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The Role of the Autonomic Nervous System in the Relationship Between Emotion Regulation and Conflict Tactics in Couples

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ABSTRACT

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Gross' emotion regulation model, Porges' polyvagal theory, and other existing research suggest that regulation of emotions, tactics used to handle conflict, and certain physiological processes that occur within the autonomic nervous system (ANS) in response to stress are significantly related, especially in relational contexts. However, despite their pervasiveness and negative impacts, there is a noticeable lack of research on predictors of violent, aggressive, or abusive conflict tactics in couples. In the current study, the predictive role of emotion regulation in relation to conflict tactics was examined, in addition to the role of respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP) as mediators for these variables. Thirty-eight participants (19 couples) completed self-report measures of emotion regulation and conflict tactics, and RSA and PEP were measured during a three-minute baseline and 20-minute conflict discussion. Results showed no significant relationships between emotion regulation and conflict tactics, and no significant relationships between these variables and RSA or PEP were found. These findings may suggest that other variables aside from measures of ANS activity better explain the relationship between emotional and behavioral regulation skills, though additional research is necessary to confirm these findings. Clinical implications of this research point to the exploration of other contributors to violence and aggression aside from poor emotion regulation as it was measured in this study. Future research may benefit from investigating the impact of other variables such as sleep and exercise on ANS reactivity in relation to the use of maladaptive conflict tactics in married couples.

Keywords: couples, conflict, emotion regulation, autonomic nervous system, vagal tone, respiratory sinus arrhythmia, pre-ejection period

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According to the most recent available data published by the National Intimate Partner and Sexual Violence Survey (NISVS), over 36% of women and 33% of men in the United States have experienced some form of intimate partner abuse involving physical violence, contact sexual violence, and/or stalking, in their lifetime (Smith et al., 2018). The lifetime prevalence for physical violence alone among U.S. married couples is estimated between 17.4% and 25.5% (Malley-Morrison & Hines, 2004). As research on this subject continues to reveal these shocking and saddening facts, it is imperative that we make it a priority to understand more about what leads to the use of violent, aggressive, and abusive behaviors in intimate partner relationships, including identifying variables in couple relationships that predict the use of these behaviors in response to conflict. Two theories – Porges' polyvagal theory and Gross' emotion regulation model – point to vagal tone and emotion regulation as potential influences on the use of maladaptive conflict-management behaviors (Gross, 1998; Porges, 2001; Porges, 2011; Porges, Doussard-Roosevelt, & Maiti, 1994). These two theories, along with more recent research, support the idea that there may be a significant relationship between emotion regulation, physiology, and the way conflict is handled in marital relationships (Balzarotti, Biassoni, Colombo, & Ciceri, 2017; Hesser et al., 2017; Finkel, DeWall, Slotter, Oaten, & Foshee, 2009; Maldonado, DiLillo, & Hoffman, 2015).

In his research on intrafamily conflict, Straus (1979) defines conflict as the discord which naturally arises in social groups when members seek to live their lives in accordance with differing personal agendas. He explains the need for conflict within any given system, stating that conflict brings about changes necessary for any social unit – be it an entire nation or a single

family – to function and avoid collapse. When conflict is suppressed, the adaptability of a system is likely to decrease dramatically, resulting in stagnation and an inability to adjust to changing circumstances. Suppression of conflict can also quickly lead to an accumulation of hostility and the subsequent erosion of feelings of unity within the group (Straus, 1979). Conflict is surely a staple within human interactions and relationships, and thus over time people have developed many different conflict tactics, or methods used to advance one's own interests when they come into conflict with another's.

While some of these strategies for handling conflict are effective and helpful for all parties involved, many conflict tactics have proven over time to be maladaptive and can have serious negative effects on individuals and families (Ellsberg, Jansen, Heise, Watts, & García-Moreno, 2008; Peltzer, Pengpid, McFarlane, & Banyini, 2013; Smith et al., 2018). Tactics such as physical violence and psychological abuse or manipulation have been shown to cause severe and lasting damage to individuals within a family or romantic relationship, as well as to the quality of relationships between those individuals (Knight & Hester, 2016; Peltzer et al., 2013; Guzmán-González, Lafontaine, & Levesque, 2016). Violence and abuse have been linked to negative mental health effects, not only for victims but for perpetrators as well, resulting in symptoms such as increased substance abuse, posttraumatic stress disorder, suicidal thoughts and attempts, poor health, and diminished quality of life (Coker, Weston, Creson, Justice, & Blakeney, 2005; Ellsberg et al., 2008; Smith et al., 2018).

The need for healthy conflict tactics and, by extension, an understanding of the underlying causes of harmful conflict tactics is vital to ensuring the safety and wellbeing of families and couples, especially those who seek treatment from mental health professionals for help with problems such as aggression and abuse from a spouse. Identifying factors that

contribute to the use of these harmful conflict tactics would be extremely beneficial to family and couple therapists by allowing them to structure therapy more effectively to address issues of aggression or abuse in family relationships. We hypothesize that poor emotion regulation is predictive of harmful, abusive, or otherwise maladaptive conflict tactics in marital relationships, and that this relationship is mediated by two physiological measures of autonomic nervous system activity.

Literature Review

Theoretical Groundwork

There are two central theories guiding this research: Gross' (1998) emotion regulation model and polyvagal theory (Porges, 2001; Porges, 2011; Porges et al., 1994). These theories discuss the roles of stress and conflict in communication and relationships, and the natural human response, both physiological and emotional, to perceived threat. While neither of these theories alone explicitly proposes a relationship between emotion regulation and conflict tactics, the conclusions and implications of each relate to one another in such a way that a relationship between these variables can be assumed.

Gross' emotion regulation model. In his extensive research on emotions and emotion regulation, Gross (1998) states that emotions serve several purposes central to individual functioning including preparing for rapid motor responses and facilitating decision making. In addition, he notes that emotions serve vital social functions such as informing an individual about the behavioral intentions of another and scripting social behavior. No matter the function served by emotion, Gross points out that our emotional response tendencies often require modulation, a process which he terms emotion regulation (1998). Gross defines emotion regulation as "the processes by which individuals influence which emotions they have, when

they have them, and how they experience and express these emotions" (1998, p. 275). He also notes that, due to ever-changing social and physical environments, our once adaptive emotional response tendencies developed by our primal ancestors, such as aggression in response to a perceived threat, are now at times inappropriate in the context of our modern lives, making emotion regulation an even more critical skill than ever before (Gross, 1998). If we wish to be successful in our interactions with others, we must learn to regulate both our internal emotional states and the way those experiences are outwardly expressed.

Without this regulating ability our emotions become dysregulated, which inevitably leads to inappropriate expressions of emotions such as yelling at, threatening, or hurting others in response to feelings of anger or fear outside the context of a life-threatening situation. When considered in a relational context, these kinds of dysregulated expressions of emotion have the potential to cause notable harm because, as Gross states, "emotion dysregulation – particularly high levels of poorly regulated hostility – has effects that extend beyond the dysregulated individual" (Gross, 1998, p. 280). These effects can be particularly salient within marital relationships, especially considering the role that emotional expression plays in interactions with an intimate partner. When used appropriately, emotional expression with one's spouse has the potential to foster a sense of security and attachment, while inappropriate or dysregulated expressions of emotion can have the opposite effect. Gross reports, therefore, that emotion regulatory processes play a central role in marital interactions (1998).

When an individual lacks skill in regulating his or her emotions, he or she may frequently experience states of emotion dysregulation, which most often becomes problematic when the individual experiences strong feelings of anger and fear. This state of emotion dysregulation has the potential to lead to intimate partner violence and other maladaptive conflict tactics, which

often occur within the context of marital relationships, and for this reason it is imperative to understand the extent to which emotion regulation influences the way conflict is expressed in married couples. Within his emotion regulation model, Gross (1998) notes at the time of publication that not enough is known about the precise mechanisms that mediate emotion regulation, and whether the same mechanisms play a role in controlling other impulses, including abusive behaviors, but acknowledges that such information could be vastly beneficial to the fields of psychology and, by extension, marital therapy.

Porges' polyvagal theory. One way to conceptualize and measure emotion regulation is through internalized physiological processes such as changes in heart rate. Some of these physiological responses are described in Porges' polyvagal theory. This theory, which centers on the role of the vagus nerve in either engaging defense mechanisms or allowing for social connection to occur, helps us understand the impact of parasympathetic regulation of cardiac activity on an individual's adaptive or maladaptive functioning with regard to emotions (Porges, 2001; Porges et al., 1994). In order to understand the role of the vagus nerve, one must first clarify the functions served by the autonomic nervous system (ANS) generally when it comes to the body's response to threat. The ANS is comprised of the sympathetic nervous system (SNS) and parasympathetic nervous system (PNS). The role of the SNS in response to perceived threat is to prepare the body to take the necessary actions to ensure survival as heart rate and blood flow to large muscle groups increase, pupils dilate, and intestinal functions become inhibited. The behavioral responses activated by the SNS are often known as "fight or flight" behaviors (Porges et al., 1994).

In contrast to the mobilizing functions of the SNS, the PNS promotes restorative functions within the body, such as digestion and other "anabolic activities concerned with the

restoration and conservation of bodily energy and resting of vital organs" (Porges et al., 1994, p. 168), thereby preparing the body for the next time the functions of the SNS are needed. The primary component of the PNS is the vagus nerve, which connects the brain stem to many other organs in the body, including the heart, lungs, and digestive tract, and allows the brain to rapidly communicate with and receive feedback from specific organs (Porges et al., 1994). The vagus nerve itself is also divided into two branches, with the first and phylogenetically older branch originating in the dorsal motor nucleus. This branch is known as the dorsal vagal complex (DVC), or "vegetative vagus," and is involved primarily with the processes of respiration and digestion. When threatened, the DVC causes a complete behavioral shutdown known as immobilization, or the "hard freeze" response. In the animal kingdom, this response manifests as feigning death in order to conserve metabolic resources and avoid detection by predators, but very rarely engages in humans (Porges, 2011; Porges et al., 1994). Seen more often is a PNS-dominated sympathetic "soft freeze" response characterized by attentive immobility, muscle tension, decreased vocalizations, and decelerated heart rate. While this behavior stems from the SNS, it is modulated by the PNS such that when PNS influence releases, the behavioral inhibitory effect of the "soft freeze" response transitions to an active "fight or flight" response (Roelofs, 2017). Evolutionarily, the DVC "hard freeze" is the first and oldest major behavioral survival strategy evolved by the nervous system, followed by the immobilizing "soft freeze" and mobilizing "fight or flight" behaviors of the SNS (Porges, 2011).

The phylogenetically newest and most adaptive behavioral strategy developed by the nervous system is regulated by the branch of the vagal nerve that stems from the nucleus ambiguus (Porges, 2011). This branch is called the ventral vagal complex (VVC), or "smart vagus," because it is the most recently evolved and sophisticated of the two vagal branches. The

VVC interacts primarily with the heart, bronchi, lanrynx, pharynx, and esophagus, and functions to facilitate social engagement through regulating social behaviors such as facial expressions, vocalization, and listening (Porges, 2001; Porges, 2011; Porges et al., 1994). The VVC interacts with the SNS to promote social engagement by acting as a vagal brake "in which rapid inhibition and disinhibition of the vagal tone to the heart can rapidly mobilize or calm an individual" (Porges, 2001, p. 129). When the tonic vagal influences from the VVC – or vagal tone – to the heart's pacemaker is high, resting heart rate lowers and exerts a calming effect on the body, like using a brake to slow a moving vehicle. When vagal tone to the heart's pacemaker is low, the brake releases and inhibition of the pacemaker completely withdraws, resulting in an increased heart rate and other mobilizing responses from the body. This vagal brake "provides a mechanism to support the metabolic requirements for mobilization and communication behaviors" and "enables the individual to rapidly engage and disengage objects and other individuals… to promote self-soothing behaviors and calm behavioral states" (Porges, 2001, p. 130).

This rapid engaging and disengaging with one's environment is a critical regulatory function served by the VVC. In order to ensure a greater chance of survival, a living organism must be able to quickly process and respond to information about its environment and the other organisms in it to determine its own safety. As highly social creatures who exist within complex social structures, our survival as humans is also dependent upon our ability to communicate with others. When the vagal brake functions as it should, we are able to accurately gauge the level of threat in our environment, regulate our physiological and behavioral responses accordingly, then quickly reassess our environment and alter our responses if necessary. If the level of threat is high enough to overwhelm the vagal brake, meaning that communication and social connection

are not sufficient to meet our survival needs, the phylogenetically older SNS responses will be called into action to regulate our responses to environmental stressors (Porges, 2001). When the vagal brake does not function as it should, it starts to become overwhelmed too easily, allowing the SNS and DVC to send us straight into fight, flight, or freeze responses. Because engaging these automated defense mechanisms comes at the expense of the conscious behavioral control required to facilitate social connection, these bodily responses can often be considered inappropriate to the settings in which they are used and therefore maladaptive.

The notion of adaptive and maladaptive physiological responses that occur as a result of regulation or dysregulation in the nervous system perfectly echoes the concept of appropriate and inappropriate expressions of emotion that occur as a result of emotion regulation or dysregulation. Furthermore, just as the internal processes of physiological and emotion regulation can be considered adaptive or maladaptive, so too are the resulting behavioral manifestations which determine the way that conflict is responded to. Thus, people's physiological and emotional regulation abilities would appear to determine in large part how adaptive or maladaptive their external behavioral response to their spouse or partner will be when faced with relational conflict. Polyvagal theory states that "vagal tone mediates the behavioral and emotional response of the organism," (p. 181) and that measures of vagal tone are associated not only with behavioral responses, but also with self-regulation skills and the expression of emotion and can thus serve as an index of emotion regulation (Porges et al., 1994). In this way, measuring vagal tone makes it possible to identify not only when emotion regulation is taking place, but also to what degree one's emotional responses are being regulated by the nervous system (Porges, 2001). Polyvagal theory also claims that individuals "with higher vagal

tone exhibit appropriate autonomic reactivity and, in turn, appropriate behavioral and emotional responses… to stimulation" (Porges et al., 1994, p. 181).

Integrating Emotion Regulation and Conflict Tactics

A small but sound body of recently published literature provides additional evidence that the link between emotion regulation and conflict tactics not only exists, but has significant implications for the field of couple therapy. Several studies of conflict in couples have found maladaptive conflict tactics to be positively associated with emotion regulation deficits (Burk & Seiffge-Krenke, 2015; Guzmán-González et al., 2016; McNulty & Hellmuth, 2008; Vater & Schröder, 2015). Other research has shown that interventions aimed at increasing adaptive emotion regulation skills leads to a decrease in aggressive or violent responses to conflict (Hesser et al., 2017; Finkel et al., 2009; Maldonado et al., 2015). Several of these studies are reviewed in more depth in the following sections.

Emotion regulation ability as a correlate of maladaptive conflict tactics. In a study of 72 newlywed couples in which 36% of couples reported having experienced at least one episode of intimate partner violence (IPV) during the last year, emotion regulation difficulty in husbands, measured as variability in negative affect over a seven-day period, was positively associated with self-reported IPV perpetration in men whose wives also reported having perpetrated IPV within the previous year (McNulty & Hellmuth, 2008). These findings were echoed by Burk and Seiffge-Krenke (2015), who, in a cross-sectional study of 189 unmarried adolescent couples, found that couples in which both partners were perceived as physically or relationally aggressive by the other displayed more emotion regulation deficits and less adaptive relationship functioning in conflict situations. Both studies concluded that emotion regulation ability may be

an important factor in reducing instances of IPV in couples, especially in relationships in which both partners are aggressive.

These findings, though significant, are limited in several important ways. First, these studies focused specifically on adolescent and newlywed populations, which provide limited generalizability to the broader population in which relationship aggression and violence occur. Additionally, both studies collected data on emotion regulation and aggression/violence exclusively through self-report measures. While the measures themselves have been empirically validated, the accuracy of any data collected through self-report measures alone is highly dependent upon the honesty of the participants. This is especially important to consider when measuring constructs such as relational aggression and IPV, as participants may be inclined to minimize their own behavioral responses to conflict when such behaviors could be perceived as socially unacceptable (Helfritz et al., 2006). One way to account for this is to use measures in which participants report on both their own and their partner's behavior, such as the revised Conflict Tactics Scale (CTS2; Straus, Hamby, Boney-McCoy, & Sugarman, 1996).

Emotion regulation ability as predictor of maladaptive conflict tactics. In a sample of 236 college students, some with a history of intimate partner aggression (IPA) and some without, Maldonado et al. (2015) measured the effect of adaptive versus maladaptive emotion regulation strategies on aggressive verbalizations during an emotionally evocative task. Participants with and without a history of IPA were randomly assigned to one of three emotion regulation strategy conditions: cognitive reappraisal (adaptive), expressive suppression (maladaptive), or no instruction. After receiving a brief training in the assigned emotion regulation strategies, participants listened to several audio recordings of anger-inducing dating scenarios while imagining that they were involved in each scenario. Participants were then asked to talk about

their thoughts and feelings in response to the presented scenarios, and the frequency of aggressive verbalizations in their responses was coded. Results showed that a history of perpetrating IPA alone did not predict a higher frequency of aggressive verbalizations. Rather, IPA perpetrators trained in cognitive reappraisal showed fewer aggressive verbalizations compared to non-IPA perpetrators with the same training, while IPA perpetrators trained in expressive suppression showed more aggressive verbalizations than non-IPA perpetrators with the same training and both groups trained in cognitive reappraisal. Maldonado et al. (2015) noted that these results "suggest that emotion regulation strategies may be important treatment targets for IPA perpetration" (p. 46).

A randomized controlled trial conducted by Hesser et al. (2017) aimed at measuring the effect of guided self-help interventions targeting emotion-regulation, communication, and conflict-management skills on IPV also found a significant relationship between emotion regulation and conflict tactics. The study recruited a sample of 65 participants who reported currently struggling with aggression or interpersonal violence or abuse in an intimate relationship. Participants completed an Internet-delivered cognitive behavioral therapy intervention over the course of eight weeks. Aggression and IPV were measured at pre- and post-treatment and 1-year follow-up, and emotion regulation ability was assessed weekly throughout the active treatment phase. Results of the intervention showed that positive changes in emotion regulation ability in individuals who struggle with mild forms of abusive behavior in intimate relationships led to reduced aggression and both psychological and physical forms of IPV, and that these improvements were maintained at 1-year follow-up. They concluded that "emotion-regulation ability is potentially a key therapeutic process of change" (Hesser et al., 2017, p. 1163).

While the results of these two studies support the proposed causal relationship between emotion regulation and conflict tactics, several important limitations must be considered in interpreting their implications for couples. Maldonado et al. (2015) recruited individuals both with and without a history of IPA, but did not distinguish between those who reported currently struggling with aggression in an intimate relationship and those who had in the past. Hesser et al. (2017) improved slightly upon this design by recruiting participants who reported current difficulty with aggression or IPV in an intimate relationship, but did not gather any data from the partners or spouses of the participants. Due to the intrapersonal rather than relational approaches taken by these studies, significant interaction effects of emotion regulation and couple dynamics on aggression and IPV may have been missed. Levenson, Haase, Bloch, Holley, and Seider note that current literature on emotion regulation in couples is "still surprisingly immature, with many gaps and unanswered questions" (2014, p. 268), despite the profoundly social nature of emotion regulation and its frequent role as a major area of concern in intimate relationships. In fact, a recent review of 564 peer-reviewed studies of emotion regulation in adults and adolescents found that "98% of reported instances of emotion regulation occur in settings with other persons," (p. 31) but fewer than 12% of the studies assessed emotion regulation in the presence of another person (Campos, Walle, Dahl, & Main, 2011). This further emphasizes the need to conduct research with couples using measures that can assess in-vivo emotion regulation in both partners in response to emotionally evocative situations. This can be accomplished through measuring the physiological changes that indicate activation of the SNS and vagal reactivity.

The Mediating Role of the Autonomic Nervous System

As outlined above, the ANS is made up of the sympathetic and parasympathetic branches, each of which exerts unique physiological effects on the body in response to perceived

threat. Therefore, in order to gain a more complete understanding of the role of the ANS in the relationship between emotion regulation and conflict tactics, it is important to assess the impact of both PNS and SNS activation on these variables individually. However, while the research presenting emotion regulation as a predictor for conflict tactics among couples is limited, the literature describing the role of physiological measures of PNS and SNS activity in mediating this relationship is even more scarce. Most of this research has conceptualized PNS activity as vagal tone, and measured SNS activity using cardiac pre-ejection period (PEP), which is a physiological measure of cardiac thoracic impedance, with shorter PEP indicating greater SNS influence (Balzarotti et al., 2017). Because no prior study has tested the role of vagal tone or PEP as mediating variables in the relationship between emotion regulation and conflict tactics in couple interactions, we review the research establishing the relationship between emotion regulation and vagal tone, and between vagal tone and conflict tactics more generally. This is followed by a review of research on PEP as an indicator of SNS activation and its relationship to emotions, and on the relationship between PEP and conflict.

The majority of peer-reviewed studies on vagal tone to date have found it to be a valid and nonintrusive measure of synchronous emotion regulation (Balzarotti et al., 2017; Conway et al., 2013; Mendes, 2016; Smith et al., 2011). Additional studies have found significant relationships between various measures of vagal tone and expressions of aggression, hostility, and violence (Puhalla, Kulper, Fahlgren, & McCloskey, 2019; Romero-Martínez, Nunes-Costa, Lila, González-Bono, & Moya-Albiol, 2014). One of the biggest limitations in current research on PEP is that many of the studies linking PEP with emotion regulation and conflict tactics have used samples of young children (Beauchaine, Gatzke-Kopp, & Mead, 2007; Beauchaine et al., 2013; Fagan, Zhang, & Gao, 2017; Kahle, Miller, Lopez, & Hastings, 2016). However, a study

comparing SNS reactivity, measured as PEP, across a variety of mentally, emotionally, and physiologically stimulating tasks in a sample of preschool-aged children and young adults found that children's changes in PEP are similar to those in young adults, though children show smaller SNS reactivity (Quigley & Stifter, 2006). For this reason, several studies conducted on samples of children have been included in the review of current research. A few studies have found a significant relationship between PEP and emotion regulation ability (Kahle et al., 2016; Kelsey, 2012; vanOyen Witvliet, Mohr, Hinman, & Knoll, 2015). Additional research has found correlations between patterns of PEP reactivity and aggression and perpetration of violence (Beauchaine et al., 2013; Romero-Martínez et al., 2014). Several of these studies and their implications are discussed below.

Vagal tone as a measure of emotion regulation. A literature review by Balzarotti et al. (2017) reviewed the findings of 135 papers published between 1996 and 2016 in order to evaluate the validity of vagal tone as a measure of emotion regulation. They limited their review to studies that focused on one specific indicator of vagal tone which measures the influence of the PNS on cardiac activity via the vagus nerve, known as cardiac vagal control (CVC). Balzarotti et al. (2017) reported that evidence supports the notion that variations in heart rate associated with respiration are predominantly controlled by the vagus nerve and therefore reflect CVC. Overall, they found that higher resting CVC was associated with greater ability to regulate negative affect using adaptive regulatory strategies. Increases in CVC were shown to reflect either recovery from stress or self-regulatory efforts. One study cited in this literature review measured couples' phasic changes in CVC, or vagal reactivity, during conflict discussions. They found that husbands' and wives' phasic CVC was significantly related to one another, indicating that emotion regulation ability varies not just on an individual level, but on a couple level as well

(Smith et al., 2011). Balzarotti et al. (2017) ultimately concluded that, despite some conflicting results in the literature, there is ample support for the use of measures of vagal tone as objective measures of emotion regulation, and that measuring these physiological responses in couples has the potential to reveal meaningful trends in emotion regulation ability.

Vagal tone and its relationship to conflict tactics. Puhalla et al. (2019) noted that the research explicitly linking vagal regulation with hostility and aggression is limited, but that existing research points to reduced physiological regulation as a possible predictor of trait hostility and aggression. Puhalla et al. (2019) designed a study aimed at examining the relationship between another measure of vagal tone known as heart rate variability (HRV) and in vivo aggression in young adults before, during, and after highly provoking experiences. Results for this sample showed that a measure of the balance between SNS and PNS influence on cardiac activity known as low-to-high frequency HRV ratio was positively associated with provoked aggression and increased aggression in response to increased provocation. These results suggest that a heightened balance of SNS and PNS functioning – or in other words, increased vagal tone – may be associated with provoked aggression but not unprovoked aggression (Puhalla et al., 2019). These findings suggest that vagal tone, in addition to emotion regulation ability, may influence the way conflict is expressed in interactions with others. However, these implications as they relate to couple conflict tactics must be interpreted with caution, as this study examined only individuals' responses to fictious same-gender others.

PEP as a measure of SNS activation and emotional arousal. PEP has been found to shorten primarily during situations involving active coping to meet environmental demands (Kelsey, 2012; Mendes, 2016). Kelsey describes active coping as behavioral responses occurring in "circumstances in which there is some possibility of escape from a stressful situation" (2012,

p. 44), or in other words, the "fight or flight" response. This response is characterized by "near complete vagal withdrawal" and "large increases in cardiac output" by the now uninhibited SNS, which can be measured as PEP shortening (Beauchaine et al., 2007, p. 175). These changes in PEP occur only in the context of SNS arousal, indicating that PEP is a reliable and valid measure of SNS activity and resulting behavioral activation (Beauchaine et al., 2007; Kelsey, 2012). Additionally, Beauchaine et al. (2007) suggest that the fighting and fleeing responses are characterized by feelings of rage and panic, respectively, which indicates that SNS activation may be accompanied by strong emotions such as anger and fear. However, research linking the regulation of these emotions with SNS arousal is limited in its ability to explain the relationship between these two variables.

In a sample of 67 preschool-aged children, Kahle et al. (2016) measured emotion regulation (as reported by mothers) and PEP during baseline, provocation, and recovery period. They found that better emotion regulation was linked with PEP lengthening, or SNS withdrawal, during the repair period but not during the provocation period. The researchers reported that these results suggest that the ability to quickly down-regulate physiological arousal after a period of provocation "rather than continuing to be physiologically primed for fight-or-flight responding" may be an important part of effective emotion regulation (Kahle et al., 2016, p. 359). However, they also note that additional research is needed in order to better understand the complicated relationship between PEP and emotion regulation, and that due to limited research, "it remains difficult to conclude whether SNS activation is adaptive in terms of emotion regulation" (p. 361).

A study of 64 college-aged students examined the relationship between PEP and emotion regulation more closely by testing the effects of practicing different emotion regulation strategies

on PEP in response to ruminations on a past interpersonal offense (vanOyen Witvliet et al., 2015). Similar to the previously discussed study by Maldonado et al. (2015), participants in this study were randomly assigned to learn one of two emotion regulation strategies: compassionate reappraisal (adaptive) or expressive suppression (maladaptive). After receiving instruction on their assigned coping strategy, participants engaged in six offense rumination trials, three of which were immediately followed by a brief period of coping using the assigned emotion regulation strategy. PEP was measured at baseline and throughout the six offense rumination trials, and participants' emotional experiences were measured via self-report questionnaires following each trial. Results showed that both emotion regulation strategies were linked to reduced self-reported ratings of negative emotion, but only compassionate reappraisal showed decreased PEP reactivity compared to offense rumination (vanOyen Witvliet et al., 2015). The researchers reported that their findings are consistent with prior research demonstrating increased activation of the SNS during rumination, but not during reappraisal (Ray, Wilhelm, & Gross, 2008). Such findings indicate that SNS activation and emotion regulation are significantly linked, though much is still unknown about the specific role of the SNS in the process of emotion regulation and the behavioral implications of this relationship.

PEP and its relationship to aggression and conflict. A study by Beauchaine et al. (2013) found a significant relationship between PEP and externalizing behaviors such as aggression in a sample of 99 preschool-aged children with attention-deficit/hyperactivity disorder (ADHD). They found that those who exhibited lengthened PEP at baseline and less PEP reactivity to incentives scored higher on measures of aggression and conduct problems, indicating that certain patterns of SNS activity and reactivity (as measured by PEP) are correlated with increased aggression in young children with ADHD. While these findings may

not be generalizable to other age groups or even those without ADHD, these results nonetheless indicate that there may be a relationship between PEP and aggression worth investigating in other populations. In response to studies linking PEP reactivity to emotions such as anger and fear, Kelsey reports it is expected that "PEP reactivity will be associated with traits and dimensions of individual differences that are… predisposed toward active (fight-flight) rather than passive (conservation-withdrawal) modes of coping" (2012, p. 57), meaning that this measure of SNS reactivity is likely significantly related to certain behavioral responses used by individuals in coping with conflict or stress.

Romero-Martínez et al. (2014) conducted a study which supports this theory by examining changes in heart rate, PEP, and vagal ratio in response to stress in IPV perpetrators. A sample of 17 men who had been arrested for impulsive acts of violence in response to marital conflict was recruited for this study and was compared to a control group consisting of 17 men of similar demographics who had never struggled with IPV. Romero-Martínez et al. (2014) found significantly higher heart rates, lower vagal ratios, and shorter PEPs among IPV perpetrators than controls, especially during the recovery period following a stress-inducing experience. They concluded that these altered cardiovascular patterns of response to stress in IPV perpetrators may increase our understanding of the biological functioning of violence-prone individuals, thus "supporting the validity of cardiovascular measures as diagnostic indicators for IPV classification" (Romero-Martínez et al., 2014, p. 321). These findings, though significant, once again provide limited insight into how couples' physiological responses to conflict and stress may affect the ways they respond to conflict in their relationships generally. This further emphasizes the need to study the role that physiological reactivity may play in the way that emotions are regulated and conflict is handled in couple relationships.

The present study aims to determine whether emotion regulation ability is associated with conflict tactics in married couples, and whether physiological reactivity of the SNS and PNS mediate this relationship. Despite the lack of existing research on the interaction of these variables within this clinical population, we believe that our hypothesis rests upon firm theoretical groundwork and has adequate supporting evidence from the research that has been conducted to date. Therefore, we test the following hypothesis and research question:

Hypothesis 1: Difficulties in emotion regulation will be positively associated with maladaptive conflict tactics.

Research Question 1: Is the association between emotion regulation and maladaptive conflict tactics mediated by specific patterns of ANS reactivity, specifically heightened SNS response and PNS withdrawal?

Methods

Participants

The sample for this study included 38 participants (19 heterosexual married couples) with an average age of 29.45 years (SD=4.4; range=22-38). All participants remained married for the duration of the study. Demographics of the sample are as follows: 84.21% White (n=32), 2.63% Asian/Pacific Islander (n=1), 7.89% Hispanic (n=3), and 7.89% mixed race (n=3), with the average number of children being 1.90 (SD=1.56; range=0-5) and the average family income between $45,000 and $55,000.

Participants for this study were recruited from clients who called into the BYU Comprehensive Clinic seeking couple therapy with marital distress as the primary complaint. Inclusion criteria included: a) fluent in English; b) able to have an MRI; c) married for at least one year; d) a score of less than 13.5 on the Couple Satisfaction Index (CSI-4; Funk & Rogge,

2007), indicating clinically significant distress; e) no substance abuse, addiction, or severe mental disorders; f) able to participate with their partner. Participants were compensated with $200 each and a digital copy of their MRI.

Design

The data for this study was taken from the Changing Hearts And Minds in RelationshiPS (CHAMPS) project that is currently being conducted at Brigham Young University. The CHAMPS project is investigating mechanisms of change within couple therapy and uses a variety of measures, including physiological data of both clients and therapists, accelerometers, daily diary assessments, fMRIs, video recordings of therapy sessions, and standard self-report assessments taken at the beginning and end of the study. Participants took an assortment of self-report assessments at a pre-treatment meeting, after which they participated in four therapy sessions. At the conclusion of these sessions, participants attended a post-treatment meeting during which they took the same assessments taken during the pre-treatment meeting. All procedures for this study were approved by BYU's Institutional Review Board for Human Subjects research. All of the data for this study were collected during the pre-treatment meeting and included self-report questionnaires on emotion regulation and conflict in the couple relationship, as well as physiological data taken at baseline and during a couple conflict discussion.

Procedure

Couples attended a one-hour research meeting prior to beginning couple therapy during which the procedures of the study were explained and participants filled out a series of questionnaires, including the Difficulties in Emotion Regulation Scale (DERS) and Revised Conflict Tactics Scale Short Form (CTS2S). Participants' physiological data, including PEP and

HRV, which is a measure of respiratory sinus arrythmia (RSA), was collected using MindWare software, MindWare Mobile Impedance Cardiographs, and nine electrodes placed on the palms, collar bone, neck, and ribcage. After placing the electrodes in the correct positions with the help of a research assistant, two 3-minute baseline readings were collected in order to establish baseline RSA and PEP. The first was three minutes of silence while the couple watched a video of fish swimming. The second was a speaking baseline, wherein couples were instructed to alternate counting aloud for 20 seconds at a time during a three-minute interval. Following the baseline period, participants were instructed to engage in a 20-minute discussion on one of the topics that they had reported on earlier as leading to the most conflict in their marriage. Each participant's average RSA and PEP during the three-minute speaking baseline period and the middle ten minutes of the conflict discussion were later calculated.

Measures

Difficulties in Emotion Regulation Scale (DERS). The DERS, developed by Gratz and Roemer (2004), was designed to assess clinically relevant difficulties in emotion regulation and consists of 36 items on a five-point Likert scale where 1 = "this almost never applies to me" and 5 = "this almost always applies to me." Examples of items from this measure include: "I experience my emotions as overwhelming and out of control" and "When I'm upset, I have difficulty controlling my behaviors." DERS scores for this study ranged from 1 to 5, with higher scores indicating greater difficulty with emotion regulation, and were calculated by taking the mean of the 36 items (11 items were reverse-scored). Gratz and Roemer tested the reliability and validity of the measure following its development and proved the DERS to have high internal consistency, good test-retest reliability, and adequate predictive and construct validity (2004). The DERS was found to have excellent internal reliability for this sample (α=0.96).

Revised Conflict Tactics Scale Short Form (CTS2S). The CTS2S is a shortened form of the CTS2 (Straus et al., 1996), which is a revised version of the Conflict Tactics Scale (CTS) developed by Straus (1979). The CTS2S is a 20-item assessment which uses five subscales to classify various behaviors used by couples to respond to conflict. Adaptive conflict tactics are measured in the negotiation subscale, and maladaptive conflict tactics are measured in the physical assault, psychological aggression, sexual coercion, and injury subscales. Each subscale consists of four questions (two of which respondents use to report on their own behavior, and two of which are used to report on their spouse's behavior) on an eight-point scale where 1 = "once in the past year," 2 = "twice in the past year," 3 = "3-5 times in the past year," 4 = "6-10 times in the past year," 5 = "11-20 times in the past year," 6 = "more than 20 times in the past year," 7 = "not in the past year, but it did happen before," and 8 = "this has never happened." Due to lack of sufficient reports of injury and sexual coercion by this sample, only scores from the physical assault and psychological aggression subscales, as reported by the spouse, were used in analyses to measure the use of maladaptive conflict tactics. CTS2S scores for this sample ranged from 1 to 6 (after all sevens and eights were recoded to zeros), with higher scores indicating greater frequency of conflict tactics measured on that subscale. Physical assault scores were taken from the mean of items 10 ("My partner pushed, shoved, or slapped me") and 12 ("My partner punched or kicked or beat-me-up") on the CTS2S, while psychological aggression scores were taken from the mean of items 4 ("My partner insulted or swore or shouted or yelled at me") and 14 ("My partner destroyed something belonging to me or threatened to hit me"). The CTS2S has been shown to have good internal consistency as well as adequate construct and discriminant validity (Straus & Douglas, 2004). The physical assault subscale was found to have

acceptable internal reliability within this sample (α=0.70). However, the internal reliability of the psychological aggression subscale was found to be unacceptably low (α=0.45).

Respiratory sinus arrhythmia (RSA). RSA is an indicator of PNS functioning, or vagal tone. As a measure of vagal reactivity within the PNS, RSA indicates when someone is in a state of rest and relaxation. RSA was collected during baseline and conflict discussion periods and was derived from respiratory and electrocardiograph (ECG) data using two ECG electrodes. The two electrodes were placed on the side of the left bottom rib and the right collarbone on each participant. One additional electrode, which served as a grounding signal, was placed on the side of participants' right bottom rib. Respiration and electrical activity of the heart were recorded by the electrodes, which were connected to the MindWare Mobile device, where data was wirelessly communicated to the MindWare software. The phases of the respiratory cycle were derived from the thoracic impedance signal. RSA scores represent the change in RSA from baseline to conflict discussion, and were found by subtracting each participant's mean RSA score during the three-minute baseline from the mean RSA score from the middle ten minutes of the conflict discussion.

Cardiac pre-ejection period (PEP). PEP is an indicator of SNS activation based on the "brief interval between the depolarization of the heart at the beginning of a contraction and the point when blood forces open the aortic valve" occurring during the initial portion of a heartbeat (Smith et al., 2011, p. 106). PEP was collected during the baseline and conflict discussion periods using ECG data and was measured as "the period of time between the Q-wave… to the B-point of the *dZ/dt* wave form" (Burns, Ferguson, Fernquist, & Katkin, 1992, p. 166). PEP shortening indicates when a person's stress response is being mediated by the SNS, thus shorter PEP indicates greater SNS activation (Mendes, 2016; Smith et al., 2011). As one of the few

measures of SNS activity that is not dually innervated by both the SNS and the PNS, PEP is considered a sensitive and reliable measure of SNS activation and has been found to have high internal consistency and good test-retest reliability (Burns et al., 1992; Smith et al., 2011; Kelsey, 2012). PEP scores in this study represent the change in cardiac pre-ejection period from baseline conflict discussion, and were found by subtracting each participant's mean PEP score during the three-minute baseline from the mean PEP score from the middle ten minutes of the conflict discussion.

Analytic Strategy

Because this study collected data from married couples, participants' relationship to their spouse was a source of non-independence. Thus, we tested the assumption of non-independence using an intraclass correlation (ICC) to assess the percentage of variance in participants' conflict tactics that is due to shared variance at the couple level. If the ICC confirms non-independence, a multi-level analysis, wherein individual-level data are nested within couples, can effectively account for shared variance due to the non-independence. The hypothesized model (figure 1) was fit in a path analytic framework using Mplus, version 8.3 (Muthén & Muthén, 1998-2013), with 5000 bootstrap draws.

Results

Preliminary results showed no significant relationship between the measured variables. Husbands' and wives' mean DERS scores were 2.03 and 2.83, respectively. While no standardized clinical cutoff scores for this measure exist, research has suggested that the clinical cutoff ranges from 2.22 to 3.53 (Haynos, Roberto, & Attia, 2015), meaning that wives' mean DERS scores may indicate clinically significant difficulty with emotion regulation. Husbands' mean physical assault and psychological aggression subscale scores taken from the CTS2S were

0.37 and 1.71, respectively, while wives' mean scores were 0.50 and 1.37, respectively. Similarly, no standardized clinical cutoff scores exist for the CTS2S, though prior research has used a cutoff of 1 on the physical assault, sexual coercion, and psychological aggression subscales to detect the presence of IPV (Iverson et al., 2013). This suggests that the couples in our sample on average did not experience a clinically significant level of physical assault, but did experience a clinically significant level of psychological aggression. Additional descriptive statistics for emotion regulation, conflict tactics, and physiological reactivity can be found in Table 1.

Bivariate analyses showed strong correlations between husbands' and wives' DERS (r = .66, $p < .001$), physical assault (r = .74, $p < .001$), and psychological aggression scores (r = .67, $p < .001$), in addition to significant correlations between husbands' and wives' changes in RSA from baseline to conflict (r = .37, $p < .05$). These correlations were expected due to nonindependence between spouses. Among husbands, a strong positive correlation was found between physical assault and psychological aggression, and a strong negative correlation was found between RSA and DERS scores. Among wives, a moderate positive correlation was found between physical assault and psychological aggression, while a weak positive correlation was found between psychological aggression and DERS scores, with weak negative correlations between RSA and DERS scores, and between RSA and PEP. See Table 2 for a complete list of bivariate correlations.

These correlations may suggest that individuals who use certain maladaptive conflict management strategies, such as psychological aggression, are more likely to use other maladaptive tactics, such a physical assault. The negative correlations between RSA and DERS scores for both husbands and wives may also indicate that a relationship between PNS reactivity

and emotion regulation may exist to some degree, but was not able to be fully explored with the data we used in our analyses. Additionally, the strong correlations found between husbands' and wives' ability to regulate their emotions and the use of physical assault and psychological aggression in response to conflict seems to support the idea that spouses influence one another in this regard. Finally, the presence of more statistically significant correlations for wives than for husbands could indicate that there are differences in the relationships between these variables for women compared to men.

The Intraclass Correlation Coefficients (ICCs) for all endogenous variables (i.e., mediators and outcomes) were .00, indicating that in this sample, there was no shared variance due to being a member of a couple. Thus, we did not fit a multi-level model as initially planned and treated each individual as independent.

Hypothesis 1: Difficulties in emotion regulation will be positively associated with maladaptive conflict tactics.

Our first hypothesis states that difficulties in emotion regulation will be positively associated with maladaptive conflict tactics, specifically psychological and physical aggression. To test this hypothesis, we regressed psychological aggression and physical assault onto DERS. The resulting model was saturated (i.e., zero degrees of freedom and "perfect" model fit indices). Results indicated, however, that DERS was not statistically significantly related to either outcome.

Research Question 1: Is the association between emotion regulation and maladaptive conflict tactics mediated by specific patterns of ANS reactivity, specifically a heightened SNS response and PNS withdrawal?

To answer the research question regarding mediation, we fit the hypothesized model (figure 1). Model fit indices represented excellent model fit [χ^2 (1) = 0.03, p = .86; RMSEA = .00, 90% CI [.00, .234], p = .87; TLI = 1.00; CFI = 1.00]. Again, results indicated that there was no significant relationship between any of the variables.

Discussion

The primary aim of this study was to investigate the relationship between difficulty with appropriately regulating one's emotions and the use of maladaptive conflict tactics in married couples, as well as the role of physiological reactivity in this relationship. Existing theories have suggested that certain measures of ANS activity may be physiological indicators of the process of emotion regulation, and that both emotion regulation and ANS reactivity may influence the use of maladaptive conflict tactics in marital relationships (Gross, 1998; Porges, 2001, Porges, 2011; Porges et al., 1994). Research on these variables has found that difficulty with emotion regulation is associated with the use of maladaptive conflict tactics in couples (Burk & Seiffge-Krenke, 2015; McNulty & Hellmuth, 2008), while increasing adaptive emotion regulation skills leads to a decrease in maladaptive responses to conflict (Hesser et al., 2017; Maldonado et al., 2015). Additional studies investigating the impact of ANS reactivity on this relationship have found significant relationships between maladaptive conflict tactics and both reactivity of the SNS and the regulatory ability of the PNS (Beauchaine et al., 2013; Puhalla et al., 2019; Romero-Martínez et al., 2014), while other studies have found significant relationships between measures of SNS and PNS activity and emotion regulation (Kahle et al., 2016; Kelsey, 2012; vanOyen Witvliet et al., 2015). We used self- and partner-reports of emotion regulation and conflict tactics, respectively, and measured changes in RSA and PEP during conflict to test the assumption that emotion regulation was significantly related to conflict tactics, and that changes

in RSA and PEP from baseline to conflict would help explain this relationship. However, no significant relationships between these variables were found based on the results obtained from this sample.

While the results of this study may have been impacted by one or more significant limitations which will be discussed later, these findings, though unexpected, may still provide some support for Gross' emotion regulation model. Gross himself states that the process of emotion regulation is multifaceted, as it includes processes aimed at increasing and decreasing experiences or expressions of both negative and positive emotions (1998). Moreover, he claims that emotion regulation processes "may be automatic or controlled, conscious or unconscious, and may have their effects at one or more points in the emotion generative process" (Gross, 1998, p. 275). To further complicate this concept, Gross also states that the "neural emotion circuits do not appear to overlap completely" in the brain, which suggests that the same is true of the circuits involved in regulating those emotions, and therefore "there may be important differences in emotion regulatory processes across emotions" (1998, p. 275). Thus, there seems to be a vast amount of variability in the emotion regulatory process both within and between individuals, as well as across emotions. The fact that we did not find a relationship between difficulty with emotion regulation and the use of maladaptive conflict tactics may be because "emotion regulation ability" is too broad a concept in relation to this specific outcome variable. Perhaps there are certain facets of what Gross defines generally as "emotion regulation" that more strongly correlate to aggressive or violent behavior.

Gross' process model of emotion regulation proposes five unique sets of emotion regulatory processes, of which only one (response modulation) occurs after an emotional response has been generated. The other four processes (situation selection, situation

modification, attentional deployment, and cognitive change), which he defines as antecedent-focused emotion regulation strategies, occur before the emotional response has been triggered. These antecedent-focused strategies aim to alter various aspects of a situation that an individual knows may trigger a maladaptive emotional response, as well as what aspects of those situations the individual chooses to focus their attention on and what meanings will be attached to that situation. According to Gross' process model (1998), it is only after these four processes have occurred that an emotional response will form, which can then be further modulated before manifesting in the form of emotional expression and behavior.

We expected to find a significant relationship between emotion regulation ability, as measured by DERS scores, and the use of maladaptive behaviors to manage conflict in marital relationships because, according to Gross' process model (1998), the more skilled an individual is in the regulation of his or her emotional experiences and responses, the more adaptive his or her emotional expression will be. However, while the DERS measures a variety of emotion regulation skills related to conscious and unconscious regulation of both positive and negative emotions, it primarily measures response-focused emotion regulation strategies (response modulation which occurs only after the emotional response has been generated), which can be clearly seen by the wording of its items, 27 out of 36 of which begin with the phrase "When I'm upset…" This suggests that our study may have only measured one out of the five emotional regulatory processes laid out in Gross' emotion regulation model. Perhaps the lack of correlation between one's ability to use response-focused emotion regulation and conflict tactics is because emotion regulation strategies are simply not effective at preventing violent or aggressive behavior when they are employed after an emotional response with the potential to trigger these behaviors has already been generated. If this is the case, then violent or aggressive individuals

may report having little difficulty with response-focused emotion regulation because their ability to use such strategies has little impact on their behavior. However, it is possible that the ability to engage in antecedent-focused emotion regulation via situation selection, situation modification, attentional deployment, and cognitive change has a much greater impact on conflict tactics than does response modulation, as it focuses on preventing emotional responses with the potential to trigger violent or aggressive behavior from being experienced in the first place.

With this in mind, it is also possible that the physiological changes we measured in this study, which were not found to be significantly related to DERS scores, may prove to be more strongly related to antecedent-focused emotion regulation. According to Gross' emotion regulation model, this may be the case because, like the emotion generative process, "emotion regulation involves changes in… behavioral, experiential, and physiological domains" (1998, p. 275). The emotion generative process is inextricably tied to antecedent-focused emotion regulation, and according to both Gross (1998) and Porges et al. (1994), emotions function in part as tools which are influenced by the SNS and PNS to inform individuals about their environment and prepare them mentally and physically to respond accordingly. Therefore, if SNS and PNS activation are considered an integral part of the formation of emotions, it follows that antecedent-focused emotion regulation would also be significantly related to the same type of physiological changes. However, because we did not specifically measure antecedent-focused emotion regulation in this study, we do not know whether and to what degree this type of emotion regulation may have been occurring in our participants, making it impossible to detect patterns between this variable and physiological reactivity.

Finally, in contrast with the findings of prior studies, we found that ANS reactivity and measures of maladaptive conflict tactics were not significantly related. One explanation for these

findings may lie in the relational nature of our study in comparison to the individual-focused design of prior research. It is possible – and perhaps even likely – that unique patterns of physiological reactivity in response to conflict may emerge in relational contexts, especially in interactions between married couples. This may be due to participants' familiarity with both the person with whom they were engaged in a conflict discussion, as well as the topic around which the discussion was centered. According to Kelsey (2012), "sympathetic influences on the heart are most evident when environmental conditions and stressors are novel, unpredictable, or high in uncertainty," and SNS reactivity "declines significantly with repeated exposure to the same or similar tasks and environmental conditions" (p. 44). Because participants in this study discussed a familiar topic with a familiar person, the only novel environmental condition experienced was the setting in which the conflict discussion took place. These conditions may have led to a decrease in physiological reactivity in our participants compared to those in prior studies who were placed in completely novel situations. Though, since this study is one of the first of its kind, this hypothesis is difficult to confirm until more research is conducted on ANS reactivity in married couples or partners in committed relationships.

Clinical Implications

Because we did not find any significant relationships between emotion regulation, conflict tactics, and physiological reactivity in this study, our results may offer some insight for clinicians working with couples who struggle with emotion regulation and conflict management. While we still do not know exactly what factors exert the greatest influence on emotion regulation and conflict tactics, these findings tell us that a person's physiological reactivity to stress and conflict may not necessarily determine his or her emotional and behavioral response to that stressor. This knowledge may provide direction for clinicians who work with individuals

who may be more at risk for ANS dysregulation due to genetics or other biological factors, as these findings suggest that there are other factors at play that influence people's ability to regulate their emotions and behaviors in response to conflict. Clinicians should take this into consideration when working with couples who struggle with more severe issues around conflict management, and may benefit from exploring some of these other influences, such as social conditioning and cognitions. Furthermore, it may be worth investigating the impact of developing more antecedent-focused emotion regulation strategies aimed at altering clients' perceptions of a situation so as to prevent emotions which might otherwise trigger violent or aggressive behavior from being generated in the first place.

Limitations

This study has several limitations that should be taken into consideration when interpreting its results. One such limitation is the small sample size from which the data for this study was obtained. With only 38 individuals (19 couples), the statistical power for our analyses was significantly decreased, limiting their ability to detect any effects that may have existed in this sample. Any future research on this topic should include a larger sample size in order to increase statistical power and obtain a more accurate understanding of any relationships that may exist between these variables.

Another significant limitation that may have impacted the results of this study comes from the poor internal reliability and lack of variability in the scores obtained from this sample. The internal reliability of the psychological aggression subscale for this sample proved to be unacceptable. In addition, measures of physical assault showed especially low variability, with only three wives and six husbands reporting any incidents of physical assault by their spouse in the last year. This lack of variability in our sample resulted in ICCs of 0.00, as well as an

inability to detect any significant relationships between variables. With such limited information on couples who engage in maladaptive conflict tactics such as physical assault and psychological aggression, it becomes difficult to accurately observe patterns between these and other variables. In order to more accurately assess these relationships, future research must obtain a sample with greater variability and better internal reliability, either by recruiting a much larger convenience sample, or by actively recruiting couples who report more incidences of physical assault and psychological aggression.

Additional limitations come from the way physiological data was collected for this study. We measured PNS and SNS reactivity by measuring changes in RSA and PEP from baseline to conflict. However, we only used mean scores during a three-minute baseline and compared them to mean scores taken across ten minutes of a couple conflict discussion. This method for collecting physiological data is limited in that these mean scores may not reflect the more complex and subtle changes that make up patterns of ANS activity during baseline or conflict. Another limitation of our data collection procedure stems from the lack of data on post-conflict ANS activity, known as recovery. Romero-Martínez et al. (2014) found the most significant trends in SNS and PNS activity during the period of recovery following a stress-inducing experience, while Kahle et al. (2016) found patterns of SNS withdrawal related to better emotion regulation only during the recovery period. Their findings indicate that the period of time after a conflict discussion could be a vital part of the relationship between emotion regulation, conflict tactics, and ANS activity. Future research may benefit from observing and comparing trends in RSA and PEP during the recovery period in order to gain a better idea of the role of the ANS in people's emotional and behavioral responses to conflict and stress.

A final limitation of this study lies in its cross-sectional design. Because the data were gathered from the sample at only one point in time rather than across multiple time points, it provides only a limited view of the relationships between the measured variables at the time it was collected and therefore cannot be used to determine causal relationships. In addition, self-report data gathered for a cross-sectional study of this nature may be less reliable due to recall bias and attempts to downplay socially unacceptable behavior on the part of the respondent, and should thus be interpreted with caution. Future research on this topic may benefit from utilizing a longitudinal design utilizing more daily-diary assessments, as well as coding for the use of emotion regulation and conflict management strategies during a conflict discussion in order to avoid these limitations.

Future Directions

One major limitation of this study that should be considered in future research relates to the potential interactive effect from additional variables that were not accounted for. For example, lifestyle factors such as sleep, exercise, diet, daily stress levels, mental illness, and social support may exert a strong influence on the autonomic nervous system's responses to conflict and other stressors (Hu, Lamers, de Geus, & Penninx, 2016; Hu, Lamers, de Geus, & Penninx, 2017; Tobaldini et al., 2017), and could be important in better determining the role of the ANS in the relationship between emotion and conflict. Another variable which may cause an interaction effect with physiology and emotion regulation relates to serotonin levels. Research has found that carriers of a particular allele of the serotonin transporter gene display heightened activation of the amygdala in response to certain emotional stimuli, indicating that these individuals may experience a heightened SNS response to displays of anger (Kilpatrick et al., 2015; Murakami, Matsunaga, & Ohira, 2009; von dem Hagen, Passamonti, Nutland, Sambrook,

& Calder, 2011). In addition, the potential influence on emotion regulation and conflict management tactics of conditions that affect impulse control and executive functioning such as ADHD were not factored into our analyses. In fact, much of the research connecting physiological measures of ANS activity to emotion regulation and responses to conflict are drawn from samples with ADHD and conduct problems related to impulse control (Beauchaine et al., 2013; Beauchaine et al., 2007; Beauchaine, Katkin, Strassberg, & Snarr, 2001). This could indicate that individuals with ADHD may show unique patterns with regard to these variables.

Conclusion

The purpose of this study was to increase our understanding of the contributions to the use of violent, abusive, and otherwise maladaptive conflict tactics in couples. Basing our research questions on Gross' emotion regulation model (1998) and Porges' polyvagal theory (Porges, 2001; Porges, 2011; Porges et al., 1994), we tested the hypothesis that emotion regulation is significantly related to conflict tactics, and that PNS and SNS reactivity (as measured by RSA and PEP, respectively) are mediating variables in this relationship. In a sample of 38 individuals (19 couples), we found no statistically significant relationship to support this hypothesis. Based on these results, we conclude it is possible that patterns of PNS and SNS activity may not be as impactful on emotional and behavioral regulation as other variables, and that future research should investigate other possible contributors to these outcomes. The results of this study contradict much of the existing literature on the relationship between these variables and may have been impacted by one or more significant limitations to the study, and we therefore recommend that they be interpreted with caution. However, a lack of significant findings may also point to the exploration of other contributing factors to maladaptive conflict management tactics aside from emotion regulation as a useful intervention for clinicians.

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Table 1

Descriptive Statistics

	Husbands		Wives	
Variable	Mean	SD	Mean	SD
Emotion regulation				
DERS	2.03	0.41	2.83	0.86
Conflict tactics				
CTS2S Phys.	0.37	1.08	0.50	1.03
CTS2S Psych.	1.71	1.33	1.37	1.12
Physiological reactivity				
RSA	0.27	0.49	0.43	0.81
PEP	-5.68	19.83	-1.33	11.12

Note. DERS = Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004); CTS2S Phys. = frequency of physical assault as reported by spouse; CTS2S Psych. = frequency of psychological aggression as reported by spouse; RSA = change in respiratory sinus arrhythmia from baseline to conflict discussion; PEP = change in cardiac pre-ejection period from baseline conflict discussion.

Table 2

Bivariate Correlations Among and Between Husbands and Wives

		Husbands				
	Variable	1	2	3	4	5
Wives	1. DERS	.66***	.25	.24	-.57***	.27
	2. CTS2S Phys.	-.27	.74***	.61***	.05	.03
	3. CTS2S Psych.	.32*	.46**	.67***	.08	-.02
	4. RSA	-.33*	.20	.09	.37*	.25
	5. PEP	.11	.05	.00	-.39*	-.15

Note. *$p < .05$, **$p < .01$, ***$p < .001$, two-tailed. $N = 38$. Husbands' correlations are on top right half of table, wives' correlations are on bottom left half of table, and correlations for each variable between husbands and wives run downwards diagonally from left to right. DERS = Difficulties in Emotion Regulation Scale; CTS2S Phys. = frequency of physical assault as reported by spouse; CTS2S Psych. = frequency of psychological aggression as reported by spouse; RSA = change in respiratory sinus arrhythmia from baseline to conflict discussion; PEP = change in cardiac pre-ejection period from baseline conflict discussion.

Figure 1. Hypothesized Path Model