

Romero-Martínez, Á., Lila, M., Gracia, E., Martín-Fernández, M., & Moya-Albiol, L. (2021). Generally antisocial batterers with high neuropsychological deficits present lower treatment compliance and higher recidivism. *Psychology of Violence, 11*(3), 318-328. <https://doi.org/10.1037/vio0000296>

Generally Antisocial Batterers with High Neuropsychological Deficits Present Lower Treatment Compliance and Higher Recidivism

Abstract

Objective: No studies have considered whether neuropsychological performance moderates the relationship between Holtzworth-Munroe and Stuart's intimate partner violence against women (IPVAW) offender typologies and treatment compliance and recidivism. Therefore, we first aimed to assess whether the typologies show differences in specific neuropsychological variables such as cognitive flexibility and emotion decoding processes. Second, we also assessed whether there are differences in treatment compliance and recidivism between the IPVAW offender typologies, based on their neuropsychological performance. **Method:** We administered a set of neuropsychological tests (e.g., Wisconsin card sorting test and eyes test) and self-reports to a group of IPVAW offenders (n=424). We also assessed their treatment compliance (i.e., dropout and intervention dose) and recidivism (i.e., risk of recidivism and official recidivism) after treatment. **Results:** Our analysis revealed that the FO offenders showed the best cognitive performance, followed by the BD group, with the GVA group showing the worst performance. Even though there were significant differences between the IPVAW offenders' typologies in their treatment compliance, and the recidivism, these differences were more pronounced when considering IPVAW offenders' typologies along with neuropsychological performance (high vs low). That is, FO with high cognitive functioning presented highest treatment compliance and lowest rates of recidivism. Conversely, GVA with low cognitive functioning presented

the lowest treatment compliance and highest rate of recidivism. **Conclusions:** Our study highlights the need to design therapeutic programs with coadjutant neuropsychological training to attend not only to the psychological needs of IPVAV offenders, but also to the neuropsychological deficits that might facilitate lower treatment compliance and recidivism.

Keywords. Cognitive flexibility; treatment compliance; intimate partner violence offenders; neuropsychology; recidivism.

A large percentage of women (around 30%) experience physical and/or sexual violence by their intimate partner at some point in their lives, with serious consequences for their physical and psychological health. Furthermore, approximately 38% of murders of women are committed by their intimate partners (World Health Organization, 2016). To reduce and prevent intimate partner violence against women (IPVAW), it is essential to develop new and effective intervention programs designed for IPVAW offenders by focusing on the mechanisms that explain their violence proneness. However, several authors have indicated that current batterer intervention programs tend to have limited efficacy in reducing IPVAW rates and/or recidivism (Babcock et al., 2016; Murphy & Ting, 2010). Hence, it is necessary to introduce new intervention targets, such as cognitive domains with deficits and/or low functioning, to add coadjutant treatments to the current ones.

Due to the heterogeneous nature of IPVAW offenders (e.g. demographic characteristics, psychological profiles, presence or not of mental disorders...), dividing them into subcategories would increase the efficacy of interventions by focusing on IPVAW perpetrator subtypes' specific therapeutic needs (Bernardi & Day, 2015; Carbajosa et al., 2017). The most well-known typology was established by Holtzworth-Munroe and Stuart (1994), based on the severity of IPVAW, the presence of general violence, and the specific psychopathology/personality disorder (i.e., borderline, antisocial, or dependent).

Holtzworth-Munroe and Stuart (1994) initially differentiated between three typologies of IPVAW offenders, which have been replicated across countries (Carbajosa et al., 2017; Cunha & Gonçalves, 2013; Delsol et al., 2003; Fowler et al., 2016; Gómez et al., 2017; Hamberger et al., 1996; Holtzworth-Munroe et al., 2000; Llor-Esteban et al., 2016; Loinaz, 2014; Waltz et al., 2000). Specifically, IPVAW

typologies ranged from individuals who were only violent with their partners and had the lowest levels of general violence (defined as family only or FO) to highly and generally violent IPVAW offenders (defined as generally violent-antisocial or GVA). Another subtype, borderline/dysphoric (BD), is characterized by higher levels of IPVAW than FO, but lower than GVA. Additionally, it is highly likely that BD also present previous criminal records, unlike FO, who do not usually have criminal records. Regarding personality disorders, the BD subtype is characterized by borderline and dependent personality disorders, and the GVA subtype exhibits elevated antisocial features on the scales utilized. However, the FO group does not tend to present psychopathological disorders and/or personality disorders. Later studies analyzed additional variables that are related to IPVAW offender typologies and important in IPVAW, such as drug misuse and impulsivity, among others. Thus, some studies have found that FO presented the lowest rate of drug misuse and impulsivity, followed by BD and, finally, GVA, with the highest rates of these variables (Cunha & Gonçalves, 2013; Delsol et al., 2003; Holtzworth-Munroe et al., 2000).

The importance of Holtzworth-Munroe and Stuart's (1994) categorization has been highlighted because of its value in predicting non-compliance with treatment or dropout during the initial stages, as well as future IPVAW recidivism (Eckhardt et al., 2008; Huss & Ralston, 2008; Stoops et al., 2010). Accordingly, the lowest dropout and recidivism risk is presented by FO, followed by BD and, finally, GVA.

Very few studies offer information about whether these typologies present different cognitive/neuropsychological profiles (see Walling et al., 2012, as an exception). Neuropsychological variables offer information about the relationships between the brain and the behavior (external manifestation). For example, studying these variables would make it possible to understand how individuals process contextual

information, make decisions, and verbalize their inner states, among others (Howieson, 2019; Humenik et al., 2020; Lezak et al., 2012). These abilities might prevent or increase the threshold for becoming violent by interfering in the interpretation of the aforementioned information (external and/or internal cues). The assessment of these variables with neuropsychological tests is useful for diagnosing individuals' abnormal functioning and, in turn, developing cognitive training/rehabilitation programs (Muñoz-Marrón et al., 2011), which have been found to be efficacious in increasing treatment adherence and reducing recidivism in schizophrenic violent men (Tao et al., 2015; Thomas et al., 2018). Therefore, it is important to consider the variables that are part of the violence facilitation system, characterized by prefrontal dysfunctions and/or executive dysfunctions to control limbic irritability. Moreover, emotional dysregulations could be aggravated by serious difficulties in understanding or correctly processing external and internal emotional stimuli (Romero-Martínez & Moya-Albiol, 2013; Walling et al., 2012). Most importantly, it is also necessary to highlight that these variables tend to be assessed by instruments that do not have the typical limitations of self-reports, such as social desirability or acquiescence response bias (Howieson, 2019; Lezak et al., 2012).

Previous research suggested that two neuropsychological variables seem to be relevant in IPVAW recidivism, although they do not necessarily have a causal relationship with treatment compliance or risk of IPVAW recidivism (Hundozi et al., 2016; Nishinaka et al., 2016; Romero-Martínez et al., 2013; 2016). First, cognitive flexibility has been highlighted, which is part of executive functioning and consists of the ability to adjust and regulate behavior depending on the contextual demands (Vitoria Estruch et al., 2017; 2018). Aggressive behaviors such as IPVAW are conceived as non-adaptive mechanisms to solve problems in our society. Thus, aggressive individuals

usually employ these strategies, and they also have serious difficulties with solving problems by switching their strategies to other more appropriate ones (Vitoria-Estruch et al., 2017). Therefore, it makes sense to conclude that aggressive individuals could be characterized as individuals with low mental flexibility (i.e. difficulties with changing mental sets). In the case of IPVAW offenders, this low flexibility or high mental rigidity tends to be associated with the maintenance of sexist cognitive schemas and certain sexist behaviors, which tend to facilitate recidivism (Vitoria-Estruch et al., 2017; 2018).

The importance of a basic empathy process that is closely related to cognitive flexibility, defined as emotion decoding in facial expressions, has also been supported (Romero-Martínez et al., 2019a; 2019b). Indeed, it consists of a set of cognitive skills that allow us to visually recognize facial expressions and understand their meaning (e.g. emotions, thoughts...), providing basic support for more complex and higher-level cognitive processes, such as Theory of mind or perspective taking. Hence, poor emotion decoding abilities usually involve errors in interpreting others' facial expressions, which leads to misunderstanding others' intentions and, thus, reacting aggressively (Baron-Cohen et al., 2001; Oakley et al., 2016). Poor emotion decoding abilities might facilitate dropout from interventions because they make individuals feel overwhelmed by the emotional content of IPVAW interventions (Romero-Martínez et al., 2016).

Several empirical studies have supported the existence of Holtzworth-Munroe and Stuart's (1994) typologies of IPVAW offenders, as well as the presence of neuropsychological deficits in IPVAW offenders. However, no studies have considered whether neuropsychological performance moderates the relationship between the IPVAW offender typologies and dropout rates and risk of recidivism. Therefore, the main objective of this study was twofold. First, we analyze whether IPVAW offender typologies show differences in specific neuropsychological variables such as cognitive

flexibility and emotion decoding processes. We first hypothesized that, in line with previous research (Walling et al., 2012), the FO subtype would present better neuropsychological performance than the BD and GVA subtypes. Moreover, we also hypothesized that there would be no differences in neuropsychological performance between these last two groups. Second, we also aimed to assess whether there are differences between IPVAW offenders' typologies, based on their neuropsychological performance, in treatment compliance and recidivism. Hence, based on previous conclusions in this field pointed out that worse cognitive performance is a risk factor for treatment compliance and recidivism, and that GVA and BD present the highest risk of recidivism (Romero-Martínez et al., 2016; 2019a; 2019b), we expected that GVA and BD with low neuropsychological functioning would present the highest dropout and IPVAW recidivism rates.

Method

Participants

Participants were recruited for this study from January 2013 to December 2018. The calculation of power analysis determined a minimum sample size of 385 participants for our study. This was based on the male population in Spain, considering a confidence level of 95%, a margin of error of 5% ($\alpha = .05$, $1 - \beta = .95$), and a response distribution of 50%.

From an initial sample of 471 IPVAW offenders who agreed to participate, only 424 were finally included in our study because they completed all the measures of interest for this study. In fact, participants with missing data on the neuropsychological variables were removed. However, there were no differences in demographic variables between the individuals who were removed and those who were finally included in the study. Specifically, there were no differences in age ($t(469) = 0.38$, $p = .70$, $d = .06$),

marital status ($X^2(4) = 0.94, p = .92, V_{\text{Cramer}} = .02$), nationality ($X^2(1) = 1.22, p = .27, V_{\text{Cramer}} = .05$), educational level ($X^2(3) = 5.56, p = .13, V_{\text{Cramer}} = .06$), and/or employment status ($X^2(2) = 0.72, p = .69, V_{\text{Cramer}} = .03$).

The participants included in our study were over 18 years old and had no physical or mental/cognitive problems (e.g. schizophrenia, severe traumatic brain injury, strokes with severe brain damage...) and/or substance use disorders. Because these IPVAW offenders were sentenced to less than two years in prison and had no previous criminal record, they received a suspended sentence on the condition that they would attend an intervention program designed specifically for this kind of violent population. They received a court mandated psycho-educational and community-based treatment program (CONTEXTO) at the University of Valencia (Valencia, Spain). The CONTEXTO intervention is a cognitive behavioral treatment that also includes motivational strategies to increase treatment compliance and promote change (Lila et al., 2018).

Participation in the study was voluntary, and participants previously gave their written informed consent, following the Declaration of Helsinki. Moreover, this project was also approved by the University of Valencia Ethics Committee (assigned codes: H1348835571691 and H1537520365110).

Procedure

Before agreeing to participate, all the IPVAW offenders were informed that refusal to participate in the study would not affect their legal status. Moreover, all the measurements and answers provided during the interviews would be confidential, and the judicial system would not have access to them. The data were collected before the IPVAW intervention started, as part of the initial assessment in the CONTEXTO program, which is manualized. Nonetheless, recidivism data were based on official

records collected during the first year after the intervention program ended. IPVAW offenders received a Standard Batterer Intervention Program that lasted approximately 35 weeks (2 hours per session). This intervention was conducted by psychotherapists with extensive experience with IPVAW offenders (for a more exhaustive description, see Lila et al., 2018).

Each man participated in two sessions in the Faculty of Psychology at the University of Valencia. In the first session, IPVAW offenders were interviewed to exclude any individuals with physical or mental illnesses that could seriously disrupt the functioning of the intervention. Moreover, anthropometric and sociodemographic data were collected. The second session took place the following day between 10 a.m. and 2 p.m., to minimize possible effects of fatigue later in the day. After arriving at the laboratory, participants were taken to a room where the neuropsychological tests and self-reports were administered, which took approximately 90 minutes.

Instruments

Cognitive flexibility. Wisconsin Card Sorting Test (WCST) measures abstract reasoning and the ability to change cognitive strategies in response to environmental changes. It consists of 4 stimulus cards and 128 response cards containing various colors (red, blue, yellow, or green), shapes (circle, cross, star, or triangle), and numbers (one, two, three, or four) of figures (Heaton et al., 1993). Participants must match the response cards to one of the stimulus cards. To achieve good performance, participants must choose from the six categories, making the fewest mistakes possible. The first, rule applied is the color classification rule; after 10 consecutive hits, the rule changes to sorting by shape and then to sorting by number. The evaluator gives corrective feedback after each card placement, but without telling the participant what rule to follow. Internal consistency was good, Cronbach's $\alpha = .88$. Correct trials, total errors,

perseverative errors, and completed categories were included as dependent variables in this study. A higher score on each scale means a higher number of correct responses, mistakes, or number of completed categories. This procedure has been previously employed with IPVAW offenders (Romero-Martínez et al., 2016; 2019).

Emotion decoding. The *Eyes Test* measures emotion decoding abilities by identifying the emotion that best represents the expression in the eyes in 36 photographs that show the eye region of different men and women. Participants must choose one adjective from a set of four. The total score, which ranges from 0 to 36 points, is obtained by adding up the number of correct answers (Baron-Cohen et al., 2001), with a higher score indicating stronger emotion decoding abilities. Internal consistency for this study was $\alpha = .48$, which is in line with previous studies employing this test (Oakley et al., 2016). Moreover, it has been previously established that this tool presents good sensitivity in assessing emotion decoding abilities (Fernández-Abascal et al., 2013). This measure has also been previously employed with IPVAW offenders (Vitoria-Estruch et al., 2017; 2018).

Impulsivity. We used the Spanish adapted and validated version of the *Plutchik Impulsivity Scale* (Plutchik, & Van Praag, 1989). Like the original version, the Spanish adaptation of this questionnaire presents acceptable psychometric properties (Páez et al., 1996). This 15-item Likert-type scale measures impulsivity as an immediate reaction, disregarding any behavioral consequences (e.g., Do you plan things in advance? Do you say the first thing that comes into your head?), using a 4-point response scale (1 = *never*; 4 = *almost always*). Internal consistency for our study was $\alpha = .71$. This instrument has presented good sensitivity in detecting impulsivity in several samples of violent individuals (Stautz & Cooper, 2013). Cut-off score for this test was 30. Furthermore, it has also been employed with IPVAW offenders (Carbajosa et al., 2017).

Personality disorders. We employed four subscales of the validated Spanish version (Cardenal, & Sanchez, 2007) of the *Millon Clinical Multiaxial Inventory* (MCMI-III) (Millon, 1994) to assess personality disorders such as borderline, antisocial, and dependent. Moreover, we also used the subscale that assesses drug misuse. Internal consistency in our study was above .80. This instrument presented good sensitivity in detecting personality disorders in violent individuals (Retzlaff et al., 2002) The cut-off score for this test was 85. It has also been employed with IPVAW offenders (Carbajosa et al., 2017; Lila et al., 2018; 2019; 2020; Loiaz, 2014).

Trait anger. Anger was assessed with the Spanish version (Miguel-Tobal et al., 2001) of the *State-Trait Anger Expression Inventory-2* (STAXI-2) (Spielberger, 1999). We employed the trait anger scale, which measures the dispositional tendency to experience anger and irritability. All the items are rated on a 4-point Likert-type scale (1 = *not at all* to 4 = *very much so*). Internal consistency for the trait anger STAXI-2 scale was $\alpha = .85$. It has also been employed with IPVAW offenders (Romero-Martínez et al., 2016; 2019a; 2019b).

Alcohol abuse. We used the Spanish version (Contell-Guillamón et al., 1999) of the *Alcohol Use Disorders Identification Test* (AUDIT) (Saunders et al., 1993) to check for the quantity and frequency of alcohol use in adults. It is composed of 10 self-report items ranging from 0 (never) to 4 (daily or almost daily). A cut-off score of 8 distinguished non-risk drinkers from risky drinkers (*i.e.*, heavy and sustained alcohol consumption). Internal consistency of the test in this study was acceptable, $\alpha = 0.77$. The AUDIT has shown good sensitivity and specificity as a screening instrument (Allen et al., 1997), and its Spanish version has been widely used with samples of IPVAW offenders (Carbajosa et al., 2017; Lila et al., 2020).

Revised Conflict Tactics Scale (CTS2). We used the Spanish version (Muñoz-Rivas et al., 2007) of this measure (Straus, Hamby, Boney-McCoy, & Sugarman, 1996). The CTS2 is a self-report inventory that assesses how individuals tend to solve their relationship conflicts. Participants report on their own behaviors and those of their partners during conflicts. The measure consists of 78 items rated on an 8-point Likert-type scale, where 0 represents —This has never happened, and 6 represents —More than 20 times in the past year; however, 7 represents —Not in the past year, but it has happened before. Cronbach's alphas for the present study ranged from $\alpha = 0.78$ to $\alpha = 0.88$. For this study, we employed the physical assault and psychological aggression scales. The Spanish version has been widely used with samples of IPVAW offenders (Lila et al., 2018; 2019; 2020; Loinaz, 2014; Vitoria-Estruch et al., 2018).

Treatment compliance. Two indicators were used: dropout and intervention dose. Participants were dummy coded as *completers* (0) if they finished the intervention, or *dropout* (1) if they left the intervention before it ended. We also considered *intervention dose* (i.e., number of intervention sessions participants attended).

To assess recidivism, we evaluated both the *risk of recidivism* as the *official recidivism*. The *Spousal Assault Risk Assessment Guide (SARA)* (Kropp et al., 1995; Spanish version by Andrés-Pueyo et al., 2008) is a clinical checklist consisted of 20 items, rated on a 3-point scale (0 = *absence*; 1 = *possibly present*; and 2 = *presence*), that include main risk factors for IPVAW (e.g., use of weapons and/or death threats, attitudes that support or consent to intimate partner violence, violations and breaches of restraining orders). It is used by trained program staff to assess participants' risk of recidivism, based on information provided by judicial and probation system professionals and by the participant. The *Risk of recidivism* is the summary of all the

risk factors present for each participant, with higher scores indicating higher risk of recidivism (range between 0 and 40). In this study, this measure presented acceptable internal consistency, $\alpha = .70$. The SARA has shown predictive validity (Messing & Thaller, 2012). The rate of *official IPVAW recidivism* was assessed for one year after the treatment ended, using the monitoring system of the Spanish Ministry of the Interior (responsible for the penitentiary system), specifically from the VIOGEN database. We coded this variable as 0 (if the participant did not reoffend) and 1 (if he reoffended).

Data analysis

To address the first objective, we first established the IPVAW offender typologies (i.e., antisocial, borderline, and family only) by running a hierarchical cluster analysis. We followed Holtzworth-Munroe et al. (2000) and Huss and Langhinrichsen-Rohling's (2006) procedure, using the Ward method to perform the cluster analysis, which was subsequently validated by means of the *k*-means method.

The Kolmogorov-Smirnov test was used to explore whether the data were normally distributed. To narrow the range of the variables not normally distributed and facilitate its interpretation, they were log transformed. A one-way ANOVA was used to check for significant differences between the typologies (GVA, BD and FO) on sociodemographic characteristics, questionnaire scores, and the Eyes test. MANOVA and MANCOVA were performed for the WCST, using Greenhouse-Geisser adjustments for degrees of freedom, which is robust when the normality and sphericity assumptions of these tests are not strictly met. Partial eta squared was reported as an effect size measure, with values between .01-.06, 0.7-.16, and above .16 for small, moderate, and large effects, respectively. For significant results, Bonferroni tests were applied as post hoc analysis. In addition, chi-square analyses were performed for categorical variables such as sociodemographic characteristics (nationality, marital

status, level of education, employment status, among others). Cramer's V statistic was computed to assess the effect size of these comparisons, with values below .20, between .20-.30, and above .30 for small, moderate, and large effects, respectively.

Neuropsychological performance was operationalized in two categories (low vs high performance) using the median score on the 'eyes test' and the 'WCST number of correct responses'. Participants were included in the 'low' group if their scores on both neuropsychological tests were below the median. Cases where both scores were above the median were classified as 'high'. For participants with discrepancies between these two scores (high on the eyes test, but low on the WCST, or vice versa), we assessed whether performance on other WCST subscales, such as total errors and perseverative errors, was below percentile 50. Participants with scores below this percentile on most of the scales were classified as 'low performance', whereas participants with scores above the median were classified as 'high performance'.

In order to address the second objective—i.e., assessing the differences between IPVAW offenders' typologies based on their neuropsychological performance—a 3×2 factorial design was used for the current study: IPVAW offender typologies (i.e., FO, BD, and GVA) × neuropsychological performance (i.e., high and low performance). To assess the effect of offenders' typologies and their neuropsychological performance on the continuous dependent variables (i.e., intervention dose and risk of recidivism), one-way ANOVA and ANCOVA were used, including potential confounding variables as covariates. Likewise, to evaluate the main effect of these variables on the dichotomous dependent variables (i.e., official recidivism and dropout), a logistic regression was carried out. Bonferroni post-hoc analyses and chi-squared tests were conducted to inspect the interactions between IPVAW offenders' typologies and neuropsychological performance. To reduce the risk of obtaining false positives on the post hoc tests, we

applied Bonferroni correction for multiple comparisons, setting the significance level at .001, and we reported the effect size of these comparisons.

Data analyses were carried out using IBM SPSS Statistics for Windows, Version 26.0 (Armonk, NY, USA). P values < 0.05 were considered statistically significant.

Results

IPVAW offenders' typologies: Hierarchical cluster analysis

Following the Holtzworth-Munroe categorization of IPVAW offenders, the final sample was divided into three groups according to their scores on three subscales of the Millon Clinical Multiaxial Inventory-III (antisocial, borderline, and dependent), the average score on the Conflict Tactics Scale-2 for physical violence, and item 2 (i.e. Past assault of strangers or acquaintances) from the Spousal Assault Risk Assessment Guide for generalized violence (see Carbajosa et al., 2017 for a similar procedure; detailed scores for each group are shown in Supplementary table 1). These statistical analyses resulted in three typologies: antisocial or generally violent (GVA, $n = 108$), borderline (BD, $n = 154$), and family only (FO, $n = 162$).

There were group differences in age [$F(2, 423) = 5.19, p = .006, \eta_p^2 = .02$], educational level ($X^2(2) = 15.41, p = .017, V_{\text{Cramer}} = 0.27$), and employment status ($X^2(2) = 10.22, p = .037, V_{\text{Cramer}} = 0.22$), with the FO group being older ($t(243) = 3.16, p = .002, d = .39$) and presenting a higher educational level than the GVA group ($X^2(1) = 9.28, p = .026, V_{\text{Cramer}} = 0.18$). Moreover, the majority of FO were employed, unlike the GVA ($X^2(1) = 7.01, p = .008, V_{\text{Cramer}} = 0.16$). There were no differences in the remaining sociodemographic variables. For self-reported questionnaires, a significant 'group' effect was found for drug use [$F(2, 423) = 141.72, p < .001, \eta_p^2 = .40$], alcohol use [$F(2, 423) = 23.20, p < .001, \eta_p^2 = .10$], trait anger [$F(2, 423) = 44.40, p < .001, \eta_p^2 = .18$], and impulsivity [$F(2, 423) = 29.55, p = .006, \eta_p^2 = .12$], with the FO group

presenting lower drug use ($t(268) = -15.44, p < .001, d = 1.93$), alcohol use ($t(145.86) = -5.92, p < .001, d = .78$), and trait anger scores ($t(140.22) = -7.75, p < .001, d = 1.03$) than the GVA group. FO participants also presented lower self-reported impulsivity than GVA ($t(268) = -7.03, p < .001, d = .88$) and BD ($t(314) = -5.96, p < .001, d = .67$) participants (see supplementary table 2). Therefore, these variables were included as covariates in later analyses.

Typologies' neuropsychological performance

Initially, we checked differences across IPVAW offender typologies on the neuropsychological variables. A number of differences were observed that approached significance on the cognitive flexibility measure (WCST), specifically the correct trials [$F(2, 423) = 2.25, p = .050, \eta_p^2 = .01$], total errors [$F(2, 423) = 3.47, p = .032, \eta_p^2 = .02$], perseverative errors [$F(2, 423) = 3.78, p = .024, \eta_p^2 = .02$], and completed categories [$F(2, 423) = 11.66, p < .001, \eta_p^2 = .06$]. Post hoc analysis revealed that FO had more correct trials than GVA ($t(268) = 3.64, p < .001, d = .42$). Moreover, FO had fewer total errors ($t(268) = -2.73, p = .007, d = .35$, and $t(304.98) = -2.63, p = .009, d = .30$, respectively) and perseverative errors ($t(244.74) = -3.45, p = .001, d = .42$, and $t = -2.67, p = .009, d = .31$, respectively) and more completed categories ($t(303.94) = 4.88, p < .001, d = .71$ and $t(274.47) = 2.08, p = .038, d = .26$, respectively) than GVA and BD. After including covariates, differences between groups still reached significance (see supplementary table 3).

Regarding emotion decoding (eyes test), a significant group effect was found [$F(2, 423) = 11.84, p < .001, \eta_p^2 = .05$], with FO performing better on detecting correct responses than GVA and BD ($t(136.55) = 3.74, p < .001, d = .49$, and $t(258.05) = 4.72, p < .001, d = .54$, respectively) (see Supplementary table 3). After including covariates, differences between groups still reached significance.

Correlations between the WCST variables and the eyes test are provided in Supplementary Table 4, whereas relationships between the WCST variables and the Eyes Test and dependent variables (i.e., dropout, intervention dose, risk of recidivism, and official recidivism) are provided in Supplementary Table 5.

Differences between IPVAW offenders' typologies based on their neuropsychological performance

Continuous variables outcomes: risk of recidivism and intervention dose (figures 1 and 2)

To examine the main effects of IPVAW offender typologies and neuropsychological performance on the continuous variables (i.e., intervention dose and risk of recidivism), one-way ANOVA and ANCOVA were carried out. Significant differences were found between offenders' typologies for intervention dose [$F(2, 423) = 12.38, p < .001, \eta_p^2 = .06$], and the risk of recidivism [$F(2, 423) = 52.64, p < .001, \eta_p^2 = .21$], with GVA receiving a lower intervention dose ($t(209.69) = -2.73, p = .007, d = .35$, and $t(178.23) = -4.82, p < .001, d = .62$, respectively) and presenting a higher risk of recidivism than BD and FO ($t(268) = 5.03, p < .001, d = .67$, and $t(155.96) = 10.10, p < .001, d = 1.36$, respectively). Significant differences were only found between BD and FO in the risk of recidivism ($t(270.41) = 5.35, p < .001, d = .62$), with a greater risk of recidivism in the BD group than in the FO group (see Table 1).

Insert Table 1

With regard to 'neuropsychological performance', significant group differences were found for intervention dose ($t(285.64) = -3.67, p < .001, d = .38$). IPVAW offenders with low neuropsychological performance showed lower intervention dose, than those with high neuropsychological performance. After including covariates and

typologies, differences between groups still reached significance for intervention dose [$F(1, 423) = 11.54, p = .001, \eta_p^2 = .03$].

We also found a significant interaction between offenders' typologies and neuropsychological performance on the intervention dose [$F(2, 423) = 6.57, p < .001, \eta_p^2 = .06$] and the risk of recidivism [$F(5, 423) = 21.22, p < .001, \eta_p^2 = .18$] (see Figure 1). Post hoc analysis revealed that GVA offenders with low functioning received fewer intervention sessions than GVA participants with high functioning ($t(75.98) = -3.96, p < .001, d = .79$). GVA offenders with low functioning presented higher total risk scores, on average, and received a lower intervention dose than BD with low functioning ($t(113) = 4.13, p < .001, d = .86$, and $t(88.16) = -3.70, p < .001, d = .72$, respectively) and BD with high functioning ($t(81.78) = -3.86, p < .001, d = .71$ for risk of recidivism, and $t(137) = 4.38, p < .001, d = .86$ for intervention dose). Similarly, GVA offenders showed a greater risk of recidivism and attended fewer intervention sessions than FO offenders with high ($t(82.44) = 6.79, p < .001, d = 1.41$, and $t(59.87) = 9.26, p < .001, d = 1.81$, respectively) and low functioning ($t(92.54) = -3.61, p < .001, d = .71$, and $t(59.18) = -6.14, p < .001, d = 1.18$, respectively). No differences were found between BD and FO offenders with low and high functioning. Regarding the BD and FO comparisons, significant differences were only found for total risk of recidivism between FO with high functioning and BD with high functioning ($t(150.29) = 5.12, p < .001, d = .76$), and BD with low functioning ($t(92.42) = 3.99, p < .001, d = .67$). After including covariates, typologies and neuropsychological performance, differences between groups still reached significance for intervention dose and risk of recidivism.

Insert Figure 1

Dichotomous variables outcomes: official recidivism and dropout (figures 3 and 4)

A logistic regression was conducted to assess the main effects of offenders' typologies and neuropsychological functioning on the dichotomous variables (i.e., official recidivism and dropout) (see Table 1). We found significant differences in dropout between offender typologies ($Wald(1) = 4.75, SE = .14, p = .029; \text{Exp}(b) = 0.73; 95\% \text{ CI} = 0.55 \text{ to } 0.94$). GVA presented more dropout than FO ($X^2(1) = 11.32, p = .001, V_{\text{Cramer}} = .20$, respectively). After including covariates, differences did not reach significance for dropout ($Wald(1) = 1.19, SE = .17, p = .275; \text{Exp}(b) = 0.83; 95\% \text{ CI} = 0.59 \text{ to } 1.16$).

We also found a significant main effect of neuropsychological performance on official recidivism ($Wald(1) = 7.77, SE = .29, p = .005; \text{Exp}(b) = 0.45; 95\% \text{ CI} = 0.26 \text{ to } 0.79$) and dropout ($Wald(1) = 10.51, SE = .25, p = .001; \text{Exp}(b) = 0.45; 95\% \text{ CI} = 0.28 \text{ to } 0.73$). IPVAW offenders with low neuropsychological performance showed higher dropout and official recidivism than those with high neuropsychological performance. After including covariates and typologies, differences between groups still reached significance for official recidivism ($Wald(1) = 4.95, SE = .31, p = .026; \text{Exp}(b) = 0.50; 95\% \text{ CI} = 0.28 \text{ to } 0.92$) and dropout ($Wald(1) = 10.81, SE = .26, p = .001; \text{Exp}(b) = 0.42; 95\% \text{ CI} = 0.25 \text{ to } 0.70$).

Insert Table 2

Finally, we examined the interaction between the offenders' typologies and neuropsychological performance. Differences were found in official recidivism ($Wald(1) = 10.64, SE = .09, p = .001; \text{Exp}(b) = 0.74; 95\% \text{ CI} = 0.61 \text{ to } 0.88$) and dropout ($Wald(1) = 13.68, SE = .08, p < .001; \text{Exp}(b) = 0.75; 95\% \text{ CI} = 0.64 \text{ to } 0.87$). In particular, GVA offenders with low functioning presented higher official recidivism and dropped out of the intervention more than FO with high functioning ($X^2(1) = 9.08, p < .001, V_{\text{Cramer}} = .29$, and $X^2(1) = 28.61, p < .001, V_{\text{Cramer}} = .41$, respectively). We also

found that GVA participants with low functioning dropped out of the intervention more than GVA participants with high functioning ($X^2(1) = 13.61, p < .001, V_{\text{Cramer}} = .35$) (see Figure 1). After including covariates and typologies, differences between groups still reached significance for official recidivism ($Wald(1) = 5.07, SE = .10, p = .024$; $\text{Exp}(b) = 0.79$; 95% CI = 0.64 to 0.97) and dropout ($Wald(1) = 9.27, SE = .09, p = .002$; $\text{Exp}(b) = 0.77$; 95% CI = 0.65 to 0.91).

Discussion

The principal aim of our study was twofold: 1) to find out whether there are neuropsychological differences between the typologies of IPVAV offenders and, more importantly, 2) whether there are differences in treatment compliance (i.e., dropout and intervention dose) and recidivism (i.e., risk of recidivism and official recidivism) based on the typologies and their neuropsychological performance. Our results indicate that the FO offenders showed the best cognitive performance (cognitive flexibility and emotion decoding abilities), followed by the BD group, and the GVA group had the worst performance. However, no differences in neuropsychological variables were found between BD and GVA. Differences between groups presented an acceptable effect size.

Regarding the first aim of this study, our results showed that the groups differed on cognitive flexibility (assessed with the WCST) and emotion decoding abilities (the eyes test). Specifically, we found that the FO group presented better performance than the other two groups, and these differences were slightly larger in comparison with the GVA group. These results are congruent with previous studies in this field of research (Romero-Martínez et al., 2019a; 2019b). Nevertheless, it should be noted that, although the performance of GVA and BD was worse than that of FO, we cannot confirm that these results can be defined as a “deficit”. This diagnosis would mean that their

performance was 1.5-2 standard deviations below the score of the comparison group, which is considered a valid and commonly used criterion to detect neuropsychological deficits (Lezak et al., 2012; Muñoz-Marrón et al., 2011). Regarding personality traits, participants did not reach the cut-off score of 85 (Cardenal, & Sanchez, 2007; Millon, 1994). Therefore, they cannot be diagnosed with antisocial, borderline, and/or dependent personality disorders. However, the categorization of IPVAW offenders might offer psychologists an orientation for conducting future in-depth interviews to diagnose offenders using other markers and/or specialized instruments.

Regarding the second aim of this study, after dividing the IPVAW offenders' typologies based on their neuropsychological performance, important differences were found between groups. In fact, FO with high cognitive functioning presented the highest rates of treatment compliance and the lowest rate of recidivism, whereas GVA with poor cognitive functioning presented the lowest rates of treatment compliance and the highest rates of recidivism. In this regard, the group with low cognitive functioning, particularly the GVA, showed marked differences from the rest of the groups, and these differences were greater when compared to the FO group with high functioning.

We have clearly shown that GVA IPVAW offenders with the worst neuropsychological performance presented the lowest rates of treatment compliance and the highest rates of recidivism. This might be explained by the fact that these individuals with low cognitive functioning not only have serious difficulties in dealing with the content of the cognitive behavioral therapy (e.g. changing cognitive distortions, improving emotional regulation...), but also in recognizing the cognitive schemas they should change. This seems logical if we consider that low cognitive functioning might interfere with treatment adherence because these individuals could be overwhelmed by the content of the therapy. Furthermore, it should be highlighted that GVA with low

cognitive functioning also presented higher levels of drug misuse, trait anger, and impulsivity than FO. These factors are clearly involved in the risk of dropout in the initial stages of the intervention and in the future risk of recidivism in IPVAW offenders, which is the reason they are targets for intervention (Capaldi et al., 2012; Lila et al., 2019; Romero-Martínez et al., 2019). Nonetheless, little attention has been paid to designing specific neuropsychological rehabilitation programs to improve neuropsychological deficits. Because these deficits clearly interfere with behavioral regulation (Romero-Martínez & Moya-Albiol, 2013), it makes sense to develop coadjutant programs to reinforce the success of current interventions for IPVAW offenders. In any case, our study identifies the need to design cognitive training coadjutant to cognitive behavioral therapy or other types of interventions for individuals with low cognitive functioning, to manage treatment compliance and recidivism. Furthermore, it is also important to reinforce current treatments by focusing on individual needs of IPVAW offenders, such as alcohol and drug misuse, anger management, impulsivity, and/or personality disorders.

Regarding neuropsychological training programs, to enhance cognitive flexibility and emotion decoding abilities, computerized tasks, pen and pencil tasks, or a combination could be used in intensive programs parallel to the main therapeutic intervention. Obviously, treatments can be combined based on patients' needs. Because cognitive flexibility is sustained by several cognitive processes, such as attention-switching, working memory, and processing speed, the neuropsychological intervention may focus directly on cognitive flexibility or on the basic cognitive processes that support it. If we decide to intervene directly in cognitive flexibility, it would be appropriate to develop problem-solving tasks (e.g. offering and proposing alternatives to solve these problems), generate sequences of activities based on

contextual demands, propose moral dilemmas and debate topics, and offer insight and feedback about their opinions, etc. However, if our goal is to treat basic cognitive processes (e.g. attention, working memory, and speed processing), it would be appropriate to employ other tasks, such as performing digit exercises (in direct and indirect order), analyzing main topics in newspapers, and including computerized go/no-go tasks, among others.

To improve emotion decoding abilities, it would be appropriate to work with visual stimuli (e.g. videos or pictures). For example, short films could be selected to examine the emotional expressions of the main characters; magazine images could be used that show several characters interacting; and role play could be employed to assess various daily situations, etc. Finally, it is also necessary to keep in mind that emotion decoding abilities are important for perspective taking (Romero-Martínez et al., 2016). Furthermore, these impairments have been closely related to alexithymia symptoms in IPVAW offenders (Romero-Martínez et al., 2019b). Thus, these tasks could be combined with other more complex tasks to improve empathic abilities.

Finally, before implementing neuropsychological training, we think it is necessary to standardize a battery of neuropsychological tests for IPVAW offenders, considering not only cognitive skills, but also emotional abilities. This would make it possible to screen for neuropsychological therapeutic needs of IPVAW offenders. In fact, this battery should be administered during the initial stages of the intervention to design later neuropsychological training programs. This extensive battery of neuropsychological tests should be adapted to the characteristics of the main therapeutic treatment to avoid saturation in patients. Accordingly, after considering the characteristics of the principal therapy, it would be necessary to plan the schedule, the

number of intervention sessions, and the content of the sessions of the coadjutant neuropsychological treatment.

Limitations

Despite the promising conclusions of this study, there are several limitations that reduce the external validity of our results. First, the study design limited the causality of the associations between the variables. Thus, it would be necessary to replicate the results in future studies with a more controlled study (e.g. randomized control studies) and a larger sample size. Furthermore, it is also important to highlight the potential limitation inherent in Bonferroni correction. Moreover, it is also necessary to demonstrate the temporal stability of the IPVAV offender typologies. Second, it would be important to consider a larger number of neuropsychological tests to demonstrate whether IPVAV offender typologies clearly differ in their cognitive profiles. Furthermore, the eyes test showed poor internal consistency, although our data are congruent with the internal consistency presented in a systematic review (Oakley et al., 2016). It is important to keep in mind that this low internal consistency reduces the value of the eyes test as a criterion for dividing groups. Finally, the majority of the variables included in this study were based on self-reports, and so it would be necessary to complete our data with objective (i.e., cognitive tests, laboratory tasks, neuroimaging techniques) and qualitative measurements (behavioral control during therapy, personality, and emotional assessment) of two variables that seem to be keys to the success of interventions, alexithymia and impulsivity (Romero-Martínez et al., 2019a; 2019b), in future research. These neuroscientific measures might also reinforce the results obtained with self-reports. Moreover, future studies should incorporate the malingering test to reinforce neuropsychological test results. Finally, future studies

should control for respondents' general intelligence level because it could partly explain differences in neuropsychological performance between groups.

Clinical Implications

In conclusion, our data reinforce the cross-cultural value of the Holtzworth-Munroe categorization of IPVAW offenders, as well as the importance of considering neuropsychological differences between the three typologies. Moreover, we highlight the need to develop coadjutant cognitive training programs for these dysfunctions, which clearly interfere with current adherence to intervention programs for IPVAW offenders. In addition, other alternatives such as pharmacological strategies and non-invasive brain techniques could increase the success of current interventions because they make it possible to increase the success of psychological interventions (Romero-Martínez et al., 2019c). Therefore, studies that consider all these variables will allow us to build a biopsychosocial model of treatment compliance and recidivism.

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