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Emotion dysregulation as an underlying mechanism of impulsive aggression: Reviewing empirical data to inform treatments for veterans who perpetrate violence

Shannon R. Miles [a,b,*,1], Carla Sharp [c], Andra Teten Tharp [b], Matthew S. Stanford [d], Melinda Stanley [a,b], Karin E. Thompson [a,b], Thomas A. Kent [a,e]

[a] South Central Mental Illness, Research, Education and Clinical Center (MIRECC), Michael E. DeBakey Veterans Affairs (VA) Medical Center, 2002 Holcombe Blvd, Houston, TX 77030, USA
[b] Menninger Department of Psychiatry and Behavioral Sciences, Baylor College of Medicine, 1 Baylor Plaza, Houston, TX 77030, USA
[c] Department of Psychology, University of Houston, 126 Heyne Building, Houston, TX 77204, USA
[d] Hope and Healing Institute, 717 Sage Rd., Houston, TX 77056, USA
[e] Department of Neurology, Baylor College of Medicine, 1 Baylor Plaza, Houston, TX 77030, USA

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ABSTRACT

Violence can lead to posttraumatic stress disorder (PTSD), which in turn is related to perpetration of aggression. Importantly, not all aggression is motivated by the same mechanisms, and understanding the driving force behind the aggression is imperative in order to select treatments that will assist the individual in decreasing the behavior. PTSD is specifically related to impulsive aggression, or aggression that is emotionally charged and uncontrolled, rather than premeditated aggression, which is planned, unemotional, and goal-directed. Emotion regulation, or the ability to recognize emotions, accept them, and control emotion-related behaviors, is related to both PTSD and impulsive aggression. This conceptual paper uses the Catalyst Model to review the literature on PTSD, impulsive aggression, and emotion regulation. Because of their high rates of PTSD, veterans are presented as a demonstration of the relationship between emotion regulation and impulsive aggression. The integrative model can be viewed as an alternative to the traditional model that proposes anger is the primary underlying mechanism of impulsive aggression in adults. Treatment recommendations, such as helping clients develop emotion regulation skills, are offered for providers who are working with individuals who have experienced trauma and who are now perpetrating impulsive aggression.

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Aggression can have devastating interpersonal and societal consequences for victims and perpetrators, including incarceration (Friel, White, & Hull, 2008; Elbogen et al., 2012); family violence; and disruption of treatment-facilitating factors, such as social support (Gros, Price,

* Corresponding author at: James A. Haley Veterans' Hospital, 13000 Bruce B. Downs Blvd (116A), Tampa, FL 33612, USA.
E-mail address: Shannon.miles@va.gov (S.R. Miles).
[1] Is now at the James A. Haley Veterans' Hospital in Tampa, Florida.

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Yuen, & Acierno, 2013; Morland, Love, Mackintosh, Greene, & Rosen, 2012). It can be driven by different causes, and an understanding of the specific underlying mechanisms that contribute to an aggressive act may be helpful in reducing future violence/aggression (Kazdin, 2011). Experiencing trauma, violence, or maltreatment has been established as a key risk factor for subsequent perpetration of aggression (Smith, Cross, Winkler, Jovanovic, & Bradley, 2014; Widom, Schuck, & White, 2006); however, the mechanisms by which trauma leads to aggression are not well understood, particularly among aggressive adults who have experienced trauma during adulthood. In this article we argue that the experience of trauma and the inability to regulate emotions afterward are important contributors to the perpetration of violence.

We illustrate the relationship between emotion regulation and aggression by examining veterans returning home from war after frequently seeing and engaging in necessary and sanctioned violence, which can be traumatic. Many veterans develop posttraumatic stress disorder (PTSD; Tanielian & Jaycox, 2008) which includes intrusive symptoms, avoidance, negative cognitions and emotions, and hyperarousal (American Psychiatric Association (APA), 2013). PTSD, in turn, is related to emotion dysregulation (Miles, Menefee, Wanner, Tharp, & Kent, 2015a), aggression, and violence in both veteran (Orth & Wieland, 2006) and civilian samples (Hahn, Aldarondo, Silverman, McCormick, & Koenen, 2015). The goal of this paper is to encourage researchers and clinicians to consider emotion regulation when treating or conducting research on trauma-exposed patients who are struggling to manage their aggression, especially emotionally reactive and uncontrolled aggression.

1. Aggression in returning veterans

The same criteria are used to diagnosis PTSD for veterans and civilians, and PTSD is related to aggression in both samples (Orth & Wieland, 2006). Yet, even with these similarities civilians and veterans with PTSD can have different clinical presentations. First, veterans develop PTSD at a higher rate (7–30%; Dohrenwend et al., 2006; Kulka et al., 1988; Richardson, Frueh, & Acierno, 2010) than civilians (8–12%; Norris & Slone, 2007). Veterans also experience a culture with excessive substance use, mental health stigma, medical injuries, and chronic pain (Frueh, Grubaugh, Elhai, & Ford, 2012, ch. 10). Younger veterans who were exposed to improvised explosive devices (IEDs) may present with extreme hypervigilance to danger cues (Tuerk, Grubaugh, Hamner, & Foa, 2009), as compared to civilians without combat experience. Keeping these differences in mind, we use veterans with PTSD as a demonstration of how emotion regulation may relate to aggression.

Aggressive behavior is common among veterans with PTSD (Taft, Watkins, Stafford, Street, & Monson, 2011). Within the first year after deployment, 48% of returning veterans with PTSD reported engaging in physical aggression, and 20% reported engaging in severe violence (Elbogen et al., 2014). Veterans with PTSD have more anger and hostility (Orth & Wieland, 2006) and engage in more acts of intimate partner aggression, than civilians with PTSD (Marshall, Panuzio, & Taft, 2005; Orth & Wieland, 2006). The association between PTSD and aggression is concerning, considering 7–20% of Afghanistan and Iraq War veterans (Hoge et al., 2004; Tanielian & Jaycox, 2008) and 19–30% of Vietnam Veterans are diagnosed with PTSD (Dohrenwend et al., 2006; Kulka et al., 1988). Bureau of Justice data show that, although veterans were less likely to have been incarcerated than the general population, veterans were more likely to serve sentences for violent offenses (57%) than nonveterans (47%; Noonan & Mumola, 2007).

Although several formulations have been employed for aggression subtypes, here we focus on the categories of impulsive and premeditated aggression (Stanford et al., 2003). Impulsive aggression has been characterized as emotionally charged, reactive, and uncontrolled. Premeditated aggression is considered deliberate, goal-directed, and planned (Stanford et al., 2003). Each has been associated with different clinical correlates (Babcock, Tharp, Sharp, Heppner, & Stanford, 2014) and treatment outcomes (Barratt, Stanford, Felthous, & Kent, 1997a; Stanford et al., 2003). Note that aggression subtyping (premediated versus impulsive) can be applied to many different violent behaviors and outcomes, such as aggression toward self, others, or objects and so has broader implications than any one specific type of violent behavior (e.g. intimate partner violence). The majority (70%) of veterans with PTSD engage in the impulsive aggression subtype (Teten et al., 2010a; Teten et al., 2010b), which often results in guilt for the act and a desire to change the behavior. The preponderance of impulsive aggression in this population indicates a potential opportunity for intervention.

Treatment studies that do not take aggression subtypes into account have the potential to obscure or wash-out important within-group variation among aggressive individuals. Perhaps counter-intuitively, the extent of the traits “impulsivity” and “anger” are not the major differentiators between these aggression subtypes; because, in antisocial, prison samples, both impulsive and premeditated aggressors demonstrated similar levels of impulsivity and self-reported anger (Barratt, 1959; Barratt, Stanford, Kent, & Felthous, 1997b). While it is possible that this finding represents a ceiling effect of high impulsivity and anger in both groups, it suggests that other factors are involved in the control of impulsive aggression acts. Neuropsychological factors can distinguish impulsive and premeditated aggressors; impulsive aggressors have poorer verbal skills, less verbal memory, less sensitive neural arousal levels for novel stimuli, and fewer planned aggressive acts than premeditated aggressors (Barratt et al., 1997b; Miller, Collins, & Kent, 2008). More recently, psychological factors have been shown to be important mediators of the distinction between impulsive and premediated aggression, namely, emotion regulation (Miles et al., 2015a).

Emotion regulation has been defined in many ways, with Gratz and Roemer providing a comprehensive definition that offers clinical utility to those treating clients with emotional difficulties. According to Gratz and Roemer, emotion regulation is the ability to be aware of emotions, accept them, control impulsive behaviors, and implement content-appropriate regulation strategies (Gratz & Roemer, 2004). Lacking or undeveloped skills in one or more of these areas is considered emotion dysregulation. Gratz and Roemer's definition has a broad scope and recognizes multiple emotion regulation facets which is useful in conceptualizing clients who may all display “emotion dysregulation” but differ with which facet they are struggling (e.g. being unaware when they are feeling sad versus feeling sadness but refusing to express it). Because of its broad scope, Gratz and Roemer's definition will be used for the remainder of this manuscript.

2. Mechanisms of impulsive aggression

The Catalyst Model (Ferguson et al., 2008) will be used to conceptualize impulsive aggression in this manuscript. There are other ways to view the development of impulsive aggression, such as the General Aggression Model, (DeWall, Anderson, & Bushman, 2011); however, we believe that the Catalyst Model incorporates biological individual differences and the environment in a way that is consistent with evolutionary theory and recognizes the adaptive value of aggression. The Catalyst Model states that there is a biological predisposition (usually in men likely because of androgenizing steroid hormones) that interacts with family upbringing and violence exposure in order to produce an aggressive personality disposition. Similar to conceptualizations of how impulsive behaviors come about in Borderline Personality Disorder (e.g. Linehan, 1993), the Catalyst Model suggest that heritable traits interact with adverse family environments to produce aggressive behavior. In this context, secure attachment to the primary caregiver plays a key role. Attachment has been shown to be important not only for the development of emotion regulation, but also for the development of theory of mind (ToM) (Sharp, Fonagy, & Allen, 2012). ToM refers to the capacity to attribute desires, feelings, and beliefs to others in order to

foster adaptive social interaction and relationships. Early family adversity, particularly that of insecure attachment or early abuse experiences, inhibits the development of adequate emotion regulation skills as well as ToM, which in turn, affects the individual's ability to make use of social support. Later trauma (such as the trauma often experienced by veterans) becomes a catalyst that interacts with dispositional traits (impulsiveness, emotion dysregulation, and reduced theory of mind capacity) and puts the individual at risk for perpetrating violence. More data are needed to empirically test the Catalyst Model in veteran samples; however, the model explains how biology, childhood, and military experiences may play a role in Veterans with PTSD developing impulsive aggression.

A unique aspect of the Catalyst Model is that it allows one to view aggression from an evolutionary perspective (Ferguson & Dyck, 2012). Aggressiveness is not only a human trait but found throughout the animal kingdom (Thomas, Davis, & Dierick, 2015), suggesting humans developed the trait and continue to have it because it serves a functional purpose, namely agenda protection (Harkness, Reynolds, & Lilienfeld, 2014). That is not to say that all aggression is good, but rather aggression can serve adaptive purposes, such as protecting oneself, family, or belongings, being assertive and defending one's agenda, or standing up for values in which one believes (Harkness et al., 2014). While these acts are generally not considered "aggression" they are on the continuum of agenda protection. Categorizing all "aggressive" acts as "bad" ignores the dimensionality of the construct that is found throughout the animal kingdom (Ferguson & Dyck, 2012).

The agenda protection system is one of the many biological factors that should be considered in regards to aggression. The Catalyst Model allows one to examine the multiple neurologically based emotions (happiness, sadness, anger, fear, and disgust) that allow humans to adapt to the environment by responding to internal (thoughts, sensations) and environmental stimuli (Panksepp, 2008). These emotions motivate behavior by directing attention and producing affective feelings (Ekman, 2007; Harkness, 2009). Although emotions are generally adaptive, they must be regulated, especially if they are too extreme, easily triggered, or have long durations (Cote, Gyurak, & Levenson, 2010; Gross & John, 2003). People are born with different emotion set points, and life events, including traumatic events, can influence how easily an emotion is triggered and its duration (Harkness, 2009). Stable properties of the fluid emotion systems are considered personality traits (Izard & Cohen, 1989) and are consistent with the biological components of the Catalyst Model.

Emotions can be *under*-regulated when the behavior that occurs in response to the emotions is experienced as inseparable from the emotion. Alternatively, emotion *over*-regulation occurs when an individual consistently stops or attempts to stop the experience from occurring (Roberton, Daffern, & Bucks, 2012). Thus, there is an optimal range of emotion regulation, which will vary depending on the environment, and can be achieved through cognitive mechanisms, including changing one's interpretation of a situation or considering future consequences, and behavioral mechanisms, such as leaving a situation or distracting oneself (Gross & John, 2003). The change in environment from war to a civilian culture can be one environmental stressor or catalyst for combat veterans who are struggling to manage their emotions.

A diminished capacity for finding an adaptive range of emotion regulation is evident in PTSD samples (Klemanski, Mennin, Borelli, Morrissey, & Aikins, 2012). Cross-sectional studies have demonstrated that emotion regulation difficulties are associated with increased PTSD symptom severity (Klemanski et al., 2012; Tull, Barrett, McMillan, & Roemer, 2007). Longitudinal studies have revealed that emotion dysregulation precedes PTSD symptoms and may influence the development of PTSD symptoms over time, rather than emotion dysregulation resulting from PTSD (Bardeen, Kumpula, & Orcutt, 2013). This relationship between PTSD and emotional dysregulation is likely bidirectional, as intense negative emotions are also a symptom of PTSD, which can tax one's emotion regulation abilities even farther. PTSD involves both under-regulation of fear and other emotions (hyperarousal symptoms) and over-regulation through avoidance and dissociation (Lanius et al., 2010).

Not only is emotion dysregulation related to PTSD, it is also associated with impulsive aggression. Under-regulation of anger (Novaco, 2007), in addition to the under-regulation of other negative emotions, such as fear, unhappiness, and negative affect, is associated with aggression (Roberton et al., 2012). Veterans with PTSD have heightened neural and physiological responses to both trauma-related and neutral stimuli, indicating they have trouble distinguishing between safe and potentially unsafe (trauma-related) people and places (Weber, 2008) If combat veterans return from deployment and continue to interpret environmental events and people as dangerous, then emotion regulation resources may be overtaxed; and emotions may be difficult to control (Roberton et al., 2012). Therefore, when a veteran with PTSD processes a stressful environmental event (catalyst), s/he may already be aroused (biology) because of the variety of PTSD-related emotions (catalyst), primed to interpret the environment as threatening (learning experiences) and respond in an impulsively aggressive manner.

Similar to under-regulating emotions, attempting to over-regulate emotions can also lead to aggression, especially through avoidance (Roberton et al., 2012), which is a hallmark feature of PTSD (American Psychiatric Association, 2013). While attempting to escape distressing, trauma-related thoughts and images, a person is also likely to avoid deep, meaningful thought and instead focus on concrete, immediate events. This is initially effective for avoiding the trauma-related thoughts; however, it also reduces concentration on deeper thought, uses cognitive resources, and inhibits thinking about values and long-term goals, things that can help reduce aggressive acts (Roberton et al., 2012). Alcohol and substance use can also be used to avoid emotions and are related to aggression (Stappenbeck, Hellmuth, Simpson, & Jakupcak, 2014). Finally, attempting to suppress negative emotions increases sympathetic activation (Roberts, Levenson, & Gross, 2008), which may make it harder for veterans to regulate emotions when they are triggered (Roberton et al., 2012).

When veterans seeking inpatient treatment for PTSD were assessed for emotion dysregulation and PTSD symptoms, PTSD was associated with impulsive aggression in bivariate analyses. However, when emotion dysregulation was entered into a bootstrapped mediation model, emotion dysregulation fully mediated the relationship between PTSD symptoms and impulsive aggression, while controlling for age and substance-use disorders. Emotion dysregulation did not mediate the relationship between PTSD and premeditated aggression (Miles et al., 2015a). Interestingly, these results were also replicated to a certain extent in a sample of college women (Miles et al., 2015b). Path analysis results, taking into account both impulsive and premeditated aggression, replicated prior findings and showed that emotion dysregulation partially mediated the relationship between trauma exposure and impulsive aggression, when controlling for substance use. The differences in results of partial versus full mediation could be due to the different samples, types of traumas experienced (e.g. combat versus sexual assault), or greater functional impairment in the veteran treatment sample.

While the current manuscript uses veterans as an example of the potential consequences of PTSD and emotion dysregulation, these challenges are not unique to veterans. Most (50–90%) of the United States population will be exposed to at least one traumatic event during their lives, and 10–20% of the population will develop PTSD (Norris & Slone, 2007). Research is beginning to flush out the connections between deficient emotion regulation abilities in trauma exposed samples and aggression. For example, emotion dysregulation plays a role in aggression in patients with borderline personality disorder (Martino et al., 2015; Zalewski et al., 2014). Additionally, in a sample of men who had past exposure to interpersonal violence, experiential avoidance and emotional inexpressivity (forms of emotion dysregulation) each contributed significant variance to aggressive behavior, above PTSD symptoms and anger (Tull, Jakupcak, Paulson, & Gratz, 2007). Research

that sampled mothers who experienced abuse as children, found the relationship between maternal experience of child abuse and later child abuse of their own children was mediated by maternal emotional dysregulation and negative affect (Smith et al., 2014). Similarly, adolescent boys who had experienced maltreatment had more negative affect and aggressive behaviors than boys who had not experienced maltreatment, and the relationship between negative affect and aggressive behavior was mediated by how much time the children allocated to an emotion task involving angry facial expressions (an example of inappropriate emotion regulation; Shackman & Pollak, 2014). Not all of these samples met full PTSD criteria, nor did the studies distinguish between impulsive and premeditated aggression. More research is needed on if it is specifically PTSD and emotion dysregulation that leads to impulsive aggression or if emotion dysregulation in combination with a variety of disorders lead to impulsive aggression. In summary, the data demonstrated emotion dysregulation was one common factor in these samples and focusing on it may be helpful for veterans and civilians alike who have experienced trauma and are struggling with impulsive aggression.

Fig. 1 shows an integrative model of how trauma can lead to PTSD and how emotion dysregulation can be evident prior to PTSD (Bardeen et al., 2013), suggesting it contributes to the development of the disorder. PTSD can also increase emotion dysregulation in a bidirectional relationship (Klemanski et al., 2012), as one's emotional coping resources are likely taxed by the extreme negative emotions that are symptoms of PTSD (American Psychiatric Association, 2013). PTSD predicts impulsive aggression; however, when emotion dysregulation is considered simultaneously, the relationship between PTSD and impulsive aggression is fully or partially mediated (Miles et al., 2015a, b). Thus, emotion regulation may be an important consideration to address when providing treatments for those with PTSD and impulsive aggression.

3. Traditional treatments for aggression

There are multiple levels from which to approach aggression reduction, including universal preventions targeting the general population, targeted prevention for at risk individuals who have yet to become violent, and indicated prevention, involving individuals who have already perpetrated aggression. An example of universal prevention includes increasing situational deterrence like adequate street lighting or security cameras. The second tier of prevention includes targeting individuals who are at risk for engaging in violence but have not yet engaged in physical aggression. An example of this is children who have risk factors for violence such as a history of child maltreatment. Finally, violence prevention can include working with perpetrators of aggression and attempt to decrease the behavior (McGuire, 2008). For the purpose of this paper, we will focus on treatments that target perpetrators of aggression. Meta-analytic data demonstrate that violence prevention programs produce small to moderate effect sizes in reducing aggression. Similar to the studies reviewed above, not all of the treatment studies distinguished between aggression types. Treatment modalities include cognitive behavioral anger management, problem-solving therapies from social learning perspectives, cognitive self-change (changes schemas related to aggression), and multi-modal interventions that incorporate a mix of motivational enhancement, behavior change, cognition change, stress management, problem solving, social skills, moral reasoning, and relapse prevention (McGuire, 2008).

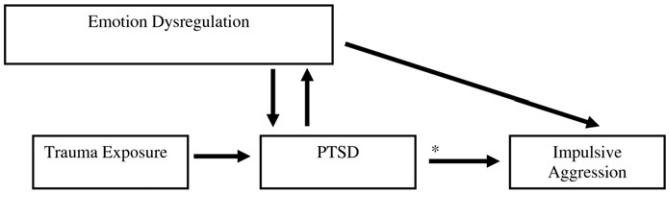

Fig. 1. Conceptual model of how trauma exposure, PTSD, and impulsive aggression relate to emotion dysregulation. Note: *When emotion dysregulation is entered into the model, the relationship between PTSD and impulsive aggression is mediated.

Given the presence of anger in aggressive subjects with PTSD (Chemtob, Novaco, Hamada, Gross, & Smith, 1997; Taft, Creech, & Kachadourian, 2012), anger management has been proposed as a solution to reduce violence and generally show the strongest effect sizes in violence reduction (McGuire, 2008) Anger management typically uses cognitive-behavioral techniques that focus on identifying situations that lead to anger, awareness of thoughts associated with anger triggers, and changing thoughts that lead to anger. Research supports the use of anger management to reduce anger and self-report measures of aggression in civilian samples (Taft et al., 2012). However, few anger-management treatment studies have examined veteran samples with PTSD (Taft et al., 2012). Even fewer studies have examined samples of veterans with PTSD and directly assessed aggressive acts as the outcome as opposed to the treatment's effect on anger. Reporting actual aggressive acts is important, given that interventions can reduce impulsive aggressive acts without influencing self-reported anger. In other words, one can be angry and not act aggressively if the anger is managed (Barratt et al., 1997a).

Limitations of the studies of anger management with veterans include small samples of Vietnam veterans (Chemtob et al., 1997; Gerlock, 1994) and no control group (Gerlock, 1994). One exception is a recent pilot study (N = 23) that found positive effects of cognitive-behavioral anger-management methods on anger and aggressive acts among Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) veterans, although reductions in aggression were not statistical different than reductions seen with supportive counseling. The sample was also small and not specific to veterans with PTSD (Shea, Lambert, & Reddy, 2013). Anger management may be one treatment to reduce aggression in veterans; however more methodologically rigorous studies are needed. Additionally, one-size fits all treatments are unlikely to be effective at reducing all types of violence (Kazdin, 2011), thus we suggest another alternative.

4. Treatments expanding beyond anger management

There are recent efforts by the Departments of Defense and Veterans Affairs to develop interventions for intimate partner violence that extend beyond traditional anger management. In May of 2012, a task force was chartered to develop a national program of violence prevention. One of the actions for the task force was to implement pilot screening and treatment programs for veterans who use violence. Two treatment programs are currently being pilot tested, Strength at Home (SaH; Primary Investigator (PI): Dr. Casey Taft) and Contextual Intimate Partner Violence Therapy (CIPVT; PI: Dr. Rachel Latta). SaH is a 12-session PTSD-focused cognitive-behavioral therapy that incorporates anger management and coping with stress. CIPVT involves individuals, couples, and group treatment that focuses on healthy relationships and increasing coping strategies. Pilot data for SaH suggest the treatment reduces intimate partner violence; however, the study experienced recruitment difficulties (N = 6; Taft et al., 2014; Taft et al., 2013). There are not yet publications describing CIPVT. We propose that a broader focus that examines impulsive aggression toward victims, objects, and self, may be particularly beneficial for veterans with PTSD, given that impulsive aggression is the most common subtype in this population.

5. Using emotion regulation treatment to reduce aggression

Recognition of emotion dysregulation as the mediator, or an underlying mechanism, of the relationship between PTSD and impulsive aggression allows for the potential of addressing impulsive aggression through building emotion regulation skills. Reducing emotion dysregulation may reduce the salience of environmental stressors (catalyst) or it

may help the veteran manage preexisting personality traits. Teaching one to regulate emotions is a novel method to reduce aggression, and fortunately, there are already emotion regulation treatments that are in current clinical practice. These treatments are not specific to those with PTSD, and future research can test if they reduce impulsive aggression in this group. Psychological treatment options include Skills Training in Affect and Interpersonal Regulation (STAIR: Cloitre, Koenen, Cohen, & Han, 2002), Acceptance and Commitment Therapy (ACT: Hayes, Wilson, Gifford, Follette, & Strosahl, 1996), and Dialectical Behavioral Therapy (DBT: Linehan, 1993). A recent publication demonstrated that 12 weekly sessions of ACT produced greater declines in psychological and physical aggression from pre to posttreatment than a support-and-discussion control group (Zarling, Lawrence, & Marchman, 2015). Other research has demonstrated that STAIR can reduce general negative affect and anger (Cloitre et al., 2002) and improve emotion regulation abilities (Hinton, Hofmann, Pollack, & Otto, 2009). DBT has been used to increase emotion regulation and interpersonal abilities and decrease anger and aggression (Frazier & Vela, 2014). Please see Table 1 for treatment studies that used emotion regulation skills training and found reductions in aggression and anger. More empirical work is needed that isolates the emotion regulation components of these treatments and examines if they are related to reductions in impulsive aggression and for what types of people. Of note, a recent case study demonstrated that teaching veterans with PTSD how to identify and label emotions and then use emotion regulation skills, such as grounding, mindfulness, and identifying values, lead to reductions in impulsive aggression if the veteran used the skills outside of session (Miles, Thompson, Stanley, & Kent, 2016). Important considerations for future research include how sex, military service, trauma-exposure, age, and psychiatric diagnoses interact to affect impulsive aggression and treatment outcomes.

6. Other treatment considerations from the catalyst model

Using the Catalyst Model to understand impulsive aggression generates other hypotheses about biology, early learning experiences, and environmental stressors that may need to be considered while treating veterans with PTSD and impulsive aggression. Sex (biology) and level of gender norm conformity of the perpetrator (early social learning) are important treatment considerations. Men and women engage in about equal rates of partner violence (Archer, 2000; Stappenbeck et al., 2014; Teten, Sherman, & Han, 2009); however, men perpetrate more violence against other men and more sexual violence (Black et al., 2011). Higher levels of masculine traits are related to increased aggression in both men and women (Reidy, Sloan, & Zeichner, 2009), thus the degree to which one ascribes to traditional gender norms may influence what topics to cover in treatment. Providers working with male veterans or masculine clients may focus on reducing physical aggression and exploration of what "being a man" or "tough" means without violence, including the gender norm of chivalry. Providers working with women or traditional feminine clients may focus on psychological aggression (Richardson & Hammock, 2007) and how to assertively navigate interpersonal relationships. Interestingly, most of the treatment studies conducted with ACT, STAIR, and DBT have used samples made up primarily of women (Table 1) which means more research is needed to examine if reductions in aggression are also seen in men who complete these treatments.

Men and women also display different emotion regulation tendencies, which can be the result of both an early learning experience and military experiences. Women are more likely to report using both adaptive and maladaptive emotion regulation strategies, yet women still have higher rates of anxiety and depression (Nolen-Hoeksema, 2012). Higher rates of anxiety and depression in women may be explained by an increased use of rumination, which is also related to higher levels of anxiety and depression. Decreasing rumination and increasing *context appropriate* emotion regulation strategies may be particularly helpful for women. Men are more likely to use substances to regulate emotions (Nolen-Hoeksema, 2012), and greater substance use is related to increased violence (Stappenbeck et al., 2014). Assessing for substance use and, if indicated, providing concurrent substance use treatment may help male veterans cope with PTSD related emotions and impulsive aggression, although as stated before emotion dysregulation continues to predict impulsive aggression even after controlling for substance use (Miles et al., 2015a, 2015b).

Veterans of both sexes may also benefit from education about how military service (learning experience) and trauma exposure (catalyst) can influence emotion regulation. For example, there are lay beliefs that negative emotions, such as sadness and fear, are "bad" to experience (Tamir, 2011), which can lead to over-regulation of emotions. However, emotions are generally adaptive and assist individuals in adjusting to the environment (Izard & Cohen, 1989). Humans will use emotions, even ones that are unpleasant, to reach their goals (Tamir, 2011). An ideal example is how the military uses anger to continue on combat missions that generally produce fear (Grossman, 1996; Hoge, 2010). Reminding the veteran that quick threat appraisal and anger reactions were adaptive and valued in combat may help reduce the stigma associated with PTSD and related emotions and increase his/her awareness and acceptance of emotions.

7. Limitations and future research

The Catalyst Model is in need of empirical testing, including studies utilization longitudinal data that examine how impulsive aggression

Table 1
Studies demonstrating emotion regulation treatments can reduce aggression.

Study	Design	Sample	Measures	Treatment	Results
Cloitre et al., 2002	RCT	N = 58 women with childhood abuse; 54% minority	General expectancy for negative mood regulation scale, state-trait anger expression inventory	STAIR + PE vs. minimal attention wait list control	STAIR + PE > wait list control on reductions in anger expression
Frazier & Vela, 2014	Review article	9 RCTs; majority female patients with borderline personality disorder	Overt aggression scale, state-trait anger expression inventory, behavioral logs	DBT	DBT > treatment as usual, case management, and standard group therapy in reducing anger and aggression
Miles et al., 2016	Pre-post treatment	N = 2 male combat veterans with PTSD	Impulsive premediated aggression scale	Three hour emotion regulation skills training	Pre- to post-treatment decreases in impulsive aggression found in veteran who practiced the skills. No reduction seen in the veteran who did not use skills
Taft et al., 2013	Pre-post treatment	N = 6 male veterans; 16% minority	Revised conflict tactics scale	SaH (CBT)	Pre- to post-treatment decreases in psychological and physical aggression
Zarling et al., 2015	RCT	N = 121; 68% female; 18% minority	Multidimensional measure emotional abuse scale, conflict tactics scales	ACT vs. support-and-discussion control	ACT > control in declines in psychological and physical aggression

Note: ACT = Acceptance and Commitment Therapy. CBT = cognitive-behavioral therapy. PE = Prolonged Exposure. RCT = randomized controlled trial. SaH = Strength at Home. STAIR = Skills Training in Interpersonal and Affective Regulation.

changes with emotion regulation treatment. Another consideration is that treating those with PTSD and impulsive aggression with emotion regulation treatments may reduce impulsive aggression; however, simply treating those with PTSD with PTSD treatments may also reduce aggression. No studies have examined this yet. Another area in need of research is which emotion regulation treatment (ACT, STAIR, DBT) will be most effective at reducing impulsive aggression and in what types of samples (veterans, civilians, men, women). Finally, impulsive aggression is only one type of aggression, and other treatment options are needed for other aggression types.

8. Conclusion

Aggressive acts can be motivated by diverse mechanisms and understanding this mechanism is pivotal in providing treatments that will assist those who have experienced trauma and are struggling to control their aggression. Veterans with PTSD primarily engage in impulsive aggression, which is unplanned, emotional, and uncontrolled. Empirical data demonstrate that emotion dysregulation mediates, or accounts for, the relationship between PTSD and impulsive aggression. This review of available evidence suggests that teaching veterans with trauma-exposure how to regulate their emotions, prior to or in conjunction with traditional PTSD treatments, may reduce impulsive aggression.

Conflicts of interest and source of funding

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