

COMORBID DEPRESSION AND SUICIDE IDEATION IN PATIENTS WITH COMBAT-RELATED PTSD: THE ROLE OF TEMPERAMENT, CHARACTER, AND TRAIT IMPULSIVITY

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SUMMARY

Background: War veterans with PTSD have a high chance of developing major depressive disorder (MDD) at some point, while they can also exhibit increased suicidal tendencies. The primary goal of this research was to investigate whether personality dimensions, including temperament, character, and trait impulsivity, were associated with comorbid MDD, as well as with suicidal ideation in psychiatric patients suffering from combat-related PTSD.

Subjects and methods: The sample consisted of 148 Croatian male war veterans (mean age 49.53 years) treated for PTSD at the National Center for Psychotrauma, Department of Psychiatry, University Hospital Center Zagreb. Fifty-one (34%) of them met ICD-10 diagnostic criteria for current or lifetime MDD, while 97 (66%) were diagnosed with PTSD alone. All the participants were assessed with the M.I.N.I. diagnostic interview and they completed the following battery of self-report instruments: the Beck Depression Inventory-Second Edition (BDI-II), the Suicidal Behaviors Questionnaire-Revised (SBQ-R), the Temperament and Character Inventory-Revised (TCI-R), and the Barratt Impulsiveness Scale-11 (BIS-11).

Results: Comparisons between the two clinical groups showed that PTSD+MDD patients were more suicidal and differed with regard to temperament dimensions Harm Avoidance, Reward Dependence and Persistence, character dimension Self-Directedness, and trait impulsivity. In three multivariate regression analyses, it was revealed that character dimension Cooperativeness as well as trait impulsivity were unique predictors of suicidal ideation, while controlling for the influence of sociodemographics, length of treatment and comorbid depression.

Conclusions: Combat-related PTSD patients with comorbid depression exhibit increased suicide thoughts and different personality profiles in comparison with those suffering from PTSD alone. Character dimension Cooperativeness and trait impulsivity seem to be uniquely predictive of suicide ideation in this population. Elucidation of individual psychological factors that increase the risk of MDD and suicidal tendencies in war veterans with PTSD may facilitate more effective prevention and treatment methods.

Key words: PTSD – comorbid depression – temperament – personality – impulsivity – suicide – war veterans

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INTRODUCTION

Experiencing severe combat related stress and trauma during the war period may lead to posttraumatic stress disorder (PTSD). Previous research has suggested a wide range between 5% and 20% prevalence rates of PTSD in various military populations (Kok et al. 2012, Hines et al. 2014), with most studies converging on approximately 15% in US military personnel (Gates et al. 2012). For example, after the Homeland War in Croatia, the number of persons diagnosed with war-related PTSD was 32,000, with some studies reporting around 18% prevalence of PTSD among individuals affected by the Croatian war (Priebe et al. 2010), and up to 33% among ex-Yugoslavia war refugees (Bogic et al. 2012). In addition to the primary symptoms of PTSD, many persons with PTSD also suffer co-occurring addictions, anxiety disorders, personality disorders, and other mental health illnesses (McDevitt-Murphy et al. 2010, Goldstein et al. 2016). Major depressive disorder (MDD) is probably the most common comorbid condition, with almost half of war veterans with PTSD

also having a diagnosis of MDD, based on a recent meta-analytic study (Rytwinski et al. 2013). Moreover, some experts believe the comorbidity between PTSD and MDD represents a distinct phenotype, possibly even a subtype of PTSD (see Shah et al. 2012, Flory & Yehuda 2015), and there are suggestions of specific names for this possibly separate psychobiological condition – ‘posttraumatic mood disorder’ (PTMD) (Sher 2005, 2009). This perspective is somewhat supported by the growing empirical evidence that patients suffering from comorbid PTSD and MDD differ clinically and biologically from those suffering from PTSD or MDD alone, such as having greater severity of symptoms, higher social and occupational impairment, and more pronounced neurocognitive deficits (see Flory & Yehuda 2015). A recent 4-year longitudinal study has found a particular combination of personality dimensions assessed at baseline, namely high Neuroticism and low Extraversion from the Big Five personality perspective, to be predictive of the subsequent development of comorbid PTSD and MDD, whereas they were not associated with new-onset cases of either disorder by

itself (Spinhoven et al. 2014). Although such preliminary evidence points to unique individual vulnerabilities to developing comorbid PTSD and MDD, more research into potential psychobiological markers, such as one's temperamental and characterological traits, is highly warranted.

In addition to developing other psychiatric disorders, such as MDD, veterans who screen positive for PTSD are four times as likely to report suicidal ideation as their peers without PTSD (Jakupcak et al. 2009). If a veteran experienced a co-occurring disorder in addition to PTSD (e.g., depression), their risk increased to 5.7 times more likely than non-PTSD peers (Jakupcak et al. 2009). Rates of lifetime and/or current suicidal ideation previously found in military personnel with PTSD were 33-46% (Guerra et al. 2011). This is especially troublesome as suicidal ideation is generally the strongest predictor of suicide attempts (Mann et al. 2008). Pompili et al. (2013) recently conducted a systematic review of 80 empirical studies and concluded that having a history of PTSD diagnosis is linked to significant morbidity and mortality, including increased risk for suicidal ideation, attempts, and completed suicides in war veterans. Moreover, these relations remain after adjusting for psychiatric comorbidity (e.g., MDD) (Ramsawh et al. 2014). In the case of Croatian Homeland war that ended in 1995, it is important to remember that symptoms of PTSD and higher risk for suicide among war veterans may persist for and occur many years after their deployment (Price et al. 2004, Lončar et al. 2014).

Current literature describes a broad range of predisposing factors for increased suicide risk among active and retired military personnel, e.g. genetic vulnerabilities, traumatic childhood experiences, levels of combat exposure, physical injury, post-deployment social support, and psychiatric comorbidity (see Jakovljevic et al. 2012a, Pompili et al. 2013). One of the potential predisposing/protective factors for the development and expression of PTSD, as well as for general suicidal tendencies, lies in one's personality profile (Brezo et al. 2006, Flood et al. 2010). Here, the Cloninger's psychobiological model of personality (Cloninger et al. 1993), comprised of 4 temperament (Novelty Seeking, Harm Avoidance, Reward Dependence, Persistence) and 3 character (Self-Directedness, Cooperativeness, Self-Transcendence) dimensions, is especially relevant because of its substantial genetic and neurobiological underpinnings implicated in suicide phenomena. In addition, trait impulsivity has been proposed as a stable marker for suicide risk due to its link with serotonin dysfunction (Courtet et al. 2011). Various researchers have demonstrated the roles of personality dimensions, particularly harm avoidance/neuroticism, extraversion, and impulsivity, in suicidal ideation and behaviors (Brezo et al. 2006, Courtet et al. 2011, Perroud et al. 2013). Unfortunately, very few of these studies were conducted with war veterans

suffering from PTSD. For example, Soltaninejad et al. (2014) have examined specific personality traits among Iranian military personnel, showing that neuroticism increases suicide risk, whereas extraversion and conscientiousness were linked to a reduced risk of suicide. Similarly, Na et al. (2013) suggested an association between character dimension Cooperativeness and suicide attempts in a sample of Korean male soldiers, but these participants were neither screened for nor diagnosed with PTSD. Our previous work with Croatian war veterans (Jakšić et al. 2015a) has linked temperament trait Harm Avoidance and, to a lesser degree, character trait Self-Directedness with the elevated suicide risk. However, this preliminary study was conducted on a small sample without controlling for the influence of comorbid depression and without the use of psychiatric diagnostic interviews. More research with military populations is needed to uncover specific personality dimensions, given their role as potential endophenotypes in suicide ideation and behaviors (see Courtet et al. 2011), that could be used in the early identification of increased suicide risk in these vulnerable individuals.

Based on the abovementioned gaps in the current literature on PTSD, comorbid depression and suicide risk, the main aims of this study were: 1) to assess specific personality dimensions (temperament and character dimensions and trait impulsivity), that might differentiate between isolated PTSD and PTSD with current or lifetime comorbid depression (i.e., post-traumatic mood disorder); and 2) to investigate the independent relations of personality dimensions and comorbid depression with increased suicide ideation in Croatian war veterans suffering from PTSD.

SUBJECTS AND METHODS

Subjects

We have recruited 148 Caucasian male adults being treated as psychiatric outpatients at the National Center for Psychotrauma, Department of Psychiatry, University Hospital Center Zagreb. These patients were war veterans who actively participated in the Croatian Homeland War (1991-1995) and were all suffering from combat-related PTSD. The study data were gathered during 2014 and 2015. For the research purposes, these patients were approached by their psychiatrist or clinical psychologist, and those who were willing to take part in this study were assessed via a diagnostic interview. In addition, they filled out a battery of self-report measures, while waiting for their appointments, after the appointments had ended, or at home. While 20 patients refused to participate, no differences in age and education level between these patients and those taking part in this study were observed.

The formal ICD-10 (WHO 1992) diagnosis of PTSD (F43.1) was determined with a structured clinical

interview - Mini International Neuropsychiatric Interview, Version 5.0.0 (M.I.N.I.; Sheehan et al. 1998) by the attending psychiatrist or clinical psychologist. Comorbid psychiatric diagnoses were also determined using the M.I.N.I., with 51 (34%) of the PTSD patients also meeting diagnostic criteria for current major depressive disorder (MDD) or having a lifetime diagnosis of MDD based on their medical records and thorough unstructured clinical interviews. Those suffering from an established neurological or organic mental disorder, substance or alcohol abuse, acute psychotic disorder and/or schizophrenia, and those with low comprehension skills were not included in this study. We also excluded war veterans who had a history of psychiatric treatment prior to the Croatian Domestic War. The research protocol was thoroughly explained to the patients, after which their written informed consent was obtained. This empirical study was officially approved by the Ethics Committee of the University Hospital Center Zagreb.

The mean age of the sample was 49.53 years ($SD=6.951$ years), while the range was between 36 and 64 years. Regarding their educational status, 16 (11%) participants had completed elementary school, 109 (73%) had completed high-school and 23 (16%) held a university degree. The sample comprised 110 (74.3%) married participants, 18 (12.2%) single participants, 17 (11.5%) divorced participants, and 1 (0.7%) widowed participant. The average length of psychiatric treatment was 6.41 years ($SD=6.701$ years), ranging between 0 and 20 years. The average number of psychiatric hospitalizations (in any of the Croatian mental health institutions) was 1.11 ($SD=1.316$), while the lowest and highest number of hospitalizations were 0 and 5, respectively.

Instruments

The Mini International Neuropsychiatric Interview, Version 5.0.0 (M.I.N.I.; Sheehan et al. 1998) is a short structured diagnostic interview, used for establishing the diagnosis of posttraumatic stress disorder (PTSD) and major depressive disorder (MDD) according to the ICD-10 diagnostic criteria.

The Beck Depression Inventory-Second Edition (BDI-II; Beck et al. 1996) is a self-report measure used for the examination of the severity of depressive symptoms. It contains 21 items in the form of statements that describe these symptoms. For each item, respondents are offered 4 statements and are asked to select the statement that best describes their mood in the last 2 weeks. It is measured on a 4-point scale, with higher scores indicating greater severity of depressive symptoms and a maximum possible score of 63. The BDI - II has been previously translated and validated in a Croatian clinical sample (Jakšić et al. 2014). In the present study, Cronbach's alpha coefficient was 0.94.

The Suicidal Behaviors Questionnaire-Revised (SBQ-R) (Osman et al. 2001) is a self-report measure of

4 different dimension of suicidality: lifetime suicidality, suicidal ideation over the past 12 months, verbalized threat of suicide attempt, and self-reported likelihood of future suicidal behavior. The four items can be summed into a *total suicidal risk* score that ranges from 3 to 18. For the purposes of this research, we used the item assessing suicidal ideation over the past 12 months on a 5-point scale (i.e., 1=never, 2=rarely, 3=sometimes, 4=often, and 5=very often). In this study, Cronbach's alpha coefficient for the entire scale was 0.83.

The Temperament and Character Inventory-Revised (TCI-R) (Cloninger 1999) is a self-report instrument that assesses 4 temperament (Novelty seeking (NS), Harm Avoidance (HA), Reward Dependence (RD), and Persistence (PS)) and 3 character dimensions (Self-Directedness (SD), Cooperativeness (CO), and Self-Transcendence (ST)) within the Cloninger's Psychobiological Model of Personality (Cloninger et al. 1993). It comprises 240 items rated on a 5-point Likert scale, ranging from 1 (*definitely false*) to 5 (*definitely true*). The Croatian adaptation of the TCI-R yielded adequate psychometric properties (internal consistencies, factorial and concurrent validity) in a large sample of psychiatric outpatients (Jaksic et al. 2015b). In the present study, Cronbach's alpha coefficients for the seven subscales ranged from 0.71 to 0.89.

The Barratt Impulsiveness Scale-11 (BIS-11; Patton et al. 1995) is a self-report instrument developed to assess the personality/behavioral construct of impulsivity. It consists of 30 items that are scored on a 4-point scale from 1 (*rarely/never*) to 4 (*almost always/always*). The questionnaire contains three subscales (Attentional Impulsiveness, Motor Impulsiveness, and Nonplanning Impulsiveness) that can be summed into a *global impulsiveness score*. It is the most widely cited instrument for the assessment of impulsivity in the last 50 years (see Stanford et al. 2009). In the present study, Cronbach's alpha coefficient was 0.82.

Statistical Analysis

We ran all the statistical analyses in the SPSS version 19 (SPSS, Chicago, IL). Descriptive statistics contained percentages, means (M) and standard deviations (SD). Internal reliabilities of the self-report measures were described by Cronbach's alpha coefficients. Independent samples t-test and chi-square test were used to examine the potential differences in sociodemographic and clinical variables, as well as personality dimensions between patients with isolated PTSD (PTSD group) and those with PTSD and current/lifetime MDD (PTSD + MDD group). The Bonferroni's adjustment was performed for multiple comparisons conducted with the t-test. Pearson correlations were computed to examine the zero-order relationship among the investigated variables. Finally, three multivariate regression analyses were performed to examine whether temperament dimensions, character dimensions, and trait impulsivity were

independent predictors of suicidal ideation. In order to control for the influence of age, education level, length of psychiatric treatment, and comorbid depression, these variables were entered in the same block together with the personality factors. The initial level of statistical significance was set at $P < 0.05$.

RESULTS

In the overall sample, the mean value of depressive symptoms (i.e., BDI-2 total score, theoretical range 0-63) was 23.98 (SD=14.193), and the mean score of suicidal ideation (i.e., SBQ-R item 2, theoretical range 1-5) was 2.01 (SD=1.209). The distribution of individual responses on the suicidal ideation scale was the following: 1/never (69; 47%), 2/rarely (36; 25%), 3/sometimes (22; 15%), 4/often (10; 7%), and 5/very often (9; 6%).

Means and standard deviations of temperament and character scales were: NS 95.69 (13.698); HA 114.91 (23.252); RD 95.14 (16.693); PS 106.12 (26.009) SD 129.74 (20.580); C 128.0 (18.788); ST 73.65 (16.025). The average score on the measure of trait impulsivity (i.e., BIS-11 total score, theoretical range 30-120) was 66.84 (SD=10.541).

Table 1 presents the comparisons between the PTSD and PTSD+MDD groups of patients, with regard to the investigated sociodemographic, clinical, and personality factors. The level of statistical significance was appropriately reduced based on the Bonferroni's correction

for multiple comparisons. We can see that none of the sociodemographic and treatment utilization variables differ between the two patient groups. The PTSD+MDD patients exhibited significantly higher scores on the self-report measures of depressive symptoms and suicidal ideation. Within the psychobiological model of personality, the PTSD+MDD group had more pronounced temperament dimension Harm Avoidance, whereas less pronounced temperament dimensions Reward Dependence and Persistence, and character dimension Self-Directedness. Trait impulsivity was significantly higher among the PTSD+MDD group in comparison to PTSD alone.

In Table 2 we presented the zero-order correlations between personality traits (temperament and character dimensions, and trait impulsivity) and sociodemographic and clinical variables. Here, the examined relations revealed that temperament trait Harm Avoidance, character traits Self-Directedness and Cooperativeness, and trait impulsivity had significant moderate-size correlations with suicidal ideation. Additionally, these traits, as well as Reward Dependence and Persistence, exhibited moderate or high correlations with the severity of depressive symptoms.

Finally, we assessed whether personality dimensions were predictors of self-reported suicidal ideation. Three multivariate regression analyses with suicidal ideation as a dependent variable and temperament dimensions, character dimensions, and trait impulsivity, respectively, as predictor variables, were performed. Age, education level, length of treatment, and comorbid depression were controlled for (Table 3). The first regression analysis

Table 1. Comparisons between the PTSD and PTSD+MDD groups in the investigated sociodemographic, clinical, and psychological variables

	Mean (SD)		t-test/ χ^2 test	P
	PTSD (n=97)	PTSD + MDD (n=51)		
Age (years)	47.88 (7.273)	49.90 (6.252)	-1.676	0.096
Education level	-	-	1.224	0.251
Length of treatment (months)	71.22 (81.556)	89.85 (78.501)	-1.290	0.199
Psychiatric hospitalizations	1.06 (1.368)	0.88 (1.248)	0.762	0.447
BDI-2 total score	15.52 (8.033)	39.74 (8.570)	-16.968	<i>0.000</i>
SBQ-R suicidal ideation	1.71 (1.030)	2.55 (1.331)	-4.250	<i>0.000</i>
Temperament dimensions				
Novelty Seeking	96.12 (13.410)	94.00 (13.803)	0.894	0.373
Harm Avoidance	105.14 (19.345)	132.20 (18.994)	-8.057	<i>0.000</i>
Reward Dependence	97.99 (15.673)	89.64 (17.674)	2.916	<i>0.004</i>
Persistence	114.44 (19.586)	91.84 (29.631)	5.501	<i>0.000</i>
Character dimensions				
Self-Directedness	137.34 (18.709)	115.70 (16.540)	6.882	<i>0.000</i>
Cooperativeness	131.25 (18.104)	122.46 (18.993)	2.733	0.007
Self-Transcendence	71.73 (15.664)	76.36 (16.048)	-1.679	0.095
Trait impulsivity	63.61 (10.11)	72.86 (8.556)	-5.555	<i>0.000</i>

BDI-2 = Beck Depression Inventory - 2nd Edition; SBQ-R suicidal ideation = Suicidal Behaviors Questionnaire-Revised; Bonferroni's adjustment for multiple comparisons reduced the significance level to $P=0.004$; Significant P values are highlighted in *italic*

Table 2. Pearson correlations between personality traits (temperament and character dimensions, trait impulsivity) and sociodemographic and clinical variables (N=148)

	NS	HA	RD	PS	SD	CO	ST	Impulsivity
Age	-0.27**	-0.12	-0.03	-0.03	0.20	0.01	-0.06	-0.09
Education level	0.08	-0.25**	0.23**	0.29**	0.29**	0.19*	-0.01	-0.20*
Length of treatment	0.06	0.19	-0.17	-0.05	-0.08	-0.15	0.09	0.19*
Psychiatric hospitalizations	0.08	0.09	-0.29**	-0.12	-0.01	-0.19*	0.09	0.06
BDI-2 total score	0.04	<i>0.68**</i>	<i>-0.33**</i>	<i>-0.51**</i>	<i>-0.61**</i>	<i>-0.35**</i>	0.19*	<i>0.58**</i>
SBQ-R suicidal ideation	0.08	<i>0.31**</i>	<i>-0.21*</i>	<i>-0.26**</i>	<i>-0.31**</i>	<i>-0.30**</i>	0.10	<i>0.41**</i>

NS= Novelty Seeking; HA= Harm Avoidance; RD= Reward Dependence; PS= Persistence; SD= Self-Directedness; CO= Cooperativeness; ST= Self-Transcendence; BDI-2= Beck Depression Inventory - 2nd Edition; SBQ-R= Suicidal Behaviors Questionnaire-Revised. Correlation coefficients ≥ 0.30 are highlighted *in italic*. * $p < 0.05$. ** $p < 0.01$.

Table 3. Three multivariate regression analyses in predicting suicide ideation with temperament dimensions (Regression 1), character dimensions (Regression 2), and trait impulsivity (Regression 3), each adjusted for age, education level, length of treatment and comorbid depression (N=148)

	R	Sig. F Change	Standardized Beta	t-test	P
Regression 1	0.375	<i>0.012</i>			
Age			-0.003	-0.037	0.971
Education level			-0.003	-0.029	0.977
Length of treatment			0.013	0.151	0.880
Comorbid depression			0.215	2.027	<i>0.044</i>
Novelty Seeking			0.059	0.673	0.502
Harm Avoidance			0.152	1.155	0.250
Reward Dependence			-0.107	-1.126	0.262
Persistence			0.005	0.040	0.968
Regression 2	0.416	<i>0.001</i>			
Age			0.016	0.186	0.853
Education level			0.007	0.079	0.937
Length of treatment			0.017	0.206	0.837
Comorbid depression			0.201	2.053	<i>0.042</i>
Self-Directedness			-0.129	-1.141	0.256
Cooperativeness			-0.194	-2.078	<i>0.040</i>
Self-Transcendence			0.082	0.973	0.333
Regression 3	0.463	<i>0.000</i>			
Age			0.006	0.073	0.942
Education level			-0.001	-0.017	0.986
Length of treatment			0.000	-0.005	0.996
Comorbid depression			0.179	1.998	<i>0.048</i>
Trait impulsivity			0.354	3.950	<i>0.000</i>

Significant P values are highlighted *in italic*

revealed a significant overall model, with comorbid depression as a significant predictor of suicidal ideation, whereas none of the temperament dimensions exhibited unique contribution to this prediction model. In the second regression analysis, in addition to comorbid depression, character dimension Cooperativeness was also a unique predictor of suicidal ideation. Lastly, the third regression analyses confirmed trait impulsivity, together with comorbid depression, to be significantly associated with suicidal ideation.

DISCUSSION

The primary goal of the current study was to investigate the role of personality dimensions, including temperament, character, and trait impulsivity, with regard to

the occurrence of major depressive disorder (MDD) as well as suicidal ideation in Croatian war veterans suffering from combat-related PTSD.

Thirty-four (34%) percent of PTSD patients in this study also had lifetime or current MDD, in line with other research showing high comorbidity between these two disorders, particularly among military and interpersonal trauma samples (see Rytwinski et al. 2013). Our findings have shown that none of the assessed sociodemographic (i.e., age, education level) and treatment utilization (i.e., length of treatment, number of psychiatric hospitalizations) variables differed between the two clinical groups – patients with PTSD and those with PTSD and comorbid MDD. However, the latter group was marked by higher levels of suicide ideation over the past 12 months, a finding consistent with

previous research in this population (see Sher et al. 2012). In addition, significant differences in personality dimensions, even after adjusting the statistical risk level due to multiple comparisons, were obtained. Within the framework of Cloninger's psychobiological model of personality, the PTSD+MDD group had more pronounced temperament dimension Harm Avoidance (HA), whereas temperament dimensions Reward Dependence (RD) and Persistence (P) and character dimension Self-Directedness (SD) were lower than in the group of PTSD patients with no comorbid MDD. This would suggest that war veterans who also develop MDD in addition to PTSD are temperamentally more fearful, pessimistic and prone to anxiety under frustrating conditions (i.e., high in HA), socially detached, aloof and critical (i.e., lower in RD), less persevering, apathetic and underachieving (i.e., lower in PS), as well as lacking in purpose, resourcefulness, mature responsibility and self-acceptance (i.e., lower in SD) (Cloninger 2003). To the best of our knowledge, this was the first study to directly compare these two groups of PTSD patients using the Cloninger's temperament and character dimensions. Nevertheless, Spinhoven et al. (2014) conducted a longitudinal study in a large and clinically heterogeneous adult sample within the Big Five personality perspective. Namely, high Neuroticism (a personality trait similar to HA) and low Extraversion were predictive of the subsequent development of comorbid PTSD and MDD, whereas they were not associated with new-onset cases of either disorder by itself. Additionally, several studies that used cluster analysis or latent class analysis to identify subtypes of PTSD based on personality inventories suggested three distinct personality-based subtypes: internalizing, externalizing and 'simple' PTSD (e.g., Flood et al. 2010, Wolf et al. 2012). Internalizers display problems in the areas of depression, anxiety, social avoidance, they exhibit features of schizoid personality disorder, and are defined by two broad personality dimensions - high negative emotionality/neuroticism and low positive emotionality/extraversion. Interestingly, low temperament trait RD and character trait SD, found to be less pronounced in the PTSD + MDD group of war veterans, are also characteristic of schizoid personality disorder from the perspective of the psychobiological model of personality (Svrakic & Cloninger 2012). Finally, we also found significantly higher levels of self-reported trait impulsivity in the PTSD+MDD group, a personality dimension more often associated with externalizing types of PTSD (i.e., antisocial behaviors, aggression, substance abuse). Overall, the findings obtained in our study add to the existing literature that suggests PTSD and depression comorbidity is often associated with greater levels of distress, symptomatology, social impairment, and occupational and global disability when compared with those who have been diagnosed with PTSD alone (see Sher 2009, Jakovljevic et al. 2012b, Flory & Yehuda 2015). Future research should

investigate whether personality dimensions are in part responsible for some of the negative aspects of PTSD and MDD comorbidity, such as greater social impairment and occupational disability, irrespective of the intensity of depressive symptoms.

Our study demonstrated moderate zero-order correlations of HA, SD, Cooperativeness (CO) and trait impulsivity with self-reported suicidal thoughts over the past 12 months in a sample of war veterans with PTSD. However, the two multivariate regression analyses showed that the effects of HA and SD were insignificant when all the temperament and character dimensions were examined simultaneously, while controlling for the influence of sociodemographic and clinical variables, including comorbid depression. In both these regressions, comorbid depression remained significantly associated with suicide ideation. Having in mind high correlations between HA, SD and depressive symptoms obtained in this study, it seems the role of these two personality dimensions in suicidal phenomena among PTSD patients is largely exerted through the effects of depressive pathology. This is in line with previous research suggesting strong relations between HA and SD and depression in various clinical samples (see Mochcovitch et al. 2012). Moreover, two large longitudinal studies carried out in samples of participants from the general population demonstrated that high HA and low SD represent a prospective risk for the occurrence of future dysphoric and depressive episodes (Josefsson et al. 2011, Rosenstrom et al. 2014). Although several studies in different psychiatric populations indicated a link between at least one of these two personality dimensions and increased suicide risk (e.g., Aukst Margetic et al. 2012, Pawlak et al. 2013), future researches are encouraged to control for the influence of depressive symptoms when examining unique contributions of temperament and character to suicide ideation.

Character dimension CO was found to be significantly and uniquely associated with war veterans' suicide ideation over the last 12 months, and this effect was independent of other character dimensions as well as comorbid depression. It is suggested that war veterans with PTSD who fail to see themselves as an integral part of society and are lacking in interpersonal connectedness, compassion and empathy (i.e., low in CO), are more prone to thoughts about ending their lives. This finding is in line with the results of another recent cross-sectional study with military personnel diagnosed with adjustment disorder, but not PTSD, where low CO increased the risk of previous suicide attempts (Na et al. 2013). On a related note, the Interpersonal-Psychological Theory of Suicide (Selby et al. 2010) describes the suicidal process as being characterized by subjective feelings and thoughts that one does not belong with other people, ideas that one presents a burden to others or society as a whole, and an acquired capability to overcome the fear of pain associated with suicide. Indeed, Bryan (2011) has showed that specific inter-

personal factors, such as perceived burdensomeness and thwarted desire to belong, are major factors in promoting suicidal behaviors in military personnel. Given that character dimension CO is not strongly inherited and biologically predetermined personality trait (unlike temperament dimensions such as HA) (Cloninger 2003), our findings imply that interpersonally oriented psychotherapeutic methods and techniques focused on building and improving communicational and social skills (Markowitz & Weissman 2004) might reduce suicide risk in combat-related PTSD populations. Finally, we demonstrated increased trait impulsivity to be also significantly associated with suicide ideation after controlling for various factors, including comorbid depression. Kotler et al. (2001) have also found such an association in a sample of patients suffering from PTSD, although they did not control for the influence of current depressive symptoms or disorder. In the existing literature on suicide phenomena, impulsive aggression and related disadvantageous decision making are conceptualized as endophenotypes for suicidal behaviors that reflect an underlying serotonergic dysfunction (Courtet et al. 2011). Even though we did not screen for personality disorders in our study sample, high impulsivity is a common characteristic of individuals with cluster B personality disorders who are particularly prone to suicide ideation and attempts (Rihmer & Benazzi 2010).

Some methodological limitations should be taken into consideration when discussing the findings of this study. The main limitation is the cross-sectional design, where only association, and not causation, can be demonstrated. However, several empirical studies have documented robust prospective associations between various personality dimensions and suicide tendencies in psychiatric populations. Future longitudinal studies should investigate potential mediating and moderating factors (e.g., levels of combat exposure, post-deployment social support, dissociative phenomena, genetic and neurobiological influences) of the personality-suicide relationships. Some authors have stressed out the need for more thorough examination of post-war social and political circumstances where veterans' feelings of disappointment, frustration and injustice, sometimes referred to as posttraumatic embitterment syndrome (see Linden et al. 2008, Jakovljevic et al. 2012b), can promote and exacerbate symptoms of PTSD and suicidal tendencies. Our research team is currently interpreting statistical data and preparing potential publications about posttraumatic embitterment and its psychological and genetic correlates in Croatian war veterans, all of which was obtained within the broader international project titled "Molecular mechanisms of PTSD" (Dzibur-Kulenovic et al. 2016). In addition, patients with(out) lifetime MDD were allocated to one of the two groups based on their medical records and clinical interviews. Even though structured diagnostic measures (e.g., SCID-I) assessing lifetime MDD would

probably be more rigorous, prior research has indicated good overlap between SCID-I, medical records and self-reported history of depression (Stuart et al. 2014, Sanchez-Villegas et al. 2008). Interview methods for the assessment of suicide ideation were not performed, however, there is evidence that self-report measures of suicidality can sometimes provide greater validity than interview methods, especially when examining recent suicide thoughts (Kaplan et al. 1994). Finally, additional aspects of suicidality (e.g., number of suicide attempts, suicide methods and lethality) should be explored in future studies with war veterans suffering from PTSD.

CONCLUSIONS

War veterans with combat-related PTSD and comorbid depressive disorder seem to be more suicidal and characterized by different personality profile than those suffering from PTSD alone. Character dimension Cooperativeness and trait impulsivity were uniquely predictive of suicide ideation in this population, even after controlling for the influence of comorbid depression. Identification of individual psychological factors that promote the occurrence of MDD and suicidal tendencies in war veterans with PTSD may facilitate more effective prevention and treatment methods. Additional pre- and post-deployment risk factors should also be investigated, particularly in studies with longitudinal research designs.

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Contribution of individual authors:

Nenad Jakšić: design of the study, data collection, literature searches, statistical analyses, interpretation of results, writing the first draft, revising the manuscript, approval of the final version.

Branka Aukst Margetić: design of the study, data collection, literature searches, interpretation of results, comments on the first draft, revising the manuscript, approval of the final version.

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