Original Research

Journal of Interpersonal Violence
1–25

Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/0886260520985484
journals.sagepub.com/home/jiv
SAGE

Emotional Regulation in Male Batterers When Faced With Pictures of Intimate Partner Violence. Do They Have a Problem With Suppressing or Experiencing Emotions?

Agar Marín-Morales,[1] Miguel Pérez-García,[1] Andrés Catena-Martínez,[1] and Juan Verdejo-Román,[1,2,3]

Abstract
Emotional regulation is crucial to psychological functioning and mental health. Studies of male batterers indicate the critical role that emotional processing plays in the violence they exert upon their partners or ex-partners. The aim of this study was to investigate the neural bases of emotional regulation in male batterers—both in experiencing and suppressing emotions—when faced with pictures of intimate partner violence (IPV). We conducted a fMRI study to compare brain functioning when emotions were experienced or increased with the case in which emotions were suppressed or reduced in response to IPV pictures and unpleasant pictures. The sample consisted of

[1]University of Granada, Spain
[2]Centre for Biomedical Technology, Madrid, Spain
[3]Complutense University of Madrid, Spain

Corresponding Author:
Juan Verdejo-Román, University of Granada, Granada 18010, Spain; Center for Biomedical Technology, Pozuelo de Alarcón, Madrid 28223, Spain; Complutense University of Madrid, Madrid, 28040, Spain.
Email: juanverdejo@ucm.es

three groups: Male Batterers Group (MBG, *n* = 26), that is, men convicted for IPV; Other Offenders Group (OOG, *n* = 27), men convicted of crimes other than IPV; and a Non-offenders Group (*n* = 29), that is, men without a criminal history. The results reveal that in MBG, the brain areas that previous studies have related to suppression and experience processes were activated when faced with unpleasant pictures. However, a different pattern of functioning was found when experiencing IPV pictures. That could be explained by a low capacity to empathize with their partners or ex-partners and by the use of maladaptive emotional regulation strategies. In addition, MBG showed activation in brain areas previously related to suppression but did not modulate their emotions, showing a similar emotional state after suppression and experience. The results of this preliminary study suggest that in psychological treatments for male batterers, it is important to promote empathy towards partners or ex-partners, along with adaptive strategies of emotional regulation.

Keywords
male batterers, emotion regulation, fMRI, emotional suppression, emotional experience, intimate partner violence, empathy

Introduction

Intimate partner violence (IPV) is a public health and social problem that affects women worldwide (World Health Organization, 2017). However, whilst there is an extensive neuroscientific literature on violent individuals, the number of studies on men who use violence against their partners/ex-partner (male batterers) is very limited (Bueso-Izquierdo et al., 2015). The few studies conducted to date highlight, among other factors, the fundamental role of emotion processing, with evidence reported at both the behavioral level (Langer & Lawrence, 2010) and from neuroimaging studies (Bueso-Izquierdo et al., 2016). However, to the best of our knowledge, no studies have been conducted on the processes of emotional regulation in male batterers and how they use the processes of suppressing and/or experiencing emotions in relation to violence against women.

Emotional regulation is fundamental to psychological functioning and mental health (Gross & Thompson, 2007). Emotional regulation involves consciously or unconsciously implementing a plan to start, stop or modulate the trajectory of an emotion (Ford & Gross, 2018). Therefore, emotional regulation involves a set of decisions aimed at achieving a desired emotional state (either increasing or decreasing such a state). One of the most relevant theoretical frameworks for understanding emotional regulation and its neural basis is that proposed by Gross (2015). According to the extended model of the emotional regulation process, emotions condition how we feel, think and behave (Gross, 2015).

Emotional regulation includes processes of experiencing/increasing (increasing an emotional state/upregulation) and suppression/decreasing (reducing an emotional state/downregulation; Gross, 2015). The strategies for experiencing or suppressing emotional states include cognitive re-evaluation (reappraisal), which involves the intentional reinterpretation of an event or situation with the aim of diminishing or amplifying (regulating upwards or downwards) the emotional effect (Gross & John, 2003). To reduce or suppress a negative emotional state, reappraisal involves downplaying or distancing oneself from the emotional situation being observed. However, in order to increase an emotional state, reappraisal consists of actively engaging in the situation represented in order to increase the sense of subjective proximity to the events represented; imagining that they are in the negative situation presented to them with negative results, and focusing on the negative feelings generated by, for example, being held at gunpoint (Holland & Kensinger, 2013). Another widely used strategy for increasing an emotional state is empathy, which involves experiencing those feelings oneself and thereby increasing the emotional state one is experiencing (Day et al., 2012).

In relation to the neural bases of emotional regulation, and specifically the neural bases of strategies such as cognitive reappraisal, Etkin et al. (2015) have proposed that the same brain structures that are responsible for cognitive reappraisal could also be responsible for both suppressing and experiencing emotional states, and proposed that dorsolateral prefrontal cortex (dlPFC), ventrolateral prefrontal cortex (vlPFC) and the parietal cortex, the insula, supplementary motor area (SMA), and pre-SMA could be the structures responsible for cognitive reappraisal.

The role of emotion and emotional regulation in violent behavior has been widely considered in various theoretical models of violence (Finkel & Hall, 2018; Raine, 2019). In fact, brain studies of emotional processing in violent people have shown that these people have different patterns of brain functioning in comparison with non-violent people when they process emotions (Siep et al., 2019). Specifically, Pardini and Phillips (2010) found that violent men showed minor activation of the prefrontal dorsomedial cortex in response to facial expressions regardless of emotional content, and hyperactivation of the amygdala in response to neutral images. Heesink et al. (2018) found that aggressive men showed increased brain activation in the SMA, cingulate, and parietal cortex in response to images, regardless of valence, along with greater connectivity between the dorsal anterior cingulate cortex and the amygdala in response to negative stimuli. Siep et al. (2019) found that violent offenders showed an altered pattern of amygdala connectivity (as revealed by resting state scans) before and after generating emotions of anger and happiness. Other studies with this type of population (Kirk-Provencher et al., 2020) have found that those convicted of rape and other sexual crimes show reduced gray matter in areas such as the amygdala, insula, and dlPFC, along with a different pattern of brain functioning, as shown, for example, by hyperactivation of the amygdala in the presence of inappropriate stimuli. Finally, it seems that having suffered traumatic experiences of violence in childhood impairs the mechanisms necessary for making moral decisions, including emotions, empathy, cognition, and inhibitory control. Specifically, these individuals show a reorganization in the neuronal circuits that affect the development of the control and reflection systems, effects which have been found in most studies with violent offenders (Massau et al., 2017; Zucchelli & Ugazio, 2019).

However, relatively few studies have focused on evaluating emotional regulation in violent people. To our knowledge, the only study assessing emotional regulation in offenders is that conducted by Tonnaer et al. (2017). These authors found that a group of violent males showed a different pattern of functioning in terms of emotional regulation of anger compared with the control group, that is, greater activity in the vlPFC when they had to experience angry emotions. However, they showed less activity in the vlPFC and dlPFC when they had to apply the distraction strategy. However, a study by Jones et al. (2017) investigated emotional regulation in adolescents who had committed sexual abuse and found no differences in activity in the front-temporal regions during emotional regulation compared with the control group, although the abused adolescents showed less activation in the visual cortex and more activation in the inferior parietal lobe.

However, to the best of our knowledge, no studies have been conducted on the cerebral basis of emotional regulation in men convicted of violence against their partners or ex-partners. The few neuroimaging studies conducted on male batterers indicate both structural and functional brain differences between male batterers and other groups in areas related to emotional processing, specifically when faced with stimuli related to IPV. For instance, Lee et al. (2008).

found that male batterers, in comparison with non-convicted persons, showed greater activation in the limbic system and less frontal activation when presented with threatening stimuli. In addition, the same authors found in a 2009 study greater activation in the precuneus when faced with pictures of IPV. Bueso-Izquierdo et al. (2016) found increased activation in the posterior and anterior cingulate cortex and medial prefrontal cortex, and decreased activation in the superior prefrontal cortex when presented with pictures of IPV in male batterers but not in other offenders. Verdejo-Román et al. (2019)

found that the group of male batterers had a reduced cortical thickness in the prefrontal area (orbitofrontal), in the midline (anterior and posterior cingulate), and in limbic areas (specifically, the insula and para-hippocampus) compared with a group of other offenders. In addition, they observed that a reduction in the posterior cingulate cortex correlated positively with scores on Ekman's emotional perception test. Finally, Marin-Morales et al. (2020) found that male batterers showed activation in the areas of the default mode network (DMN) related to moral decisions when presented with violence-related dilemmas but not IPV dilemmas. In summary, the results published to date indicate that male batterers show different patterns of brain functioning in areas related to emotional processing compared to other offenders at both functional and structural levels, although it is currently unknown whether these findings can be extended to emotional regulation processes. It is important to note that the results that have been found so far with this type of sample (offenders versus non-offenders) must be interpreted with caution, since criminal records may not necessarily be a true reflection of the violent behaviors that have been committed in the past.

Therefore, the aim of this article is to analyze, using functional magnetic resonance techniques, the neural substrates of the emotional regulation of male batterers when they implemented processes of experiencing (e.g., re-evaluation to empathize with the situation) or emotional suppression (e.g., re-evaluation to distance themselves from the situation), based on the areas proposed by Etkin et al. (2015). A further goal is to relate this brain activity to behavioral measures of emotional regulation such as the Emotion Regulation Questionnaire and the Cognitive Emotional Regulation Questionnaire, and measures of empathy such as Interpersonal Reactivity Index test. In order to confirm whether the results are specific to male batterers or common to people convicted of other crimes, male batterers group will be compared with another group of offenders convicted of crimes other than IPV and a group of non-offenders. In addition, in order to examine whether the results are specific to emotional processing in situations of IPV or are common to other unpleasant situations, brain activity will be studied for both pictures of IPV and pictures with unpleasant content. We hypothesize that when male batterers use the experiential process, they will show greater activation of the vlPFC than the rest of the groups (Tonnaer et al., 2017) and that this greater activation will be specific to male batterers when they observe pictures of IPV (Bueso-Izquierdo et al., 2016). In the case of emotional suppression, male batterers will show less activation of the dlPFC, vlPFC, the parietal cortex, the insula, SMA, and pre-SMA (Etkin et al., 2015) and, as in the experiential process, this lower activation will be specific to male batterers when they observe pictures of IPV (Bueso-Izquierdo et al., 2016). Finally, we hypothesize that differences in activation will be related to the different regulatory strategies measured by the test.

Materials and Methods

Participants[1]

Twenty-six men convicted for a crime of intimate partner violence (Male Batterers Group, MBG), 27 men convicted of crimes other than intimate partner violence (Other Offenders Group, OOG), and 29 men without a criminal history (Non-offenders Group, NOG) participated in this study. All offenders were recruited from the Center for Social Integration (CSI) (Centro de Inserción Social, CIS) "Matilde Cantos Fernández," in Granada (Spain). NOG was recruited through internet advertisement, training academies, and social networks. The groups did not differ in age or years of education (Table 1). However, MBG and NOG were different in terms of severity in use of drugs (p = .036).

Table 1. Characteristics of the Sample.

Variables (Mean (*SD*))	MBG (*n* = 26)	OOG (*n* = 27)	NOG (*n* = 29)	*P*-value
Demographic variables				
Age	41.19 (9.71)	40 (10.65)	38.28 (8.24)	0.525
Years of education	9.19 (4.3)	9.67 (3.64)	9.86 (2.44)	0.772
Severity in use of drugs	17.23 (13.15)	14.96 (11.59)	9.59 (7.84)	0.033*
CTS2	4.27 (6.27)	0.26 (0.52)	0.31 (0.93)	0.000*
Type of crime (% (n))				
	Psychological = 58% (15) Psychological and physical = 42% (11)	Dangerous driving 14.81% (4) Drug trafficking 37.04% (10) Scams 11.11% (3) Assault on authority 3.7% (1) Theft 25.93% (6) Missing (unspecified minor crime) 11.11% (3)		

Note. *p < 0.05. *SD* = Standard deviation; MBG = Male Batterers Group; OOG = Other Offenders Group; NOG = Non-Offenders Group.

The general inclusion criteria in the study were: to be male and over 18 years of age; for MBG, to be convicted of a crime of physical, psychological, or sexual assault against a partner or former partner; for OOG, to be convicted of non-violent crimes such as drug trafficking, social security fraud, and any other crime not involving the use of force or power against oneself, another person, group, or community. The exclusion criteria for the three groups included having a history of drug abuse or dependence according to the DSM-IV, illiteracy, or any conditions that are incompatible with the MRI scanning (pacemaker, brackets, prosthesis…) and history of brain damage (loss of consciousness lasting more than one hour; Cohen et al., 2003); and for NOG, being convicted of a crime. Based on previous studies (Cohen et al., 2003), to rule out the presence of IPV in the remaining groups, the participants of OOG and NOG were excluded if they obtained a score equal to or greater than 11 on the Conflict Tactics Scale-2 (CTS2; Loinaz, Echeburúa, Ortiz-Tallo, & Amor, 2012).

Materials

Sociodemographic variables were measured using a risk assessment questionnaire for serious violence in a partner relationship (Echeburúa et al., 2008). This instrument gathers information on sociodemographic variables of both the aggressor and the victim, the situation of the couple's relationship, types of violence, profile of the aggressor, and vulnerability of the victim. The diagnostic subscale for substance dependence disorder (First, 1999) was included in the interview to calculate the severity of drug use according to the DSM-IV.

IPV severity. CTS2 (Spanish version, Loinaz, Echeburúa, Ortiz-Tallo, et al., 2012). CTS2 was used to detect the existence of physical, psychological, and/or sexual violence toward a partner in a relationship. It measures violence frequency and intensity in the relationship.

Interpersonal Reactivity Index (IRI) (Spanish version, Pérez-Albéniz et al., 2003). Scale measures empathy composed of four dimensions: Fantasy Scale (FS), Perspective-taking Scale (PT), Empathic Concern Scale (EC), and Personal Distress Scale (PD).

Emotion Regulation Questionnaire (ERQ) (Spanish version, Cabello et al., 2013). Scale designed to measure respondents' tendency to regulate their emotions in two ways: Cognitive reappraisal and expressive suppression.

Cognitive Emotional Regulation Questionnaire (CERQ) (Garnefski et al., 2001). This questionnaire measures nine cognitive strategies of emotional regulation (adaptive strategies and less adaptive strategies): Self-blame, acceptance, rumination, positive refocusing, refocus on planning, positive reappraisal, putting into perspective, catastrophizing, and blaming others.

Self-assessment Manikin (SAM) (Lang, 1980). Following the resonance session, all participants evaluated on a computer the pictures observed in the task according to three dimensions: 1. valence (level of liking/disliking the picture); 2. activation (level of activation/calm caused by the picture), and 3. dominance (level of control of the subject over the picture), with a score between 1 (minimum liking, minimum activation, minimum control) and 9 (maximum liking, maximum activation, maximum control) per dimension.

fMRI task: Emotion regulation task.

A task of emotion regulation similar to those created by Phan (Phan et al., 2005) was designed for this study. Forty pictures were used as stimuli: 8 neutral pictures; 16 negative valence pictures collected from the IAPS (Lang et al., 1997); 16 pictures related with IPV (e.g., injured women, men threating and hitting their partner) were collected from the internet. These pictures have been used in previous studies with male batterers (Bueso-Izquierdo et al., 2016). Three instructions were given: 1. Observe; 2. Experience (upregulation); 3. Suppress (downregulation). Explanation and training with regard to these instructions were provided by expert psychologists prior to the fMRI session.

1. In the Observe instruction, participants had to passively observe neutral pictures.
2. In the Experience instruction, participants had to observe the pictures, paying attention to all the details and being aware of the emotions that they generate as well as increasing negative emotions through previously trained regulation and empathy strategies. For example, in the description and training phase, the participants were instructed: After the instruction "Experience," and during the viewing of a picture of a man at war: "Imagine that you are that person and you are living that painful situation, think that you are the one in the picture. Feel and be aware of your emotions."
3. In the Suppress instruction, participants had to observe pictures and control negative emotions by reducing these as much as possible through previously trained regulation strategies. For example, when explaining and training with the participants, if the instruction was "suppress" and then a picture of a disfigured man was presented, the participant was told: "At the very moment the picture appears, try to transform the negative emotion generated by that picture by reinterpreting it: imagine he is an actor wearing make-up." Or, for a picture of a man with a spider on his shoulder "Think it's a plastic spider."

Neutral pictures were used in the Observe condition. For the Experience and Suppress instructions, there were two different conditions, one with unpleasant pictures and the other with pictures of IPV. Therefore, the task was composed of 5 different conditions (Observe; Experience Unpleasant; Experience IPV; Suppress Unpleasant; Suppress IPV). The task consisted of four blocks for each condition, for a total of 20 blocks. Each block began with the instruction that was presented in the center of the screen for four seconds. The participants then observed two different pictures of the same category for 10 seconds each, during which they had to implement the instruction given earlier. Finally, the participants were given five seconds to rate the intensity of the negative emotion experienced on a scale from 1 to 5, with 1 being slightly unpleasant and 5 very unpleasant (Supplementary Figure 1). After each block, a fixation cross appeared for 10 seconds. The total duration of the task was 780 seconds. Behavioral responses were recorded through a five-button box, Evoke Response Pad System (Resonance Technology Inc.).

Procedures

Before starting the evaluation, the participants were informed of the objective of the study following the data protection law (Organic Law 3/2018, December 5). Two weeks before the evaluation, those men who met the inclusion criteria were informed about the project at the social integration center. They were told that the objective of the study was "To evaluate the psychological and neuropsychological characteristics and brain functioning of various types of offenders." Once they had been informed about the objective of the study and the procedure to be followed, and we had resolved any of their doubts, the interested participants were asked to sign the consent form. The study was approved by the Research Ethics Committee of the University of Granada (number: 1000-CEIH-2019), Spain.

The evaluation consisted of two separate sessions. In the first session, participants signed the informed consent and completed the socio-demographic interview and psychological tests at the "Matilde Cantos Fernández" Social Integration Center (CIS) in Granada (Spain). The second session took place at the Mind, Brain and Behavior Research Center of the University of Granada (CIMCYC-UGR) where the participants performed the task inside a magnetic resonance scanner. This session lasted approximately one hour. Before starting the task, participants were trained to reduce and increase the intensity of negative emotions through cognitive strategies of emotional regulation (Gross, 1999) and empathy by performing a computer-based practice test. Following the resonance session, participants evaluated the emotional content of the pictures used during the task using SAM scale. The total duration of the two sessions was approximately three hours. The participants who completed the two sessions received 50 euros for taking part in the study. Participants did not receive prison benefits for their participation.

Imaging data acquisition and preprocessing. (Supplemental Material 1)

Statistical analyses.
The statistical analyses were divided into behavioral and neuroimaging analyses.

Behavioral analyses.
Behavioral data were analyzed using the Statistical Package for the Social Sciences, version 22 (SPSS; Chicago, IL). ANOVAs were conducted to compare the groups in the demographics and severity of crime variables and behavioral responses to self-reported ratings of reappraisal task. In addition, *post hoc* comparisons were made between groups. In order to evaluate the success in carrying out the task instructions, a variable of emotional modulation was defined, calculating the difference between the values reported in the suppress and experience conditions for each type of picture by subtracting the score on the experience condition from the score on the suppressed condition (higher values of this variable indicate a greater capacity for emotional modulation). The drug severity variable was calculated by summing the criteria that met those set out by the DSM-IV for alcohol consumption, including frequency and intensity (quantities, number of drugs, etc.) and the criteria that met the DSM-IV for the consumption of other drugs (cocaine, marijuana, heroin, hashish, etc.). This variable was normalized by applying the logarithm in base 10.

Neuroimaging analyses. (Supplemental Material 2)

Results

Behavioral Results

With respect to emotional regulation, the results on the CERQ test indicate that in the Self-blame subscale, MBG did not differ from OOG, but both groups showed higher scores than NOG (all $p < .002$). Further, MBG showed higher scores on the Catastrophizing subscale than NOG ($p = .003$). Finally, for the subscale of maladaptive strategies, significant differences were found between groups ($p = .03$), with NOG obtaining lower scores in comparison with the rest of the groups. Regarding empathy, IRI test scores were lower for MBG than NOG in the Fantasy ($p = .012$) and Empathic concern ($p = .043$) subscales. In summary, MBG showed lower scores on the subscales of the IRI test and higher scores on the maladaptive strategies of the CERQ test, which could be taken to indicate lower empathic and emotional regulation capacity (Supplemental Table 1).

Regarding the intensity of the negative emotion generated by the pictures during the resonance task (Supplemental Table 2), the behavioral results revealed that there were no differences between groups in the Observe, Experience, and Suppress conditions. That is, MBG, OOG, and NOG rated their emotional experience similarly when presented with the pictures in each condition. However, when emotional modulation scores were compared, the results indicated that in the IPV condition, MBG showed lower scores than NOG ($p = .022$), that is, MBG showed a lower capacity to modulate their emotions when presented with IPV pictures. With regard to the validation of pictures according to activation, dominance, and valence, the results of the SAM showed (see Supplemental Material 3) that participants rated the unpleasant and IPV pictures similarly. Therefore, the differences in task performance cannot be explained by differences in the affective assessment of the pictures.

Neuroimaging Results

Emotional experience:Areas activated in male batterers when they attempt to increase their negative emotions in the presence of pictures of IPV and unpleasant pictures.

Intra-group analysis.

First, we examined whether the proposed areas for the experience process were activated during the task for both IPV pictures (Experience IPV > Observe) and for the unpleasant pictures (Experience unpleasant > Observe)

Table 2. Statistically Significant Differences in the Activation of Areas for Suppression and Experimentation Between Male Batterers and the Rest of the Groups.

Contrasts	Brain Region		MNI Coordinates				
		Side	X	Y	Z	Cluster Size	*T*-value
Suppress IPV > observe							
MBG > OOG	vlPFC	R	34	14	–16	48	3.90
Suppress unpleasant > Maintain unpleasant							
NOG > MBG	Amygdala	R	26	2	–30	41	4.41
Suppress IPV > Maintain IPV							
MBG > NOG	SMA	L	–12	–4	70	72	4.53

Note. MBG = Male Batterers Group; OOG = Other Offenders Group; NOG = Non-offenders Group.

in each group (see Supplemental Materials 4, 5, and 6). The results revealed that in all groups and for both types of pictures, the dlPFC, SMA, and parietal cortex were activated during the experience process. Specifically, in the contrast Experience IPV > Observe, the ventromedial areas (vACC/vmPFC) and vlPFC were activated. In addition, the OOG and NOG groups showed activation in the PAG, and the MBG and NOG groups showed activation in the amygdala. In contrast, in the contrast Experience Unpleasant > Observe, all groups showed activation of the amygdala and additionally MBG and OOG activated the insula. OOG and NOG activated vlPFC and PAG. Only the NOG group activated the vACC and vmPFC.

Inter-group differences.

When making comparisons between groups, the results showed that there were no statistically significant differences between the three groups for either IPV pictures or unpleasant pictures.

Differences according to the type of pictures.

To analyze whether there were differences between the groups according to the content of the pictures (IPV versus unpleasant), the contrasts Experience IPV > Experience Unpleasant and Experience Unpleasant > Experience IPV were analyzed. The results showed that there were no differences between the groups, or an interaction with the type of picture. However, analysis of the type of pictures within each group revealed that MBG showed significantly greater activation of the bilateral parietal cortex (angular gyrus), right dlPFC, and left vlPFC when experiencing IPV pictures in comparison with unpleasant pictures. Moreover, OOG showed significantly greater activation of the right vlPFC and the right ACC, and finally, the NOG showed greater activation of the right dlPFC, left angular gyrus, and the right ACC.

Finally, the NOG showed greater activation of the left vlPFC and left parietal cortex when experiencing unpleasant pictures than IPV pictures. However, in the rest of the groups no regional differences in brain activity were found between experiencing unpleasant pictures and experiencing IPV pictures.

Emotional suppression:

Areas activated in male batterers when they attempt to reduce their negative emotions with regard to IPV and unpleasant pictures.

Intra-group analysis.

We analyzed whether the areas proposed in the literature were activated in each group (see Supplemental Materials 4, 5, and 6) when engaging in emotion suppression processes for both IPV pictures (Suppress IPV > Observe) and unpleasant pictures (Suppress Unpleasant > Observe). The areas that were activated in all groups when they tried to suppress both types of pictures were the vlPFC, dlPFC, amygdala, insula, PAG, SMA, and parietal cortex. Specifically, during presentation of the IPV pictures, all groups showed activation of the vACC and vmPFC. However, only the NOG activated these two regions (vACC/vmPFC) by suppressing emotions when faced with unpleasant pictures.

Inter-group differences.

The results of the group analyses revealed that the MBG showed greater activation of the right vlPFC (Table 2, Supplemental Figure 2) compared with the OOG when suppressing emotions in the presence of IPV pictures. Activation of the vlPFC in MBG during the suppression of IPV pictures correlated with scores on the acceptance subscale of the CERQ ($r = -.389$, $p = .049$), indicating that the greater the activation of the vlPFC during the suppression of IPV pictures in the group of male batterers, the lower the acceptance or use of thoughts that acknowledge the occurrence of the unpleasant event.

Differences according to the type of pictures.

The contrast Suppress IPV > Suppress Unpleasant and the contrast Suppress Unpleasant > Suppress IPV were tested to explore if there were any differences between the groups depending on the content of the pictures. The results showed that there were no differences between the groups and no interaction between group and the type of picture. However, a within-group analysis of the type of pictures revealed that MBG showed significantly greater activation of the right vACC and the left insula in the presence of IPV pictures compared with unpleasant pictures. In the remaining groups, no statistically significant differences were found. Further, if we look at the regions that were most strongly activated when suppression occurred in the presence of unpleasant pictures compared with IPV pictures, all groups showed greater activation of the bilateral parietal cortex (angular gyrus), with the OOG and NOG groups showing particularly strong activation of the left vlPFC and dlPFC.

Interaction: Areas activated in the interaction of experience and suppression in the presence of pictures related to IPV and unpleasant events.

Finally, the possible differences between the groups in the processes of experiencing and suppressing emotions were studied in the presence of both IPV pictures (Suppress IPV > Experience IPV) and unpleasant pictures (Suppress Unpleasant > Experience Unpleasant).

IPV pictures: Suppress IPV > Experience IPV contrast.
In comparison with NOG, MBG showed stronger activation of the SMA during emotional suppression than emotional experiencing in the presence of the IPV pictures (Table 2 and Supplemental Figure 3). In order to confirm whether this interaction is due to activation during the suppress condition or during the experience condition, mean activation values in the SMA were calculated for the participants (Supplemental Figure 4). It can be seen that the interaction is mainly due to the lower activation of the SMA in the MBG during the experience condition. The greatest difference in SMA activation in the group of male batterers correlated with scores on the distress subscale of the IRI ($r = –.459$, $p = .018$). A similar correlation was also found with the subscales of cognitive reappraisal ($r = –.533$**, $p = .007$) and expressive suppression ($r = –.586$**, $p = .002$) of the ERQ ($p < 0.01$). Finally, a correlation was also found with the rumination subscales ($r = –.438$, $p = .025$); putting into perspective ($r = –.438$, $p = .032$); and maladaptive strategies ($r = –.401$, $p = .042$) of the CERQ.

Unpleasant pictures: Suppress unpleasant > Experience unpleasant contrast.
When faced with unpleasant pictures, the MBG showed less activation in the right amygdala during suppression when compared with the experience condition, unlike the NOG (Table 2, Supplemental Figure 5). To analyze whether the interaction is due to activation during the suppressed condition or during the experiential condition, mean activation values in the amygdala were calculated for the participants (Supplemental Figure 4). It was found that this interaction was due to the fact that while the NOG participants show greater activation of the amygdala during suppression than during experience, the MBG shows the reverse pattern.

With regard to differences in activation of the amygdala in the Suppress > Experience comparison, no significant correlations were found in MBG. In NOG, the difference in activation of the amygdala correlated with the refocus planning subscale of the CERQ ($r = –.398$, $p = .033$), indicating that the greater the difference in activation, the less use is made of the strategy that focuses on thinking about the steps that must be taken to solve the problem.

Discussion

To the best of our knowledge, this is the first study to examine the cerebral basis of emotional regulation in male batterers. Our main objective was to study whether the brain functioning of emotional regulation (experience and suppression) in male batterers was different from that of other offenders and non-offenders. The findings indicated that in male batterers, the brain areas responsible for experience and emotional suppression were activated when faced with unpleasant pictures, although they showed lower activation in the amygdala in the suppressed condition with respect to the group of non-offenders. However, they showed a different pattern of brain processing during emotional experience, that is, lower activation of the SMA when they were required to experience emotions in situations of IPV. This difference in SMA activation was specific to male batterers and was not observed in the normal population or group of non-offenders. Moreover, male batterers activated the areas related to emotional suppression in situations of IPV and activated prefrontal areas (vlPFC) to a greater extent than the group of other offenders. However, male batterers did not modulate their emotions when presented with pictures of IPV, showing a similar emotional state after suppressing and experiencing pictures of IPV. Finally, the level of activation in the regions where differences between the male batterers and the other groups were found correlated with the scores for maladaptive emotional regulation strategies and low empathy. These results partially confirm our hypothesis. In particular, whilst no differences were found in the hypothesized areas, differences were found in areas related to the emotional regulation model when presented with IPV pictures and such areas were correlated with lower scores in emotional regulation and empathy.

In relation to the ability of male batterers to regulate their emotions by increasing what they are feeling (experiencing/upregulation), our results indicated that male batterers showed less activation in SMA than the NOG, and that was related to lower empathy or emotional distress, and lower scores on regulatory strategies such as cognitive reassessment, expressive suppression, rumination, putting into perspective, and maladaptive strategies. These results are in line with those found by Verdejo-Román et al. (2019), who found that reduced thickness of the posterior cingulate cortex correlated positively with scores on Ekman's emotional perception test, that is, the lower the thickness, the lower the levels of empathy and/or emotional recognition. These findings are also congruent with previous results reported in the literature demonstrating that activation of the SMA is involved in emotional regulation and empathy. Previous studies and meta-analyses have found that increased activity in the SMA, along with other prefrontal areas, is involved in both upregulation and downregulation (Buhle et al., 2014). In addition, the SMA is part of the neural circuit involved in the perception of pain suffered in others (Decety et al., 2009) or empathy (Fan et al., 2011), specifically when empathizing with others that are suffering pain, fear, happiness, discomfort, and anxiety (Fan et al., 2011).

Therefore, the lower activation of the SMA in the experiential condition could indicate that the male batterers show deficits in upregulation (they use adaptive emotional regulation strategies to a lesser extent) and avoid perceiving pain or showing empathy in response to situations of IPV. Previous studies have found cognitive biases toward negative affect stimuli in male batterers (Chan et al., 2010). However, this study shows that cognitive and emotional biases are specific to situations of IPV, since they experience their emotions in the same manner as the rest of the participants when faced with unpleasant pictures. Covell et al. (2007) found that the different dimensions of empathy, both separately and combined (deficits in cognitive empathy but high levels emotional empathy, for example), were related to the expression of different types of violence toward their partners/ex-partners. Further, in the process of emotional regulation that involves increasing an emotion (upregulation) our data also support previous results on the specificity of the brain functioning of male batterers when faced with pictures of IPV. The results found are in line with those of the few neuroscientific studies on male batterers (Bueso-Izquierdo et al., 2016; Lee et al., 2008, 2009; Verdejo-Román et al., 2019). Specifically, our findings replicate the specific brain functioning of batterers when faced with pictures of IPV in comparison with (non-offenders) controls (Lee et al., 2009) and other types of offenders (Bueso-Izquierdo et al., 2016).

In relation to the ability of male batterers to regulate their emotions by reducing them (suppression/downregulation), our results indicated that male batterers showed greater activation in the vlPFC when they have to suppress emotions related to IPV in comparison with the group of other offenders. However, when faced with unpleasant pictures, they activated the same brain areas as the rest of the groups. The vlPFC is a region involved in cognitive control, that is, in the selection and inhibition of responses, and therefore selects appropriate regulatory strategies (Frank et al., 2014). These results could indicate that when faced with pictures of IPV, the male batterers suppress emotions by using regulation strategies that differ from those used by the group of other offenders. In addition, activation of the vlPFC in male batterers correlated negatively with scores on the acceptance subscale (CERQ test), indicating that the greater the activation of this area, the less acceptance or use of thoughts that acknowledge the occurrence of the unpleasant event. These results could indicate that whilst male batterers activate the areas related to emotional suppression like the rest of the groups, they use maladaptive strategies to do so.

The fact that the male batterers showed no problems in the process of suppressing emotions is supported by the fact that they showed less activation of the amygdala than controls when faced with unpleasant pictures.

Meta-analyses (Buhle et al., 2014; Frank et al., 2014) indicate that activation of the amygdala is involved in increased upregulation or experience, whilst a decrease in activation is linked to downregulation or suppression. A greater inhibition of the amygdala is associated with an improved ability to reduce pain through reappraisal (Lapate et al., 2012) and when faced with negative pictures (Ochsner et al., 2002). These results could be taken to suggest that male batterers—compared with controls—are more effective at suppression when faced with unpleasant pictures, since they show a greater reduction in amygdala activity or negative emotional experience during suppression. In addition, amygdala activation in the control group was negatively related to scores on the planning refocus subscale (CERQ test), indicating that the greater the difference in amygdala activation, the less use was made of strategies focused on thinking about the steps that must be taken to reach a solution to the problem afflicting the person. Overall, these results show that increased activation of the amygdala during suppression is related to poorer execution of downregulation and the use of maladaptive emotional regulation strategies. These results are not consistent with some previous reports in the literature (Langer & Lawrence, 2010) and should therefore be replicated. With respect to the emotional regulation tests, the results indicate that the male batterers used fewer adaptive strategies of emotional regulation (self-blame and catastrophizing) than the rest of the groups. These results are in accord with those of the study by Langer and Lawrence (2009) who found that male batterers show deficits in emotional regulation, which play a critical role in the violent acts committed against their partners/ex-partners. A number of studies have found that male batterers have deficits in emotional regulation skills, with low levels of emotional intelligence (Winters et al, 2004); rejection of negative emotions (sadness, anxiety); and little empathy for the thoughts and feelings of their partners (Clements et al., 2007). Covell et al. (2007) found that higher rates of physical assault were associated with a general lack of understanding towards others and an inability to tolerate the negative emotions of others. Poor emotional perception generates hostile interpretations, which could facilitate the expression of violence (McKee et al., 2012).

The results of the empathy test revealed that the male batterers obtained low empathy scores in comparison with the control group, particularly in terms of the imaginative ability to put themselves in fictional situations and the ability to feel compassion, concern, and affection when faced with another person's discomfort. In other words, male batterers show low empathy both in terms of the cognitive component—referring to the capacity to put themselves in the place of another person—and in the emotional component that refers to the ability to understand/feel the emotions of another person. These results are partially in accord with those reported by Romero-Martínez et al. (2013), who found worse scores on cognitive and emotional empathy, as in the present study. Our findings also partially replicate the results of Loinaz et al. (2018), who found that male batterers scored lower on the fantasy subscale in comparison with the normal population.

Limitations

There are, however, some limitations of the present study that should be noted. First, some studies indicate that empathy is specific to the object to which it refers (Day et al., 2012). Therefore, we should have used an empathy test specific to IPV. However, due to the lack of a specific empathy test, we have used the one that is most widely used in studies of male batterers (Loinaz, Echeburúa, & Ullate, 2012; Romero-Martínez et al., 2016). Second, our sample was composed of participants who met strict inclusion criteria related to drug use and brain damage, which could reduce the representativeness of the group of male batterers, other offenders and non-offenders. However, the exclusion criteria have allowed us to rule out the possibility that our results are due to substance use or brain damage. Our sample could be considered small, thus making it difficult to generalize the results obtained. However, we calculated the sample size based on prior neuroimaging articles in male batterers. Besides, of all the neuroimaging studies conducted with male batterers, our study has used the largest sample size to date. Also, the results of this type of study should be interpreted with caution due to the limited access to information on the violent behaviors of these individuals. In other words, the criminal history of these individuals might not necessarily be an accurate reflection of violent acts that might have been committed in the past. However, in an attempt to reduce this bias, we have used a standardized instrument (Echeburua's interview). Finally, the results of this type of study should be interpreted with caution due to the limited access to information on the violent behaviors of these individuals. In other words, the criminal history of these individuals might not necessarily reflect those violent acts that might have been committed in the past. However, in an attempt to reduce this bias, we have used CTS2, together with a standardized instrument (Echeburua's interview).

With regard to diversity, since male batterers are a heterogeneous group (Ali et al., 2016), we did not include exclusion criteria based on age, ethnicity, culture, socioeconomic status, or cultural level to make the sample as representative as possible. Future studies should compare male batterers according to these variables in order to analyze diversity. Finally, the results of this study have a number of important implications. At the clinical level, psychological treatments with male batterers should incorporate the promotion of empathy and emotional regulation by the use of adaptive strategies in situations of IPV, that is, using specific stimuli related to IPV. We have shown that male batterers do not have deficits in the brain regions involved in emotional regulation and empathy. Therefore, with psychological treatment they could learn to empathize with the situations of IPV or with their partners/peers. At the social level, our results show the invisible face of IPV and reveals the typology of the single family abuser (Holtzworth-Munroe & Stuart, 1994), who, outside the home, is empathetic, regulates his emotions, and is not violent, whilst inside the home shows little empathy, low emotional regulation, and mistreats his partner.

Conclusions

This study shows, for the first time, that the study of emotional regulation in male batterers is of fundamental importance. It has been found that male batterers regulate their emotions and empathize with unpleasant situations. However, a different pattern of brain functioning has been detected in male batterers when they experience (upregulation) emotions when faced with pictures of IPV. Specifically, male batterers show less activation in the SMA along with low empathy and the use of maladaptive strategies of emotional regulation. The results found at both the neuroimaging and behavioral level indicate that specific brain functioning in emotional experience when faced with situations of IPV could be explained by a low capacity to empathize with their partners or ex-partners and by the use of maladaptive regulation strategies. Given that intervention programs for male batterers have a low impact on reducing recidivism (Arias et al., 2013) and that the ultimate goal of this research is to contribute toward reducing the high rates of recidivism that currently exist, we consider it very important that intervention programs should include empathy, experience, and emotional suppression with adaptive cognitive strategies. Some studies show that a diminished ability to empathize with partners or ex-partners could explain the risk of continued abuse following psychological therapy with male batterers (Romero-Martinez et al., 2016). Therefore, future work should replicate the results of this preliminary study and explore the neural bases of empathy in situations of IPV in male batterers.

Note

1. First of all, we calculated sample size according to formal power analysis G*Power (Faul et al., 2007). Based on prior neuroimaging data that found an

effect size of 0.9 (Bueso-Izquierdo et al., 2016), an expected power of 0.8 and an assumed alpha-level of 0.05, the sample size should be of a minimum of 25 per group.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Spanish Ministry of Science and Innovation (Project: PSI 2009-13585), Ministry of Economy and Competitiveness (Projects: PSI2013-42792-R; PSI2016-79481-R), and Regional Ministry of Economy, Innovation and Science from Andalusian Government (Project: P2012-SEJ1723). AMM is supported by Ministry of Education, Culture and Sport (University Faculty Training program: FPU15/04335). JVR is supported by a grant from the Spanish Ministry of Science, Innovation and Universities (FJCI-2017-33396). ACM is supported by the CTS176 Andalusian group.

ORCID iDs

Agar Marín-Morales https://orcid.org/0000-0001-7812-8598

Miguel Pérez-García https://orcid.org/0000-0003-4775-7556

Juan Verdejo-Román https://orcid.org/0000-0001-5112-8918

Supplemental Material

Supplemental material for this article is available online.

References

*References with asterisks are cited in the supplemental material.

Ali, P. A., Dhingra, K., & McGarry, J. (2016). A literature review of intimate partner violence and its classifications. *Aggression and Violent Behavior*, *31*, 16–25. https://doi.org/10.1016/j.avb.2016.06.008

Arias, E., Arce, R., & Vilariño, M. (2013). Batterer intervention programmes: A meta-analytic review of effectiveness. *Psychosocial Intervention*, *22*(2), 153–160.

Bueso-Izquierdo, N., Hart, S. D., Hidalgo-Ruzzante, N., Kropp, P. R., & Pérez-García, M. (2015). The mind of the male batterer: A neuroscience perspective. *Aggression and Violent Behavior*, *25*, 243–251. https://doi.org/10.1016/j.avb.2015.09.009

Bueso-Izquierdo, N., Verdejo-Román, J., Contreras-Rodríguez, O., Carmona-Perera, M., Pérez-García, M., & Hidalgo-Ruzzante, N. (2016). Are batterers different from other criminals? An fMRI study. *Social Cognitive and Affective Neuroscience*, *11*(5), 852–862. https://doi.org/10.1093/scan/nsw020

Buhle, J. T., Silvers, J. A., Wager, T. D., Lopez, R., Onyemekwu, C., Kober, H., Weber, J., & Ochsner, K. N. (2014). Cognitive reappraisal of emotion: A meta-analysis of human neuroimaging studies. *Cerebral Cortex*, *24*(11), 2981–2990. https://doi.org/10.1093/cercor/bht154

Cabello, R., Salguero, J. M., Fernández-Berrocal, P., & Gross, J. J. (2013). A Spanish adaptation of the emotion regulation questionnaire. *European Journal of Psychological Assessment*, *29*(4), 234–240. https://doi.org/10.1027/1015-5759/a000150

Chan, S.-C., Raine, A., & Lee, T. M. C. (2010). Attentional bias towards negative affect stimuli and reactive aggression in male batterers. *Psychiatry Research*, *176*(2), 246–249. https://doi.org/10.1016/j.psychres.2008.12.013

Clements, K., Holtzworth-Munroe, A., Schweinle, W., & Ickes, W. (2007). Empathic accuracy of intimate partners in violent versus nonviolent relationships. *Personal Relationships*, *14*(3), 369–388. https://doi.org/10.1111/j.1475-6811.2007.00161.x

Cohen, R. A., Brumm, V., Zawacki, T. M., Paul, R., Sweet, L., & Rosenbaum, A. (2003). Impulsivity and verbal deficits associated with domestic violence. *Journal of the International Neuropsychological Society*, *9*(5), 760–770. https://doi.org/10.1017/S1355617703950090

Covell, C. N., Huss, M. T., & Langhinrichsen-Rohling, J. (2007). Empathic deficits among male batterers: A multidimensional approach. *Journal of Family Violence*, *22*(3), 165–174. https://doi.org/10.1007/s10896-007-9066-2

Day, A., Mohr, P., Howells, K., Gerace, A., & Lim, L. (2012). The role of empathy in anger arousal in violent offenders and university students. *International Journal of Offender Therapy and Comparative Criminology*, *56*(4), 599–613. https://doi.org/10.1177/0306624X11431061

Decety, J., Michalska, K. J., Akitsuki, Y., & Lahey, B. B. (2009). Atypical empathic responses in adolescents with aggressive conduct disorder: A functional MRI investigation. *Biological Psychology*, *80*(2), 203–211. https://doi.org/10.1016/j.biopsycho.2008.09.004

Echeburúa, E., Fernández-Montalvo, J., & de Corral, P. (2008). ¿ Hay diferencias entre la violencia grave y la violencia menos grave contra la pareja?: Un análisis comparativo [Are there differences between serious and less serious intimate partner violence? A comparative analysis]. *International Journal of Clinical and Health Psychology*, *8*(2), 355–382.

Etkin, A., Büchel, C., & Gross, J. J. (2015). The neural bases of emotion regulation. *Nature Reviews Neuroscience*, *16*(11), 693–700. https://doi.org/10.1038/nrn4044

Fan, Y., Duncan, N. W., de Greck, M., & Northoff, G. (2011). Is there a core neural network in empathy? An fMRI based quantitative meta-analysis. *Neuroscience & Biobehavioral Reviews*, *35*(3), 903–911. https://doi.org/10.1016/j.neubiorev.2010.10.009

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

Finkel, E. J., & Hall, A. N. (2018). The I3 model: A metatheoretical framework for understanding aggression. *Current opinion in psychology*, *19*, 125–130.

First, M. B. (1999). *Guía del usuario para la entrevista clínica estructurada para los trastornos de la personalidad del eje II del DSM-IV (SCID-II) [User's Guide for the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II)]*. Masson.

Ford, B. Q., & Gross, J. J. (2018). Emotion regulation: Why beliefs matter. *Canadian Psychology/Psychologie Canadienne*, *59*(1), 1–14. https://doi.org/10.1037/cap0000142

Frank, D. W., Dewitt, M., Hudgens-Haney, M., Schaeffer, D. J., Ball, B. H., Schwarz, N. F., Hussein, A. A., Smart, L. M., & Sabatinelli, D. (2014). Emotion regulation: Quantitative meta-analysis of functional activation and deactivation. *Neuroscience & Biobehavioral Reviews*, *45*, 202–211. https://doi.org/10.1016/j.neubiorev.2014.06.010

Garnefski, N., Kraaij, V., & Spinhoven, P. (2001). Negative life events, cognitive emotion regulation and emotional problems. *Personality and Individual Differences*, *30*(8), 1311–1327. https://doi.org/10.1016/S0191-8869(00)00113-6

Gross, J. J. (1999). Emotion regulation: Past, present, future. *Cognition and Emotion*, *13*(5), 551–573. https://doi.org/10.1080/026999399379186

Gross, J. J. (2015). Emotion regulation: Current status and future prospects. *Psychological Inquiry*, *26*(1), 1–26. https://doi.org/10.1080/1047840X.2014.940781

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *Journal of personality and social psychology*, *85*(2), 348.

Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: Conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). The Guilford Press.

Heesink, L., Gladwin, T. E., Vink, M., van Honk, J., Kleber, R., & Geuze, E. (2018). Neural activity during the viewing of emotional pictures in veterans with pathological anger and aggression. *European psychiatry*, *47*, 1–8. https://doi.org/10.1016/j.eurpsy.2017.09.002

Holland, A. C., & Kensinger, E. A. (2013). An fMRI investigation of the cognitive reappraisal of negative memories. *Neuropsychologia*, *51*(12), 2389–2400. https://doi.org/10.1016/j.neuropsychologia.2013.02.012

Holtzworth-Munroe, A., & Stuart, G. L. (1994). Typologies of male batterers: Three subtypes and the differences among them. *Psychological Bulletin*, *116*(3), 476.

Jones, S., Joyal, C. C., Cisler, J. M., & Bai, S. (2017). Exploring emotion regulation in juveniles who have sexually offended: An fMRI study. *Journal of Child Sexual Abuse*, *26*(1), 40–57. https://doi.org/10.1080/10538712.2016.1259280

Kirk-Provencher, K. T., Nelson-Aguiar, R. J., & Spillane, N. S. (2020). Neuroanatomical differences among sexual offenders: A targeted review with limitations and implications for future directions. *Violence and Gender*, *7*(3), 86–97. https://doi.org/10.1089/vio.2019.0051

Lang, P. (1980). *Self-assessment manikin*. The Center for Research in Psychophysiology, University of Florida.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1997). International affective picture system (IAPS): Technical manual and affective ratings. *NIMH Center for the Study of Emotion and Attention*, *1*, 39–58.

Langer, A., & Lawrence, E. (2010). Emotion regulation and experiential avoidance in intimate partner violence. *Advances in Psychology Research*, *70*, 73–101.

Lapate, R. C., Lee, H., Salomons, T. V., van Reekum, C. M., Greischar, L. L., & Davidson, R. J. (2012). Amygdalar function reflects common individual differences in emotion and pain regulation success. *Journal of Cognitive Neuroscience*, *24*(1), 148–158.

Lee, T. M. C., Chan, S. C., & Raine, A. (2008). Strong limbic and weak frontal activation to aggressive stimuli in spouse abusers. *Molecular Psychiatry*, *13*(7), 655–656. https://doi.org/10.1038/mp.2008.46

Lee, T. M. C., Chan, S. C., & Raine, A. (2009). Hyperresponsivity to threat stimuli in domestic violence offenders: A functional magnetic resonance imaging study. *Journal of Clinical Psychiatry*, *70*(1), 36–45.

Loinaz, I., Echeburúa, E., Ortiz-Tallo, M., & Amor, P. J. (2012). Propiedades psicométricas de la conflict tactics scales (CTS-2) en una muestra española de agresores de pareja [Psychometrics properties of the Conflict Tactics Scales (CTS-2) in a Spanish sample of male batterers]. *Psicothema*, *24*(1), 142–148.

Loinaz, I., Echeburúa, E., & Ullate, M. (2012). Estilo de apego, empatía y autoestima en agresores de pareja [Attachment style, empathy and self-esteem in male batterers]. *Terapia psicológica*, *30*(2), 61–70.

Loinaz, I., Sánchez, L. M., & Vilella, A. (2018). Understanding empathy, self-esteem, and adult attachment in sexual offenders and partner-violent men. *Journal of Interpersonal Violence*. https://doi.org/10.1177/0886260518759977

*Maldjian, J. A., Laurienti, P. J., Kraft, R. A., & Burdette, J. H. (2003). An automated method for neuroanatomic and cytoarchitectonic atlas-based interrogation of fMRI data sets. *NeuroImage*, *19*(3), 1233–1239.https://doi.org/10.1016/S1053-8119(03)00169-1

Marin-Morales, A., Bueso-Izquierdo, N., Hidalgo-Ruzzante, N., Pérez-García, M., Catena-Martínez, A., & Verdejo-Román, J. (2020). "Would you allow your wife to dress in a miniskirt to the party?" Batterers do not activate default mode network during moral decisions about intimate partner violence. *Journal of Interpersonal Violence*. https://doi.org/10.1177/0886260520926494

Massau, C., Kärgel, C., Weiß, S., Walter, M., Ponseti, J., Krueger, T. H. C., Walter, H., & Schiffer, B. (2017). Neural correlates of moral judgment in pedophilia. *Social Cognitive and Affective Neuroscience*, *12*(9), 1490–1499. https://doi.org/10.1093/scan/nsx077

McKee, M., Roring, S., Winterowd, C., & Porras, C. (2012). The relationship of negative self-schemas and insecure partner attachment styles with anger experience and expression among male batterers. *Journal of Interpersonal Violence*, *27*(13), 2685–2702. https://doi.org/10.1177/0886260512436395

Ochsner, K. N., Bunge, S. A., Gross, J. J., & Gabrieli, J. D. E. (2002). Rethinking feelings: An fMRI study of the cognitive regulation of emotion. *Journal of Cognitive Neuroscience*, *14*(8), 1215–1229. https://doi.org/10.1162/089892902760807212

Pardini, D. A., & Phillips, M. (2010). Neural responses to emotional and neutral facial expressions in chronically violent men. *Journal of Psychiatry & Neuroscience*, *35*(6), 390–398. https://doi.org/10.1503/jpn.100037

Pérez-Albéniz, A., De Paúl, J., Etxeberría, J. Montes M., P., & Torres, E. (2003). Adaptación de interpersonal reactivity index (IRI) al español [Spanish adaptation of the interpersonal relativity index]. *Psicothema*, *15*(2), 267–272.

Phan, K. L., Fitzgerald, D. A., Nathan, P. J., Moore, G. J., Uhde, T. W., & Tancer, M. E. (2005). Neural substrates for voluntary suppression of negative affect: a functional magnetic resonance imaging study. *Biological Psychiatry*, *57*(3), 210–219.

Raine, A. (2019). The neuromoral theory of antisocial, violent, and psychopathic behavior. *Psychiatry Research*, *277*, 64–69. https://doi.org/10.1016/j.psychres.2018.11.025

Romero-Martínez, Á., Lila, M., & Moya-Albiol, L. (2016). Empathy impairments in intimate partner violence perpetrators with antisocial and borderline traits: A key factor in the risk of recidivism. *Violence and Victims*, *31*(2), 347–360. https://doi.org/10.1891/0886-6708.VV-D-14-00149

Romero-Martínez, Á., Lila, M., Sariñana-González, P., González-Bono, E., & Moya-Albiol, L. (2013). High testosterone levels and sensitivity to acute stress in perpetrators of domestic violence with low cognitive flexibility and impairments in their emotional decoding process: A preliminary study. *Aggressive Behavior*, *39*(5), 355–369. https://doi.org/10.1002/ab.21490

Siep, N., Tonnaer, F., van de Ven, V., Arntz, A., Raine, A., & Cima, M. (2019). Anger provocation increases limbic and decreases medial prefrontal cortex connectivity with the left amygdala in reactive aggressive violent offenders. *Brain Imaging and Behavior*, *13*(5), 1311–1323. https://doi.org/10.1007/s11682-018-9945-6

*Song, X.-W., Dong, Z.-Y., Long, X.-Y., Li, S.-F., Zuo, X.-N., Zhu, C.-Z., He, Y., Yan, C.-G., & Zang, Y.-F. (2011). REST: A toolkit for resting-state functional magnetic resonance imaging data processing. *PLoS ONE*, *6*(9), e25031. https://doi.org/10.1371/journal.pone.0025031

Tonnaer, F., Siep, N., van Zutphen, L., Arntz, A., & Cima, M. (2017). Anger provocation in violent offenders leads to emotion dysregulation. *Scientific Reports*, *7*(1), 1–9. https://doi.org/10.1038/s41598-017-03870-y

Verdejo-Román, J., Bueso-Izquierdo, N., Daugherty, J. C., Pérez-García, M., & Hidalgo-Ruzzante, N. (2019). Structural brain differences in emotional processing and regulation areas between male batterers and other criminals: A preliminary study. *Social Neuroscience*, *14*(4), 390–397. https://doi.org/10.1080/17470919.2018.1481882

*Ward, B. D. (2013). Simultaneous inference for FMRI data. AFNI and NIFTI server at NIMH in Bethesda, MD, USA. https://afni.nimh.nih.gov/pub/dist/doc/manual/AlphaSim.pdf

Winters, J., Clift, R. J. W., & Dutton, D. G. (2004). An exploratory study of emotional intelligence and domestic abuse. *Journal of Family Violence*, *19*(5), 255–267. https://doi.org/10.1023/B:JOFV.0000042076.21723.f3

World Health Organization. (2017). Violence against women. https://www.who.int/news-room/fact-sheets/detail/violence-against-women

Zucchelli, M. M., & Ugazio, G. (2019). Cognitive-emotional and inhibitory deficits as a window to moral decision-making difficulties related to exposure to violence. *Frontiers in Psychology*, *10*. https://doi.org/10.3389/fpsyg.2019.01427

Author Biographies

Agar Marín-Morales, Master of Science in Psychology, PhD student, researcher at the Mind, Brain and Behavior Research Center at University of Granada. Her research focuses on neuropsychology, neuroimaging, and intimate partner violence. Specifically, she studies the neuropsychological and psychological characteristics (emotional regulation, empathy, morality, social cognition) and cerebral functioning of male batterers.

Miguel Pérez-García, PhD in psychology, professor of Neuropsychology in the School of Psychology at University of Granada. His research focuses on adverse effects on the brain caused by drugs, armed conflicts, the situation of poverty, etc. Currently, he is assessing neuropsychological consequences in victims of intimate partner violence and the neuropsychological and cerebral functioning of male batterers to reduce recidivism.

Andrés Catena-Martínez, PhD in psychology, professor of Psychology in the School of Psychology at University of Granada. He is the Director of Mind, Brain and Behavior Research Center at University of Granada. His main research interest is learning emotion decision and neuroimaging.

Juan Verdejo-Román, PhD in psychology, postdoctoral Researcher at Universidad Complutense of Madrid. He is a Biomedical Engineer and PhD in psychology. His main research interest is neuroimaging and its application to different pathologies/conditions. He has published more than 25 JCR papers.