerous literature reviews and meta-analyses of standard offender group intervention models indicate little or no positive change to violent behavior through mandated offender intervention programs (Breiding et al., 2014; Buttell & Carney, 2006; Corvo et al., 2008; Day et al., 2009; Hamel, 2012; Herman et al., 2014; Howard, 2011; Langlands et al., 2009; Murphy &

Ting, 2010). Offender intervention programs founded on the Duluth model have evidenced minimal to no reduction of recidivism (Corvo et al., 2008; Herman et al., 2014; Murphey & Ting, 2010). The Duluth model remains core to the controversy of DV offender programs. In their milestone review, Dutton and Corvo (2006) challenged the 30 years of public policy response to DV defined by activists as socially sanctioned dominance of women by men. Established in 1981, the Duluth Domestic Abuse Intervention Project (DAIP), also know as the Duluth model, created a treatment program for men who assaulted their female partners. The pro-feminist curriculum of the DAIP program was developed by activists in the battered women's movement (Pence & Paymar, 1993). According to Dutton, (2012) the Duluth model framework still persists and is a significant part of the controversy (Dutton, 2012).

In light of the DV program controversy, the Washington State Legislature directed the State Institute for Public Policy to conduct an analysis of national and international DV treatment literature and found similar DV program requirements in 25 other states—group-based intervention offender programs that incorporated elements of the Duluth model (Washington State Institute for Public Policy, 2013). The Institute found the intervention had *no* effect on DV recidivism (Washington State Institute for Public Policy, 2013).

Despite gains in intervention and IPV awareness, the patriarchal structure of the Duluth DV offender intervention model suggests a barrier to effective IPV intervention and continues to ensure women carry the larger burden of consequences (Messing et al., 2015). Dutton and Corvo's (2007) review of meta-analytic studies consisting of all available treatment outcomes at that time showed little to no positive effect for Duluth model-based DV intervention programs. Babcock et al. (2004) completed a meta-analytic review of 22 studies that evaluated treatment for DV male offenders, comparing the Duluth model versus Cognitive Behavioral Therapy (CBT)

offender intervention. Domestic violence recidivism rates indicated no significant change between groups, and there was no percentage effect between CBT and Duluth behavioral offender programs based on police records and/or victim reports. This comparative study is significant for DV program assessments and for further research.

Supporting broader DV assessment, Bradley and Gottman (2012) evaluated a psychoeducational intervention program designed to reduce IPV focused on low-income and situationally violent couples (with low levels of physical aggression) with encouraging results. This study of 155 couples indicated a reduction in IPV for couples taught skills for cultivating healthier relationships. Bradley, Friend, and Gottman (2011) further suggested identification of DV offender subgroups, rather than proffering one-size-fits-all treatment options, including relationship-focused treatment (Bradley, Friend, & Gottman, 2011). Such an approach may be possible if and when the DV concept of male offender assessment and treatment changes from the current model to a model that considers individual IPV risks based on thorough and comprehensive evaluation (Cantos & O'Leary, 2014). All male offenders do not present the same risk factors; therefore, one-size-fits-all treatment is likely inefficient regarding time and treatment costs (Cantos & O'Leary, 2014).

Additional studies have shown poor results for DV programs. Seventy-three abusive men participated in a qualitative DV offender intervention program study by Campbell et al. (2010). The focus of the study was exploring help-seeking behaviors and perceived benefit of offender intervention programs. Results indicated that, based on aggregate outcomes, only one-fourth of offenders felt the program was useful or helpful for addressing violent behavior. A review by Day et al. (2009) focused on the issues underlying the effectiveness of DV intervention programs and reported low percentage levels of program integrity. The authors found that a woman is only

5% less likely to be re-assaulted by a man who was arrested and attended a batterer's intervention program than a man who was simply arrested and sanctioned (Day et al., 2009). Herman et al. (2014) examined changes in 156 DV offenders' beliefs who participated in a Duluth model batterer intervention program, with a nine-year follow-up. Over one-third of the participants had re-offended, and, at program completion, there were no decreased levels of recidivism when defined as committing any violent crime (Herman et al., 2014).

Current research supports concerns regarding success rates for DV programs. A meta-analytic review of four experimental and six quasi-experimental studies using matching or statistical controls found modest effects, harmful effects, and zero effects for victim reported outcomes, which brings into question the value of DV offender mandated programs (Feder & Wilson, 2005). McClure (2013) studied records of 244 defendants who were either court ordered or who volunteered for DV treatment, finding that volunteers were less likely to recidivate. Bowen et al. (2008), in a preliminary United Kingdom study of 52 male DV offenders, had similar results, indicating program completers achieved limited significant psychological change and that that change had no association with re-offending. Buttell and Carney (2006) evaluated a 26-week batterer intervention program through 850 DV offenders assigned to two groups completing the course. The study found neither group improved significantly on targeted constructs in treatment.

Research evidence supports assessment and treatment models other than the current Duluth or mixed model method that appears to be entrenched in the judicial systems' response to IPV. Another, more valuable approach in this field is Moral Recognition Therapy (MRT), which is based on making deliberate and conscious moral decisions. According to a meta-analysis by Ferguson and Wormith (2012), 33 MRT programs found recidivism rates for MRT-treated

offenders at 26 percent and untreated offenders at 41 percent, showing some promise for effective change. MRT has treated over one million individuals and continues to gain ground in effectiveness (Correctional Counseling, Inc., 2010). Hamberger (2008) suggests a model based on thorough assessment and evaluation of the offender to determine which treatment works best with which client and under what circumstances. A comprehensive model incorporating and addressing health history, assessment of IPV risk factors including TBI, individualized treatment approaches, and evaluation of contributing factors such as substance abuse would be a step forward for effective, result-focused treatment (Bradely et al., 2011; Hamberger, 2008).

Traumatic Brain Injury and Domestic Violence

Increasingly, the research community is investigating other factors contributing to IPV, and there is significant evidence of brain injury connected to aggression in male IPV offenders (Howard, 2011). Early research by Rosenbaum and Hoge (1989) set the stage for assessing contributing factors for IPV, moving beyond the traditional approach based on male dominance in IPV. In a study of 31 consecutive male patients referred for evaluation of marital violence, 61.3% were found to have histories of severe head injury (Rosenbaum & Hoge, 1989). Turkstra et al. (2003) added evidence from a study of 40 African American males: 20 were convicted of violent crimes and 20 had no convictions (Turkstra et al., 2003). Fifty percent of participants had experienced a significant TBI, connecting brain injury as a possible factor in violence (Turkstra et al., 2003).

A meta-analysis found prevalence of traumatic brain injury among DV offenders at approximately 54% to 60% (Farrer et al., 2012) as compared to among nonviolent men at 16% to 25% (Pinto et al., 2010). Ninety-three percent of head-injured abusers had endured their injury prior to their first occurrence of marital abuse, and 74% of those men had received their head

injury before 16 years of age (Rosenbaum et al., 1994). Marsh and Martinovich (2006) also investigated the prevalence of head injuries among abusers and found similar results. Consistent with Rosenbaum et al. (1994), in Marsh and Martinovich's (2006) study, 58% of offenders reported at least one head injury prior to 16 years of age or as a precursor to the use of violence in an intimate relationship.

American football in recent years has been at the forefront of the discussion and research of long-term brain injury effects (Amen et al., 2011). One hundred active and former National Football League players provided a clinical history and underwent brain SPECT imaging and qEEG brain mapping with results showing elevated slow waves in the frontal and temporal regions of the brain (Amen et al., 2011). These areas of the brain involve the ability to self-soothe and regulate emotional responses (Thompson & Thompson, 2015). Warnken et al. (1994) found equivocal evidence of increased risk for battering among head-injured males at risk for DV in a study of 33 head-injured men and 42 orthopedically injured men. A meta-analysis by Farrer et al. (2012) comprising six studies and 222 subjects found that 53% (119) of the IPV offenders had a history of TBI, indicating the prevalence of TBI among IPV perpetrators is significantly higher ($p < .0001$) than the prevalence of TBI in the general population. Aggressive behavior after a TBI is supported by substantial research suggesting significant evidence compelling the judicial system to consider implementing new and more effective DV assessment and treatment (Ali & Naylor, 2013; Pinto et al., 2010; Saout et al., 2011; Tateno, Jorge, & Robinson, 2014; Walling et al., 2012).

Aggression resulting from a TBI may indicate support for more effective assessments for DV offenders. Tateno et al. (2014) assessed aggressive behavior in 89 patients with TBI and 26 patients with multiple traumas without TBI using the quantitative Overt Aggression Scale as a

measure of aggression. Aggressive behavior in this study was associated with frontal lobe issues, poor social functioning, and a history of substance abuse. In this study, post-TBI aggression was significantly more frequent ($p = 0.03$) among TBI patients than among the control group (Tateno et al., 2014). In addition to possible aggression following a TBI, there is probable impact on the executive function of the brain, where decision-making, goal setting and self-regulation occur (Corvo, 2014; Hart & Evans, 2006; Marsh & Martinovich, 2006). Marsh and Martinovich (2006) analyzed 22 TBI male offenders compared to 16 non-TBI offenders and found that the group that had experienced TBI scored poorly on current IQ measures and in executive functioning measures as compared to the control group with implications of a reduced ability to self-regulate strong emotions.

Emerging Fields and Innovative Methods

Review and assessment of DV offenders currently relies primarily on law enforcement and prosecutors, with psychological assessments often ordered by a judge. Given that TBI has been recognized in the literature as a risk factor for IPV, this suggests an emerging area of study with limited research (Howard, 2011; Pinto et al., 2010; Walling et al., 2012). Comprehensive assessment and evaluation is needed in IPV cases. Neurofeedback has been presented as an assessment and treatment option for DV offenders who enter the judicial system (Howard, 2011; Thornton & Carmody, 2009) as has the qEEG brain (Howard, 2011; May, Benson, Balon, & Boutros, 2013). Neurofeedback treatment guided by a qEEG brain map has shown significant improvement for TBI in reduction of standard deviations from the norm in a literature review of 22 primary research examples (May et al., 2013). Other research has resulted in similar findings and recommendations for individualized, comprehensive assessment and treatment in DV cases (Duff, 2004; Howard, 2011; Thornton & Carmody, 2009).

Tailoring treatment to the individual rather than making the individual fit the existing predetermined treatment necessitates an evidence-based model (Cantos et al., 2014). Assessment of substance abuse and drug and alcohol misuse and abuse should be included in any assessment as these are known risk factors for IPV and because there is a well-established link between alcohol, illicit drug use, and IPV (Easton et al., 2007; Fals-Stewart & Stappenbeck, 2003; Leonard & Jacob, 1988). In a pilot study of 78 offenders, participants were randomly assigned to a CBT-based substance abuse DV program or a twelve-step facilitation group; greater reduction in frequency of violence was found in the substance abuse DV program (Easton et al., 2007). A longitudinal diary study of IPV suggested violent incidents were significantly higher on days of alcohol use (Fals-Stewart, 2003). The link between alcohol and physical aggression was found to be significant in individuals who consumed substances; they were more likely to engage in IPV, suggesting that intoxication facilitates violence (Chermack & Taylor, 1995; Leonard & Jacob, 1988).

New Directions for Treatment

The judicial system's narrow focus on one-size-fits-all DV intervention treatment does not support the existing literature that indicates the need for a much broader range of programs addressing risk factors for IPV: psychosocial, psychological, and neuro-psychological (Babcock et al., 2004; Cantos & O'Leary, 2014; Corvo & Dutton, 2015). Hamel (2012) suggested using a systemic model, including best practice, evidence-based treatment after assessment of broader risk factors for IPV. IPV offender sub-group assessment has been suggested, allowing for DV treatment to meet a condition or unique situation for most effective treatment (Bradley et al., 2011). Research on the one-size-fits all DV treatment model provided little evidence to justify the current legal system practice of mandating all DV offenders to psychological programs

addressing power and control issues (Cantos & O'Leary, 2014). Researchers consistently encouraged the consideration of other models as traditional therapies and IPV offender treatments are becoming increasingly informed by neuroscience (Corvo, 2014; Corvo & Dutton, 2015; Corvo et al., 2008; Howard, 2011).

Theoretical Framework

There is a need for all intervention programs to be based on a coherent and empirically sound theory or theories of causation regarding DV behavior; a foundation in sound causation theory is critical for DV program effectiveness (Andrews & Bonta, 2004; Cooley-Quille & Lorion, 1999).

Biopsychosocial theories provide a framework for integrating complex theoretical pathways into focused research on outcomes of intervention aimed at behavioral change (Clark, Lissel, & Davis, 2008). The biopsychosocial theory of DV perpetration is a theory that encompasses biological and social elements contributing to domestic violence (Corvo & Dutton, 2015). Biological influences, such as alteration in neurological chemicals of the brain and environmental exposure, can combine to impact behavior and the psychological self and can ultimately result in aggression or violence (Corvo & Dutton, 2015).

Mild TBI is a biological issue and behavior resulting from head injury that can influence risk factors for DV (Howard, 2011). Impaired self-regulation, poor impulse control, and poor judgment are noted outcomes of mTBI and are factors associated with risk factors for domestic violence (including stress, anger, and aggression; Howard, 2011). Biological factors such as neurological chemicals and environmental exposure can combine to cause changes in the psychological domain of anxiety and depression. It is also noted that a significant number of men who perpetrate violence have experienced violence in their childhood home and related social

links (Corvo & Dutton, 2015). The biological changes that can occur in the case of brain injury, changes that influence behavior and impact psychosocial abilities, are recognized in the literature (Howard, 2011). The biopsychosocial impacts of a head injury can cause changes in the brain, influencing behavior that is *further* influenced by psychosocial life experience—resulting in reduced executive function specifically, the ability to self-regulate Chen et al., 2003; Marsh & Martinovich, 2006). The effects of social or environmental influences in life can cause partner-abusive men to selectively attend to perceived threatening stimuli, causing them to fail to recall the essential skills that assist an individual in talking calmly through an issue (Howard, 2011).

Application of individual and biopsychosocial theories has had the most influence on rehabilitation interventions for offenders (Day et al., 2009). These theories levied at the individual level identify the offender as the unit of analysis; the behavior and the "offending" are explained as an intra-individual process of affect, cognition, and behavior (Day et al., 2009). Biopsychosocial theories around DV are focused on the individual and applied in the present study by exploring an intervention that can potentially influence the impact of social, biological, and psychological experiences of an individual through neurofeedback. The ability to respond effectively to the growing problem of domestic violence at the individual brain function level and to support restorative justice approaches that shape measurable change via the use of neurofeedback offers a potential for positive change.

Operant Learning Theory is based on the concept that behavior operates on and is maintained by its consequences (Wood & Alderman, 2011). Neurofeedback is a type of learning that involves operant conditioning of brain wave activity by rewarding the production of certain EEG patterns with increased probability that the individual's brain will produce the patterns again, resulting in potential change in brain function (Thompson & Thompson, 2015). The

probability of any specific behavior occurring again may be dependent on reward of positive or negative reinforcement or on the withholding of an expected reward. The positive reinforcement hypothesis states that behaviors are maintained by and reinforced by preferred activities (Mace, Page, Ivancic, & O'Brien, 1986). An operant model provides a conceptual framework to understand reinforcement and how it contributes to both development and maintenance of challenging behavior (Wood & Alderman, 2011). Neurofeedback treatment is an approach founded on operant learning as it provides positive rewards when the brain functions efficiently and withholds rewards when the brain is inefficient (Thompson & Thompson, 2015).

It is essential that DV research incorporates new and expanding research into the theoretical view of perpetration to establish evidence-based assessment and effective interventions for DV offenders. The theoretical framework of the present study integrates complex biopsychosocial theories and applies them to DV perpetration. Individual operant learning theory is utilized in the present study as a framework for influencing behavioral change with neurofeedback treatment known to reduce factors contributing to DV. The framework helps to connect the biological changes occurring with brain injury and the psychosocial influences on individual behavior with the outcomes of the neurofeedback treatment.

Conclusion

The literature provides a foundation and prescriptive need for further research in these new areas of DV offender assessment and treatment. Options for effective assessment and treatment of DV male offenders are available, and empirical evidence regarding current DV treatment program *ineffectiveness* suggests a need for exploring such options for assessment-driven treatment of DV offenders. The literature is limited in considering the use of neurofeedback intervention in response to IPV arrest and in addressing risk and factors

contributing to violence. Limited research has been done in the male DV offender population on alternative options to DV intervention following arrest for IPV. There is also limited research on providing individualized approaches in this aggregate. The present study measures outcomes of treatment utilizing neurofeedback through qEEG pre- and post-brain map and measures pre-post risk factors that can contribute to IPV (as elicited in the literature) including stress, anger, and aggression. The present study provides data addressing this gap and provides further evidence of potential options for individualized IPV intervention to ameliorate the devastating outcomes of DV and the costly and heartbreaking effects on families, communities, and the world.

Chapter III: Research Approach

The recidivism rate for intimate partner violence (IPV), also known as domestic violence (DV), remains high, estimated at 39% in the United States (Bowen, Gilchrist, & Beech, 2008; Dutton & Corvo, 2006; Herman, Rotunda, Williamson, & Vodanovich, 2014; McClure, 2013). Current research has shown the one-size-fits-all court-mandated IPV offender treatment program approach to be ineffective—even harmful (Babcock et al., 2004; Day et al., 2009; Feder & Wilson, 2005; Hamel, 2012; Washington State Institute for Public Policy, 2013). The present study moves beyond one-size-fits-all responses to IPV and measures neurofeedback treatment outcomes focused on DV-associated correlates in a sample of males arrested for DV, entering a DV court, and court ordered into a state-approved offender intervention program.

Neurofeedback is not a new treatment modality; it has been a research subject for several decades and has proven to help individuals consciously control their brain waves (Marzbani, Marateb, & Mansourian, 2016). Walker and colleagues (2001) found qEEG-guided treatment/training to be effective in remediating symptoms of post-concussion head injuries, such as anger and aggression, with significant improvement (>50%) in 88% of 26 patients (Walker, Norman & Weber, 2001); however, there seems to be a dearth of research utilizing neurofeedback treatment among males arrested for DV.

The purpose of the present study was to perform a randomized treatment/control experiment investigating the outcomes of LORETA (low resolution electromagnetic tomography) neurofeedback treatment on recognized factors contributing to DV. The sample population comprised males arrested for misdemeanor DV who were compliant with a court-ordered DV program.

The hypotheses addressed by this study were as follows:

1. Male DV offenders receiving neurofeedback treatment will show a significant shift in positive number of deviations from the norm between qEEG pre- and post-brain maps following neurofeedback compared to those who did not receive neurofeedback.

2. There will be a significant decrease in self-reported anger among male DV offenders receiving neurofeedback compared to those who did not receive neurofeedback.

3. There will be a significant decrease in self-reported feelings of aggression among male DV offenders receiving neurofeedback compared to those who did not receive neurofeedback treatment.

4. There will be a significant decrease in self-reported stress among male DV offenders receiving neurofeedback treatment compared to male DV offenders who did not receive neurofeedback treatment.

Study Design

The study design comprised a randomized treatment and control to test the efficacy of neurofeedback treatment and factors contributing to DV—stress, anger, and aggression—in a male sample of men arrested for DV, entering a DV court, and entering a state-approved offender intervention program. The sample consisted of males arrested for misdemeanor DV. Twenty-five men volunteered to participate in the study through a court-approved DV educational program. Twenty-one volunteers appeared for their initial appointment. The researcher addressed questions and concerns and provided a consent form. Each participant completed a demographic page, and the researcher used instruments to measure anger, aggression, and stress. The researcher collected a qEEG baseline brain map from each participant. Participants then selected a sealed envelope with random group assignment that randomly placed them in either the treatment group or the nontreatment group. Ten participants randomly selected the treatment

group, and eleven randomly selected the nontreatment group. Sixteen participants completed both pre- and post-qEEG brain maps and pre- and post- questionnaires. Of these, six participants completed 10 hours each of neurofeedback live *z*-score treatment (brain training), and ten participants completed the nontreatment group protocol. Five participants were lost to attrition. The dependent variables included measurements taken from the pre-frontal, frontal, and temporal sides of the participants' brains. The researcher took measurements with participant eyes open and closed.

Ethical Considerations

Research studies require ethical standards, especially when using human subjects. For the present study, the researcher solicited voluntary participation and provided informed consent. The researcher ensured participants avoided harm. The researcher protected participants' privacy by keeping all identifiers confidential. Further, the researcher ensured integrity and quality of data by pursuing accurate collection methods and precise methodology. Ultimately, the researcher safeguarded the present study with independence and impartiality by applying for a full review by the Idaho State University Internal Review Board (IRB). The IRB granted full approval prior to research or data collection. Due to attrition, the IRB granted a second approval for a retrospective analysis of data collected in the initial implementation of the study comprising an exploratory pre-post comparison using paired sample *t* tests individually for both groups (see Appendix A, IRB Approval.).

Sample

The researcher invited males arrested for misdemeanor (MD) domestic violence, entering a DV court, and court ordered to attend a state-approved offender intervention program in the urban Pacific Northwest, US, to participate in this study. The Idaho Legislature defines

"misdemeanor domestic violence" as comprising a household member who commits an assault on another household member; when the assault does not result in traumatic injury, the assailant is guilty of a misdemeanor domestic assault (Idaho Legislature, 2018). All participants in the present study were charged with misdemeanor domestic violence. The researcher presented an overview of this study to approximately 100 (*N=100)* potential participants in small groups of 6-10 men. The researcher addressed questions and concerns at the end of each presentation. These DV groups were open groups, as males entered and graduated according to their individual court orders. The researcher provided their contact information to each group. Those who were interested in participating in the study made appointments for inclusion/exclusion assessment. The researcher made assessment appointments with potential participants and conducted further research at a private counseling clinic with 24-hour security.

Inclusion criteria comprised males aged 18–65 years who had been arrested for DV and who were compliant in an established state-approved offender intervention program. Exclusion criteria comprised individuals with chronic alcohol or drugs use, reported epilepsy, or reported mental disorders. Neurofeedback may not be an appropriate treatment for participants with these conditions according to Thompson and Thompson (2015).

Once the researcher determined participant eligibility, the researcher provided informed consent forms to participants. The researcher assigned each participant a code to ensure confidentiality. The researcher stored participants' names in locked files at all times. Twenty-five men volunteered, and 21 appeared for their appointments. Through the process of random assignment, ten participants were randomly assigned to the treatment group, and 11 participants were assigned to the control group.

Outcome Measurement Instruments

Anger.

Self-reported anger questionnaires utilizing the Clinical Anger Scale (CAS) quantified participants' "anger." The CCAS consists of 21 questions scored on a four-point Likert-type scale (Snell, 1997). The scale consists of the following measures: A = I do not feel angry, B = I feel angry, C = I am angry most of the time now, and D = I am so angry all the time that I can't stand it. Values assigned to the four measures are as follows: A = 0, B = 1, C = 2, and D = 3. The four measures in each section vary in demarcation of symptom intensity, with higher scores corresponding to greater clinical anger. The CAS is a well-established tool that has been used to measure an array of psychological, physiological, affective, cognitive, motoric, and behavioral symptoms contributing to clinical anger (Snell Jr., Gum, Shuck, Mosle, & Hite, 1995). Rothenberg (1971) verified the reliability and validity of the CAS in previous studies regarding therapeutic work and violent behavior. In the present study, the researcher analyzed the internal consistency for the 21 items on the CAS by means of Cronbach's alpha, which yielded a reliability coefficient of .94 (Snell et al., 1995).

Aggression.

The Buss Perry Aggression Questionnaire (BPAQ; Buss & Perry, 1992) quantified "aggression" in the present study; the BPAQ consists of 29 questions and includes four individual measures of aggression: Physical Aggression (PA), Verbal Aggression (VA), Anger (A) and Hostility (H). Individuals respond to questions on a five-point Likert-type scale where 1 = extremely uncharacteristic of me to 5 = extremely characteristic of me (Buss & Perry, 1992). This tool has shown strong psychometric properties and has demonstrated internal consistency and stability over time (Buss & Perry, 1992). In the present study, the researcher found reliability

to be adequate and concurrent validity to be supported by high correlations between subscales (Diamond & Magaletta, 2006).

Stress.

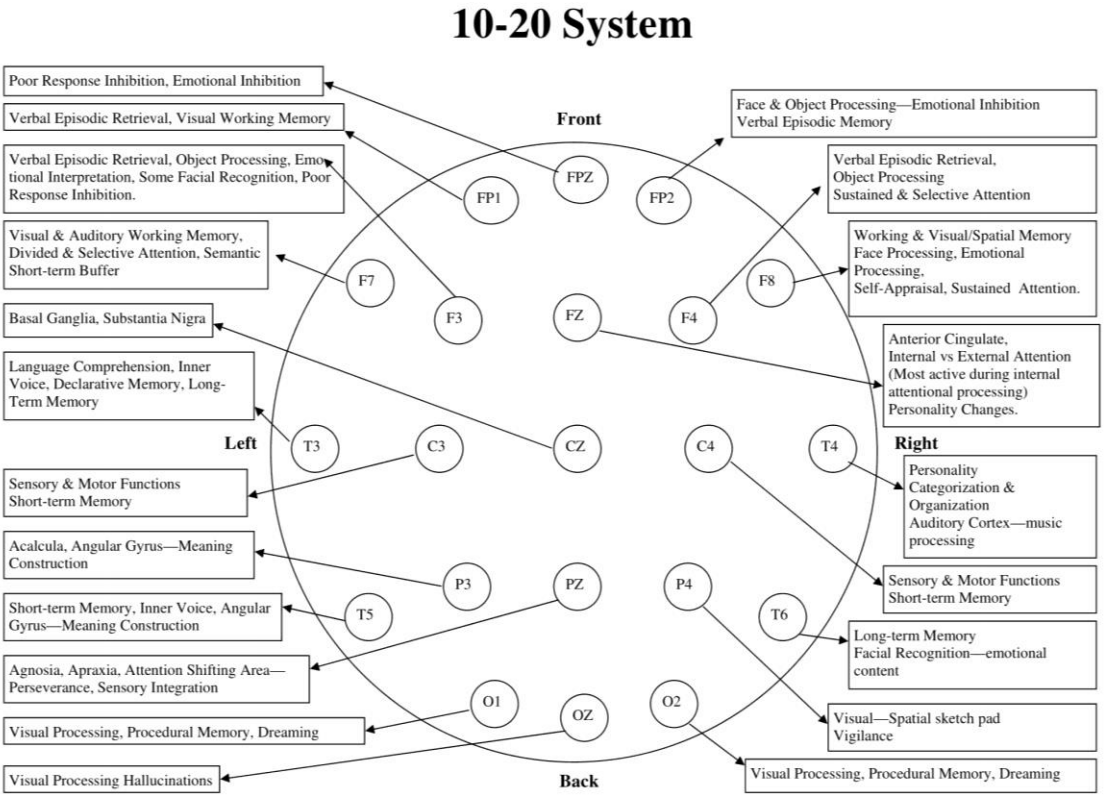
The Perceived Stress Scale (PSS), a questionnaire about feelings and thoughts, is a psychological instrument widely used for measuring perception of stress (Cohen & Williamson, 1988). The PSS uses a Likert-type scale of reverse scoring for positive statements and summing across all scale items to provide pre-post comparison (Cohen & Williamson, 1988). The PSS quantified "stress" in the present study (Cohen & Williamson, 1988), comprising ten questions measured on a Likert-type scale. The ten questions are about feelings and thoughts and how often a person feels a certain way. The researcher obtained scores by reversing responses to the positively stated questions with items 1, 2, 3, 6, 9, & 10 valued at, 0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, and 4 = very often. The researcher reversed coded items 4, 5, 7, and 8. The reliability and validity of the PSS have been reported in previous studies, such as Cohen and Janicki-Deverts (2012). In the present study, the reliability of α=.84 -.86, and the validity correlation of the PSS to other measures with similar symptoms ranged between .52 - .76 (Cohen et al., 1988).

qEEG brain map.

The researcher utilized a qEEG (quantitative electroencephalogram) brain map to individually measure pre-post brain function for both the treatment and control groups. (See Image 1, Electrode Placements.) The researcher collected the qEEG brain maps using q20 Neurofield equipment for both treatment and nontreatment groups. NeuroGuide software (FDA 510K, K041263) includes LORETA Z-score (low resolution electromagnetic tomography) software for neurofeedback treatment and brain maps. QEEG brain map reliability and validity

has been established (Duff, 2004). Data collection in the present study consisted of standard seven-minute eyes open and eyes closed protocol, sampled at 256 Hz, using international 10/20 system electrode placement. Each strategically placed electrode captured brain wave information recorded in the computer program. The researcher manually removed data such as eye blinks, eye rolls, and heartbeats to ensure brain map accuracy.

There were two measurement categories: (1) amplitude or power at different frequencies and (2) network measures indicating deviations from a comparative normative brain wave maps database. The researcher calculated brain wave averages by participant age and left or right-handedness and then compared this data to a large database of normative brain maps (Thatcher & Lubar, 2008).



Brain Wave Frequency Simple Description

Delta waves are most common when sleeping, but can also be active if there has been head injury or other significant trauma. The brain goes into sleepy mode in order to heal, unfortunately it can sometimes get stuck in those patterns.

Theta waves are also slow waves, and are often associated with twilight states such as that between sleep and wakefulness. It is abnormal in awake adults and pre-dominant in children with ADD/ADHD. If Theta waves are particularly active when awake it may feel 'foggy', making it hard to focus and concentrate.

Alpha waves are associated with an ability to self-soothe and resolve trauma/stress. We should have alpha waves very active in the back of our heads when our eyes are closed. Having very active alpha with eyes open and/or in other parts of the brain may feel 'spacey'.

Beta waves are the fastest and most active form of brainwave, and is associated with focus and concentration. It dominates our normal waking state, has been subdivided into Low Beta, beta and high beta. **Low Beta** is characterized as a relaxed, but alert state. **High beta** may be described as a hyper-alert state, sometimes leading to tension, anxiety and agitation.

Image 1. Illustration Electrode Placements.

The qEEG brain map measured Delta, Theta, Alpha, Beta, and High Beta brain wave

frequencies. The researcher measured brain waves in HZ (Hertz-cycles per second), ranging as follows: Delta 1-3 HZ, Theta 4-8 HZ, Alpha 8-13 HZ, Beta 13 -20 HZ, and High Beta 24-36 HZ. Delta waves are slow and generated in deepest, dreamless sleep. If Delta waves are too high, then the person is in a sleepy state and not in an efficient brain state. Theta waves surface in a meditative state or twilight state, and, if waves are too low, then there may be issues of the person not being able to sleep. Alpha waves indicate alertness, a sense of well-being, and calm feelings. Beta waves comprise a normal waking state, and, if not measuring in the normal range, then a person's cognitive tasks become challenging. High Beta waves can be described as constituting a hyper-vigilant state, sometimes leading to tension, anxiety, and agitation. High Beta waves may also result in panic, ruminating thoughts, and catastrophizing (Thompson & Thompson, 2015). The present study focused on High Beta waves.

Data Entry and Management

The researcher placed the completed questionnaires and results from the qEEG brain maps in research files and locked the files in a file cabinet. The researcher entered data in an Excel spreadsheet on secured and password-protected computers. Identifying information included, solely, participants' codes, which were necessary to identify whether a participant was part of the treatment or control group; the researcher kept the master name list in a separate, locked file cabinet.

Analysis

The researcher analyzed data using Statistical Package for the Social Sciences (SPSS) software. The researcher conducted evaluation for the effect of neurofeedback on the various outcomes of interest by comparing pre-scores to post-scores using a series of dependent sample *t* tests. By mirroring analyses for both groups, outcome differences between the treatment and

nontreatment groups could be used to rule out external reasons for change in qEEG, stress, anger, or aggression values. To this end, if any values showed similar pre- to post-changes in both the treatment and control groups, it would be unlikely that such a change would be due to intervention. Conversely, changes in the treatment group that were not present in the control group would be considered evidence that the change was related to the treatment and not to an external effect.

The researcher compared pre- to post-differences by analyzing qEEG brain maps from both collection periods; this was completed individually for the treatment and nontreatment groups according to z-scores for the identified brain areas. The brain areas targeted in this study were FP1, FP2, F3, F4, T3, and T4. The researcher conducted the same procedure for stress, anger, and aggression scores, sorting data into a subset of only treatment or only control observations. The researcher used a series of individual dependent sample *t*-tests to measure differences for either group. The researcher repeated each pre- to post-comparison for either group so that any significant pre- to post-differences for one of the two groups could be reviewed in reference to the other group, allowing the researcher to determine whether significant differences were global or restricted to the treatment group only. The assumptions of the dependent sample *t* tests included normality, equality of variance, and absence of outliers. Based on the results of Shapiro-Wilk tests, Levene's test, and a preliminary outlier assessment, the assumptions of normality, equality of variance, and absence of outlines, respectively, were met. Result details for the present study follow in chapter four.

Data Collection

Following inclusion/exclusion assessment and informed consent, the researcher scheduled all participants to appear, at independent times, for an initial brain map and completion

of instruments measuring anger, aggression, and stress in addition to a demographic page. Participants completed a demographics questionnaire. Participants completed pre- questionnaires (anger, aggression, and stress) while sitting in a private office at a clinic in Eastern Washington. The researcher collected pre-qEEG brain maps from each participant through Q20 amplifier and Neuroguide software. The researcher used office space at the clinic for privacy and participants' comfort.

Randomization Protocol

Following pre-qEEG brain map and pre-questionnaire completion (designed to measure stress, anger, and aggression levels), each participant selected a sealed envelope from a clinic staff person. The envelope contained a slip of paper indicating assignment to either the treatment or control group. The researcher of the present study was not involved in the random placement process for group assignment.

Intervention: neurofeedback

Treatment group participants (n=10) each completed 10 one-hour neurofeedback sessions. The researcher scheduled the participants' sessions over a five- to six-week time period, two to three times a week at the convenience of each participant. The researcher conducted participants' neurofeedback treatment in a quiet room with participants sitting in a comfortable chair. The researcher matched treatment sessions to time of day as closely as possible across participants.

Neurofeedback treatment guided by qEEG brain mapping involves using a stretchable cap containing 19 sensors strategically placed (according to the International 10/20 System) on the subject's scalp (Jasper, 1958). During neurofeedback treatment, the EEG records various components of brain wave electrical activity and real-time data feeds back to the individual

through an audio and/or visual program, such as a generic movie (Marzbani et al., 2016). In the present study, the feedback loop comprised both audio and visual cues—a participant-selected movie (DVD). The movie continued to play when brain function improved; if no improvement occurred, then the movie dimmed or stopped.

LORETTA neurofeedback is considered "operant conditioning," as the individual is literally reconditioning his or her brain (Hammond, 2011). Operant learning is based on a reward system; in the present study, the movie continuing to play was the reward. Walker and colleagues (2001) found qEEG-guided treatment/training to be effective in remediating symptoms of post-concussion head injuries with significant improvement (>50%) in 88% of 26 patients (Walker, Norman, & Weber, 2001).

The strategically placed electrodes record brain waves and sort different types of brain frequency waves. The software compares the recorded waves to a normative distribution database, calculating Z-scores for each participant's brain map. The software calculates Z-scores from a normative database of brain maps (Thatcher, 2016).

During neurofeedback treatment, extreme Z-scores are not reinforced and, thereby, are minimized by the operant learning procedure in the direction of =0 (Thatcher, 2016). Z-score biofeedback methods are unified in the goal of modifying the brain toward greater homeostasis and inhibiting unstable and extreme states. Z-score biofeedback tends to have the greatest impact on unstable or dysregulated neural systems.

Chapter IV: Results

The purpose of the present study was to evaluate the outcomes of neurofeedback—which are noninvasive forms of intervention biofeedback—on recognized contributing factors to domestic violence (DV), including anger, aggression, and stress, and to evaluate any change in the qEEG brain map pre- to post-. The researcher initiated the study using a randomized controlled study design to compare male DV offenders placed in a treatment (i.e., experimental) and control (i.e., nontreatment) group. All offenders were ordered to attend a DV offender intervention program in the state and were compliant in the court-ordered DV psycho education court-ordered program they were attending. The researcher made multiple presentations introducing the research project to the DV groups, and offenders were invited to participate in this study.

Twenty-one men showed up for appointments and provided informed consent. The researcher collected pre-data questionnaires (regarding stress, anger, and aggression) and qEEG brain maps. Following the pre-data collection, each participant selected a sealed envelope containing either a control or treatment assignment. Eleven men randomly selected an envelope with assignment into the control group while ten men randomly selected the treatment group envelopes. Following participant treatment, the researcher collected post questionnaires (regarding anger, stress, and aggression) and qEEG brain maps. In the three months following the treatment of the last volunteer participant, the researcher continued participant solicitation presentations at the DV groups, but no new participants volunteered; the supervisor of this research project advised closure of the study due to sample pool exhaustion. Based on attrition in the study, the researcher and her supervisor determined that a randomized control treatment study could not be completed based on power analysis; therefore, the researcher moved forward with

IRB and full committee approval for pretest-posttest analysis of the established treatment and control groups.

This chapter presents results related to the following hypotheses:

1. Male DV offenders receiving neurofeedback will show a significant shift in the positive number of deviations from the norm between the qEEG pre- and post-brain maps following treatment compared to those who did not receive neurofeedback.
2. There will be a significant decrease in self-reported anger among male DV offenders receiving neurofeedback compared to those who did not receive neurofeedback.
3. There will be a significant decrease in self-reported feelings of aggression among male DV offenders receiving neurofeedback compared to those who did not receive neurofeedback treatment.
4. There will be a significant decrease in self-reported stress among male DV offenders receiving neurofeedback treatment compared to male DV offenders who did not receive neurofeedback treatment.

The present study analysis included a pretest posttest of the two groups, treatment and control, to test the efficacy of neurofeedback on brain functioning and contributing factors to DV. The study targeted specific areas of the brain in the neurofeedback treatment provided. The areas of the brain targeted focused on the executive function, decision-making, and self-regulation. The ability to self-regulate emotions such as anger, stress, and aggressive thoughts were of interest as DV factors. These areas included the frontal and right and left temporal of the brain. The identifiers on the qEEG brain map were FP1, FP2, F3, F4, T3, T4, and High Beta

frequency. Identified brain area analysis focused on high beta frequencies. High-beta frequency is described as a hyper-vigilant state with anxiety, panic, ruminative thinking, and catastrophizing.

Sample Data Management

The sample consisted of males arrested for misdemeanor DV. Twenty-five participants volunteered via a court-certified DV educational program. Twenty-one volunteers showed up for their appointments. The researcher addressed participant questions and concerns and provided participants a consent form. Each participant completed three self-reported questionnaires regarding anger, stress, aggression, and a qEEG brain map for baseline data. Participants then selected a sealed envelope with a random group assignment, either the treatment group or the nontreatment group. Ten participants randomly selected the treatment group, and eleven randomly selected the nontreatment group. Sixteen participants completed both the pre- and post-qEEG brain map and the pre- and post-questionnaires. Of these, six completed ten hours of neurofeedback live *z*-score treatment, and ten completed the nontreatment group protocol. Five participants were lost to attrition. The dependent variables included measurements taken from the pre-frontal, frontal, and temporal sides of the brain. The researcher took measurements with participant eyes open and closed and labeled results as such, as seen in Table 1.

Table 1

Description of qEEG Variable Labels

Variable		Description	
EC FP1	Eyes closed	FP1	Pre-frontal left side
EO FP1	Eyes open	FP1	Pre-frontal left side
EC FP2	Eyes closed	FP2	Pre-frontal right side
EO FP2	Eyes open	FP2	Pre-frontal right side
EC F3	Eyes closed	F3	Frontal left side
EO F3	Eyes open	F3	Frontal left side
EC F4	Eyes closed	F4	Frontal right side

EO F4	Eyes open	F4	Frontal right side
EC T3	Eyes closed	T3	Temporal left side
EO T3	Eyes open	T3	Temporal left side
EC T4	Eyes closed	T4	Temporal right side
EO T4	Eyes closed	T4	Temporal right side

Note. All measures regard High Beta, the frequency focus for this study.

Sample Descriptive Statistics

Most of the final sample comprised Caucasian or White participants (*n* = 16, 87 %), with 13% of participants reporting a Hispanic ethnicity. The average age in the sample was 35 (*SD* = 9.80). The researcher asked participants about their levels of education, and most participants responded that they had no college education (56%), with lesser proportions who had some college (31%) or graduate level (13%) education. Self-reported head injuries represented 50% (*n* = 8) of the sample.

Treatment Group

The researcher then calculated summary statistics for the treatment group difference (DIFF) scores pre- to post-. The research found the largest difference in EO (eyes open) T3 (temporal left side) High Beta (*M* = 3.47) and the smallest difference in EC (eyes closed) F4 (frontal right side) High Beta (*M* = 0.02). These results, and the remainder of statistics for the pre- to post- difference scores, are in Table 2.

Table 2

Summary Statistics Table for Interval and Ratio Variables: Treatment Group

Variable	*M*	*SD*	*n*
Aggression Difference	9.67	11.31	6
Stress Difference	1.00	2.10	6
Anger Difference	-1.67	4.27	6
EC_FP1_H_DIFF	0.20	0.22	6
EO_FP1_H_DIFF	0.05	0.58	6
EC_FP2_H_DIFF	0.14	0.25	6
EO_FP2_H_DIFF	0.05	0.49	6

EC_F3_H_DIff	0.10	0.19	6
EO_F3_H_DIff	0.22	0.36	6
EC_F4_H_DIff	0.02	0.27	6
EO_F4_H_DIff	0.38	0.48	6
EC_T3_H_DIff	0.44	0.42	6
EO_T3_H_DIff	3.47	2.65	6
EC_T4_H_Diff	1.08	0.75	6
EO_T4_H_Diff	3.34	3.25	6

Note. Shading is for ease in identifying each EC-EO pair.

Control Group

Next, the researcher calculated the control group variables pre- to post- among those in the control group (who did not receive treatment). Among this group, the largest changes existed in the EO (eyes open) F4 (frontal right side) High Beta (M = 0.56), while EC (eyes closed) FP1 (pre-frontal left side; M = -0.05), EC F3 (frontal left side; M = -0.01), EC F4 (M = -0.11), and both T4 (temporal right side) measures (eyes closed, M = -0.27; eyes open M = -0.36) all decreased. See Table 3 for additional change statistics.

Table 3

Summary Statistics Table for Interval and Ratio Variables: Control Group

Variable	*M*	*SD*	*n*
Aggression Difference	3.90	7.45	10
Stress Difference	-1.80	3.33	10
Anger Difference	-4.89	9.74	10
EC_FP1_H_DIff	-0.05	0.41	10
EO_FP1_H_DIff	0.38	2.15	10
EC_FP2_H_DIff	0.05	0.58	10
EO_FP2_H_DIff	0.36	1.59	10
EC_F3_H_DIff	-0.01	0.39	10
EO_F3_H_DIff	0.43	0.95	10
EC_F4_H_DIff	-0.11	0.39	10
EO_F4_H_DIff	0.56	1.38	10
EC_T3_H_DIff	0.55	1.41	10
EO_T3_H_DIff	0.52	3.53	10
EC_T4_H_DIff	-0.27	1.05	10

EO_T4_H_DIff	-0.36	3.19	10

Note. Shading is for ease in identifying each EC-EO pair.

Hypothesis Testing

Four hypotheses guided the study. To test the effects, the researcher conducted a series of analyses to mirror the order of hypotheses. The first hypothesis was as follows:

1. Male DV offenders receiving neurofeedback will show a significant shift in the positive number of deviations from the norm between the qEEG pre- and post-brain maps following treatment compared to those who did not receive neurofeedback.

Regarding Hypothesis One, the researcher was interested in how differences from baseline to second assessment might vary for those who did and did not participate in neurofeedback treatment. As the effect of interest was *shift in qEEG from pre- to post-treatment implementation,* the researcher performed a series of paired sample *t* tests; however, the effect of treatment required comparison to lack of treatment, and, as such, the researcher conducted paired sample *t* tests for both the treatment and control group, allowing for comparison. Use of these *t* tests allowed the researcher to hone the results and to specify the individual effects of interest.

qEEG Paired Sample *t* Tests: Control Group

The researcher conducted a series of paired sample *t* tests to better understand the degree of difference between pre- and post-measurements. Though the focus was on T4 High Beta values for both eyes open and eyes closed, the researched included each qEEG variable in the series of analyses for completeness. Because the main effect of pre- to post- was the effect of interest, and because this effect appeared to be different for the treatment and control groups, the researcher conducted a series of analyses independently for both the treatment group and the control group. The researcher assessed the control group first, which was not hypothesized to

show any difference from baseline to second measurement. Prior to analysis, the researcher assessed the assumptions of normality through Shapiro-Wilk tests and homogeneity of variance through Levene's test.

Results of the Shapiro-Wilk tests were significant for EC_T4_H ($W = 0.74$, $p = .003$), EO_F3_H ($W = 0.69$, $p < .001$), EO_F4_H ($W = 0.57$, $p < .001$), EO_T3_H ($W = 0.80$, $p = .017$). These results suggest that difference is unlikely to have been produced by a normal distribution; thus, normality cannot be assumed. For these variables, results should be interpreted with caution. All other pre- to post- variables returned a nonsignificant ($p > .05$) result and were assumed to be normal. The results of a series of Levene's tests for homogeneity of variance were not significant for any of the variables (i.e., $p > .05$ for all) and indicated that the assumption of homogeneity of variance was met for each paired sample *t* test.

The results of the paired samples *t* tests indicated that there was no evidence of a significant difference from baseline to post-measurement for any of the variables among the control group participants (i.e., $p > .05$ for all). Analysis results are presented in Table 4. Following this analysis, the researcher conducted the same dependent sample *t* tests on the treatment group, for comparison.

Table 4

Paired Sample t-Tests for qEEG Difference Between Pre- and Post-Measures: Control Group

	Pre-		Post-				Cohen's
Variable	*M*	*SD*	*M*	*SD*	*t*(9)	*p*	*d*
EC_FP1_H	0.88	0.28	0.93	0.41	-0.37	.718	0.14
EC_FP2_H	0.95	0.59	0.91	0.44	0.27	.792	0.10
EC_F3_H	1.01	0.30	1.02	0.48	-0.10	.925	0.03
EC_F4_H	0.96	0.36	1.07	0.48	-0.84	.420	0.25
EC_T3_H	1.45	1.34	0.90	0.67	1.23	.250	0.52
EC_T4_H	1.45	1.08	1.73	1.58	-0.82	.435	0.20
EO_F3_H	1.46	0.99	1.03	0.26	1.42	.188	0.59
EO_F4_H	1.56	1.52	1.00	0.32	1.29	.231	0.51

EO_T3_H	3.32	4.24	2.80	3.77	0.46	.653	0.13
EO_T4_H	2.30	4.28	2.67	2.75	-0.36	.728	0.10

qEEG Paired Sample *t* Tests: Treatment Group

Following the assessment of pre- to post-differences in the control group (where no effect was hypothesized), the researcher assessed the group who received neurofeedback treatment for any significant differences from baseline to post-treatment. Prior to analysis, the researcher assessed the assumptions of normality and homogeneity of variance.

Results of a series of Shapiro-Wilk tests were significant, indicating violations of normality for EC_FP2 ($W = 0.72$, $p = .010$), EO_FP2 ($W = 0.78$, $p = .041$), EC_F3 ($W = 0.72$, $p = .009$), and EO_FP1 ($W = 0.71$, $p = .008$). The remaining variables tested nonsignificant (i.e., $p > .05$), indicating that normality was met; thus, for the EC_ and EO_FP2, EC_F3, and EO_FP1 measurements, results should be interpreted with some caution. The result of Levene's test was significant for EO_T3_H only ($F[1, 10] = 8.12$, $p = .017$), indicating that the assumption of homogeneity of variance was met for all measures except this variable; thus, results for the analysis of EO_T3_H should also be interpreted with caution.

Results for this analysis showed that, within the treatment group, the EC_T4 and EO_T3 measures differed significantly from pre- to post-treatment. For the EC_T4 measure, values dropped from 1.97 ($SD = 1.47$) at pre-treatment to 0.89 ($SD = 0.79$) at post-treatment. Similarly, EO_T3 measures dropped from 5.23 ($SD = 3.89$) at pre-treatment to 1.75 ($SD = 1.36$) at post-treatment. Though the EO_T4 measure approached significance, there was not enough evidence to specify a significant difference for this variable. Table 5 contains the results of this analysis.

Table 5

Paired Sample t-Tests for qEEG Difference Between Pre- and Post-Measures: Treatment Group

	Pre-	Post-				

Variable	*M*	*SD*	*M*	*SD*	*t*(5)	*p*	*d*
EC_FP1_H	1.10	0.64	0.90	0.5	2.26	.074	0.34
EC_FP2_H	1.04	0.47	0.91	0.44	1.37	.229	0.30
EC_F3_H	1.12	0.72	1.03	0.63	1.26	.264	0.14
EC_F4_H	1.20	0.79	1.18	0.81	0.2	.852	0.03
EC_T4_H	1.97	1.47	0.89	0.79	3.51	.017	0.92
EO_FP1_H	1.21	0.52	1.16	0.62	0.23	.825	0.10
EO_FP2_H	1.10	0.32	1.06	0.65	0.23	.824	0.09
EO_F3_H	1.28	0.72	1.06	0.77	1.45	.207	0.29
EO_F4_H	1.45	0.90	1.07	0.65	1.95	.109	0.48
EO_T3_H	5.23	3.89	1.75	1.36	3.21	.024	1.19
EO_T4_H	5.27	3.70	1.93	1.68	2.51	.054	1.16

Note. Shaded rows indicate significant differences.

The researcher formulated three hypotheses to understand the effect of neurofeedback treatment on self-reported anger, aggression, and stress among male DV offenders. To understand these effects, the researcher conducted a second series of *t* tests, which she, again, analyzed in two stages. The first stage tested effects among the control group and acted as a method to understand the effect of time alone, while the second series tested effects among the treatment group. Comparison of pre-treatment measures to post-treatment measures for both treatment and control groups allowed comparison of the effects from pre- to post- and afforded the researcher's ability to draw conclusions about the effect of the treatment when compared to those who did not receive treatment. Those three hypotheses were as follows:

2. There will be a significant decrease in self-reported anger among male DV offenders receiving neurofeedback compared to those who did not receive neurofeedback.

3. There will be a significant decrease in self-reported feelings of aggression among male DV offenders receiving neurofeedback compared to those who did not receive neurofeedback treatment.

4. There will be a significant decrease in self-reported stress among male DV

offenders receiving neurofeedback treatment compared to male DV offenders who did not receive neurofeedback treatment.

Anger, Aggression, and Stress Paired Sample *t* Tests: Control Group

The researcher calculated participant anger, aggression, and stress variables at a period both before and after treatment, resulting in matched pairs, which the researcher used as dependent variables in the paired samples *t* tests. The researcher first calculated the results from participants in the control group only. Results of a series of Shapiro-Wilk tests were significant for anger, indicating a violation of normality for this variable ($W = 0.58$, $p < .001$). The remaining variables tested nonsignificant (i.e., $p > .05$), indicating that normality was met; thus, for anger, results should be interpreted with some caution. The results of the Levene's tests were not significant, indicating that the assumption of homogeneity of variance was met for all measures. Results of the *t* tests were not significant for anger, aggression, or stress among the control group, indicating that no changes outside of random chance were detected in this group (see Table 6).

Table 6

Paired Sample t-Tests for Difference Between Pre- and Post-Measures: Control Group

	Pre-		Post-				
Variable	*M*	*SD*	*M*	*SD*	*t*(9)	*p*	*d*
Anger	10.00	11.98	5.11	3.72	1.51	.171	-.55
Aggression	88.20	22.99	92.10	26.81	-1.66	.132	.16
Stress	21.50	3.95	19.70	3.50	1.71	.121	-.48

Anger, Aggression, and Stress Paired Sample *t* Tests: Treatment Group

The researcher calculated the second series of results from participants in the treatment group only. Results of a series of Shapiro-Wilk tests were significant for anger only, indicating a violation of normality for anger ($W = 0.75$, $p = .020$). The remaining variables were

nonsignificant (i.e., $p > .05$), indicating that normality was met; thus, for anger, results should be interpreted with some caution. The result of the Levene's tests were not significant, indicating that the assumption of homogeneity of variance was met for all measures. Results of the *t* tests were not significant for anger, aggression, or stress among the treatment group, indicating that the treatment group also exhibited no changes outside of what could be expected at random (see Table 7).

Table 7

Paired Sample t-Tests for Difference Between Pre- and Post-Measures: Treatment Group

	Pre-		Post-				
Variable	*M*	*SD*	*M*	*SD*	*t*(5)	*p*	*d*
Anger	6.00	5.83	4.33	4.13	0.95	.383	-.33
Aggression	97.50	22.53	107.17	21.36	-2.09	.090	.44
Stress	15.83	8.88	16.83	8.68	-1.17	.296	.11

Chapter five follows with results summary, limitations of the present study, and recommendations for further research.

Chapter V: Conclusions

Domestic violence (DV) continues to be a complex and significant public and social health problem (Breiding, Chen, & Black, 2014; Campbell, Neil, Jaffe, & Kelly, 2010; Corvo & Dutton, 2015; Farrer, Frost, & Hedges, 2012; Garcia-Moreno, Jansen, Heise, & Watts, 2005). In response, court-approved DV educational programs have been established nationwide; however, recidivism rates among male DV offenders in the United States remain high, estimated at 39% (Bowen, Gilchrist, & Beech, 2008; Dutton & Corvo, 2006; Herman, Rotunda, Williamson, & Vodanovich, 2014; McClure, 2013).

DV is devastating to families, individuals, and to society, and the focus of the present study was to explore possible options for treatment. More specifically, the purpose of this study was to evaluate the outcome of neurofeedback treatment among males arrested for misdemeanor (MD) domestic violence and the DV-contributing factors of stress, anger, and aggression. The reviewed literature confirmed the persistent recidivism rate of DV in spite of court-ordered DV programs; therefore, this study compared pre-post data outcomes for two groups: neurofeedback treatment versus nontreatment. The researcher was primarily concerned with the established DV factors of stress, anger, and aggression and with exploring the effect of neurotherapy treatment.

Twenty-one male offenders signed up to participate in the study. Random placement procedures put ten participants in the treatment group and eleven in the control (nontreatment) group. Treatment group males each received ten hours of neurofeedback treatment, and the control group males received no neurofeedback treatment. Five participants from the treatment group and one participant from the control group were lost to attrition. The researcher performed pre-post analysis between the groups with qEEG brain maps and self-reported questionnaires measuring anger, aggression, and stress.

Participants' demographics comprised mostly Caucasian or White ethnicity at 87% and Hispanic ethnicity at 13%. Participant education levels ranged from no college at 56%, some college at 31%, to graduate level at 13%. Fifty percent of the participants self-reported having previously sustained head injuries.

Discussion of Research Findings

Summary and interpretation of the findings.

Four hypothesizes guided this study. Regarding hypothesis one—male DV offenders will show a significant shift in positive number of deviations from the norm between qEEG pre- and post-brain maps following neurofeedback compared to those who did not receive neurofeedback—, the researcher found significance between the treatment and control (nontreatment) groups. The qEEG paired sample *t* tests for the treatment group suggested significance at EC (eyes closed) T4 (temporal right side) High Beta brain wave frequency. T4 dropped from pre-neurofeedback treatment 1.97 (*M)* and 1.47 (*SD*) to post-neurofeedback 0.89 (*M*) and 0.79 (SD). EO (eyes open) T3 (temporal left side) also dropped from 5.23 (*M)* and -3.89 (*SD*) pre-neurofeedback to 1.75 (*M*) and 1.36 (*SD*) post-neurofeedback treatment. EO T4 came close to approaching significance; however, there was not sufficient evidence for this variable.

A concern with High Beta wave brain frequencies is potential limited ability to self-regulate emotions. For instance, High Beta waves can produce a hyper vigilant state that may lead to anxiety, tension, stress, and agitation (Thompson & Thompson, 2015). High Beta wave frequency at the T4 (right temporal area) location, then, merits interest as current research connects abnormal High Beta wave frequency and this area of the brain with a limited ability to self-regulate emotional responses (Hortensius et al., 2012). Researcher analysis of the control group (nontreatment) found no difference between pre-post qEEG brain maps; thus, there were

no shifts in the positive number of deviations from the norm.

To further understand the effect of neurofeedback treatment, the researcher analyzed data collected from the participants' self-reported questionnaires regarding anger, aggression, and stress, comparing pre-post treatment and nontreatment. Hypotheses two, three, and four stated there would be significant decrease in self-reported anger, aggression, and stress between the treatment group and nontreatment group.

Researcher analysis of hypotheses two, three, and four found no significant results between treatment and nontreatment regarding participants' self-reported pre-post anger, stress, and aggression. Although the researcher found no significant difference in participants' self-reported feelings of aggression, participants' posttest scores were higher for self-reported feelings of aggression. This is a point of interest as the increase in self-reported feelings of aggression may indicate increased self-awareness of emotional responses, an important factor in learning to self-regulate emotional reactions. With the small sample size of the present study, detecting significance was inherently difficult. A larger sample may indicate more accurate results, and further research may be warranted.

Strengths and limitations of the study.

To evaluate the data, the researcher chose data collection tools based on validity and reliability. Rothenberg (1971) verified the reliability and validity of the Clinical Anger Scale (CAS) in previous studies regarding therapeutic work and violent behavior. Diamond and Magaletta (2006) verified the reliability and validity of the Buss Perry Aggression Questionnaire. Cohen et al. (1988) verified the reliability and validity of the Perceived Stress Scale (PSS). Finally, Thatcher (2010) verified the reliability and validity of qEEG brain maps. The researcher of the present study also implemented high ethical standards for working with humans, with full

approval from and compliance with the Internal Review Board (IRB).

The sample size of this study was a limitation. Future studies that include a larger sample of >30 may provide statistical significance for generalization. The small sample size of the present study prevented generalizable statistical analysis. The population of court-ordered males arrested for DV may be a challenging sample to study and may be an inherent limitation; follow-through with commitments may be an issue for this population. In spite of the researcher's repeated presentations to approximately 100 individuals in such DV groups, less than 25% volunteered, which may indicate difficulty in obtaining a larger sample size. Research with open groups such as these DV court-ordered programs might be a limitation given that the sample population is not static but fluid. Lack of financial funding to incentivize participation and to support extended neurofeedback treatment sessions may have been a limitation.

Future Research Possibilities

The results of the present study support prior research in indicating a continued need for further research on the effectiveness of DV assessment and treatment for males arrested for DV. The persistently high rate of DV recidivism is a concern and warrants continued research regarding effective assessment and treatment. There are several areas where research may be beneficial.

Treatment options focused on individualized assessment and court sentencing protocols may offer increased effectiveness for DV recidivism reduction. Another possible research route is to consider options other than "one-size-fits-all" DV treatment programs for male offenders. A study comparing types of offender treatment programs and length of time in said DV programs may offer clearer protocol options for the courts.

In light of the results of the present study, further research regarding neurofeedback

treatment with an increased sample size may suggest viable alternative options. A larger sample of court-ordered males arrested for MD DV may provide possibilities for significant statistical analysis and generalization. Obtaining funding for research may offer greater incentive for participants' time and effort, resulting in a larger sample for research study. Length of neurofeedback treatments >10 hours may also provide useful data regarding possible concurrent DV treatment.

Fifty percent of participants in the present study self-reported previously sustaining head injuries; in light of this data and current research, a health assessment prior to court sentencing may indicate integrative options for treatment. In a meta-analysis, prior researchers found the prevalence of head injuries among male DV offenders to be approximately 54% to 60% (Farrer et al., 2012) compared to nonviolent males at 15% to 25% (Pinto et al., 2010). Further, Marsh and Martinovich's (2006) study suggested 58% of offenders reported at least one head injury prior to 16 years of age or as a precursor to the use of violence in an intimate relationship. Future research that included head injury assessment may provide data for further understanding the complexity of DV and possible integrative options that include health issues.

Conclusion

Considering the heartbreaking damage and devastation of DV for individuals and families as well as the significant financial costs, further research may be warranted. When considering the consistently high recidivism rates of DV, research points to the need for an exploration of new methods for treatment (Bowen et al., 2008; Dutton & Corvo, 2006; Herman et al., 2014; McClure, 2013).

DV is devastating to men, women, children, and to our society. Further research may offer data for reviewing the possible needed changes to assessment and DV treatment. Although

the present study did not produce statistically significant results for generalization due to its small sample size and participation attrition, results did suggest a difference in pre-post neurofeedback treatment versus nontreatment for High Beta wave frequency. The major finding of this research, although limited by sample size, presents exigence for further research.

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Appendices Introduction

The following appendices contain two IRB modifications that pertain to the present study. Full IRB approval was granted.

Appendix A: IRB Modification May 11, 2017

Idaho State
UNIVERSITY
Office for Research - Research Outreach & Compliance
921 S. 8th Avenue, Stop 8046 • Pocatello, Idaho 83209-8046

May 11, 2017

Linda Larson-Spagon
School of Nursing

RE: study number IRB-FY2017-99: Neurofeedback treatmetn in Response to Veterans Arrested for Domestic Violence with History of Traumatic Brain Injury: A Pilot Study

Dear Ms. Larson-Spagon:

I have reviewed your application for revision of the study listed above. The requested revision involves: The study will expand potential participants to all males arrested for domestic violence.
The study will include Veterans but not exclusive to Veterans. The history of head injury will not be an inclusion criteria. History of head injury will be a question on the demographic sheet with the participant indicating yes/no to a history of head injury with hospitalization or loss of consciousness..

You are granted permission to conduct your study as revised effective immediately. The date for renewal remains unchanged at 3-28-2018, unless closed before that date.

Please note that any further changes to the study must be promptly reported and approved. Contact Tom Bailey (208-828-2179; email humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

Appendix B: IRB Modification June 15, 2018

Idaho State UNIVERSITY

Office for Research - Research Outreach & Compliance
921 S. 8th Avenue, Stop 8046 • Pocatello, Idaho 83209-8046

June 15, 2018

Linda Larson-Spagon
School of Nursing
MS 8101

RE: regarding study number IRB-FY2018-316 : An Exploration of Neurofeedback Treatment Among Male Domestic Violence Offenders with Correlates of Anger, Aggression, and Stress

Dear Ms. Larson-Spagon:

I have reviewed your request for expedited approval of the new study listed above. This is to confirm that I have approved your application.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

You may conduct your study as described in your application effective immediately. The study is subject to renewal on or before June 15, 2019, unless closed before that date.

Please note that any changes to the study as approved must be promptly reported and approved. Some changes may be approved by expedited review; others require full board review. Contact Tom Bailey (208-282-2179; email humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair