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Research Article

The Relationship between Neuroticism, Nightmare Characteristics and Suffering in respect to PTSD Psychopathology

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ABSTRACT

Introduction: The role of neuroticism in the relationship between nightmare characteristics (e.g., frequency and replicativity), and nightmare-related suffering, i.e., nightmare-related distress and impairment after awaking, is still to be explored.

Methods: In a sample of 346 soldiers (mean age 33.95 years, 13.9% females) who experienced at least one traumatic event (47.0% having a formal clinical diagnosis of PTSD), we tested the contributions of neuroticisms and PTSD symptomatology in predicting nightmare characteristics, as well as their moderating effects on the relationship between variables reflecting nightmare characteristics and suffering.

Results: Results showed no significant effect of neuroticism on nightmare frequency and replicativity beyond PTSD symptomatology, while its contribution to nightmare-related suffering was only partially explained by PTSD symptomatology. However, in the subsample of soldiers with PTSD diagnosis, neuroticism showed no significant effects beyond PTSD symptom severity and replicativity. Furthermore, no moderating effects of neuroticism or PTSD symptom severity on the relationship between nightmare characteristics and nightmare-related suffering in traumatized soldiers were found.

Discussion: These results confirm the predictive role of neuroticism on PTSD symptom severity and nightmare-related suffering but not nightmare frequency and replicativity. Furthermore, neuroticism and PTSD symptom severity did not contribute to higher vulnerability to nightmare suffering, in traumatized people who experience frequent and replicative nightmares.

Ključne reči: neuroticism, nightmare characteristics, suffering, PTSD

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Introduction

Nightmares are "extended, extremely dysphoric" dreams that "usually involve efforts to avoid threats to survival, security, or physical integrity" (APA, 2013). Both physical symptoms (such as sweating and shortness of breath) and unpleasant emotions (mainly fear, but also anger, shame, or sadness) can occur during nightmares, after awakening, and later during dream recollection. Some classifications distinguish nightmares from anxiety dreams and bad dreams by adding "a direct awakening from dream" as a criterion (APA, 2013). Nightmares characteristics (e.g., nightmare frequency) are differentiated from nightmare suffering, i.e., waking distress and impairment associated with nightmares (Belicki, 1992). The differentiation between idiopathic and post-traumatic nightmares is also commonly found in the literature (Gieselmann et al., 2019). While the former deal with imaginative content, the latter depict topics related to traumatic events. More specifically, Schreuder and colleagues (2001) defined three types of post-traumatic dreams: a) replicative dreams (post-traumatic reenactments), which the affected persons describe as a realistic repetition of the original traumatic event; b) mixed dreams, which repeat parts of the traumatic experience, but also include deviations; and c) non-replicative dreams referring only symbolically to the original traumatic event.

Studies done in different countries reported nightmare prevalence between 3.5 and 8.3% in the general population (Munezawa et al., 2011; Sandman et al., 2013; Schredl, 2010). Nightmares are well-known correlates of different mental health problems and disorders, with a prevalence of 27.7% in psychiatric outpatients (e.g., mood disorders, personality disorders, psychotic disorders) without PTSD (Swart et al., 2013). In contrast, with incidences between 40 and 71%, nightmares are particularly prominent in representative samples diagnosed with PTSD (Wittmann et al., 2007). Finally, growing empirical evidence suggests that it is the replicativeness of nightmare content that is linked specifically to post-traumatic psychopathology (Davis et al., 2007; De Dassel et al., 2017; Freese et al., 2018; Gorzka et al., 2019; Mellman et al., 2001; Wittmann et al., 2010).

Nightmare distress is usually defined as an impact of the nightmare on an individual during the dream itself (i.e., nightmare sleeping distress) and/or after wakening and recalling either the imagery or the affective experience of the nightmare (nightmare waking distress). In addition, nightmare impairment is defined as a degree of impairment that nightmares cause in different areas of a person's life, such as work, relationships, or leisure activities. Nightmare distress in comparison with nightmare frequency could be even more substantially and indiscriminately associated with psychopathology in general (Böckermann et al., 2014; Levin & Fireman, 2002; Levin & Nielsen, 2007; Roberts & Lennings, 2006).

Neuroticism as a predictor of nightmare experience

One of the well-established nightmare correlates has been the dispositional tendency to react with unpleasant emotions, i.e., trait neuroticism (Levin & Nielsen, 2009). Although the majority of studies have revealed positive correlations between neuroticism or neuroticism-like characteristics, such as trait anxiety, and nightmare frequency (e.g., Abdel-Khalek, 2016; Levin & Fireman, 2002; Schredl et al., 2003), the absence of correlation has been reported as well (Chivers & Blagrove, 1999; Wood & Bootzin, 1990). Miró and Martínez (2005) argued that these results' inconsistencies might be explained by the complex relationship between nightmares, anxiety traits, and trauma-related psychopathology. It seems that rather than implying a direct link, neuroticism (and trait anxiety) might be a risk factor for the experience of psychiatric symptoms (e.g., anxiety-related psychopathology) and general stress, which in turn predict nightmare frequency (Köthe & Piotrowsky, 2001; Schredl, 2003). A positive correlation between neuroticism and PTSD symptomatology was found in both cross-sectional (e.g., Cox et al., 2004; Steele et al., 2017) and prospective studies (e.g., Breslau & Schultz, 2013; Lawrence & Fauerbach, 2003). When it comes to underlying mechanisms, it might be that neuroticism increases emotionality, rehearsal, and centrality of trauma memories, which then may lead to the increase of PTSD symptomatology (Ogle et al., 2017), as well as content-overlap with PTSD arousal symptoms explains a significant amount of variance in the obtained relations (Engelhard et al., 2003).

The relationship between neuroticism and nightmare replicativity has been rarely investigated. Levin and Nielsen (2007) assumed that post-traumatic nightmares and/or those that reoccur and reflect real events would be strongly linked with neuroticism and higher emotional reactivity. Indeed, Schredl and Goeritz (2019) showed that reoccurring nightmares related to a waking-life event were associated with higher neuroticism in a large community sample.

On the other hand, a positive association between nightmare distress and neuroticism has been well established (e.g., Blagrove et al., 2004; Levin & Fireman 2002; Köthe & Piotrowsky, 2001; Roberts & Lennings, 2006).

Relationship between nightmare characteristics and suffering: neuroticism's moderation role

Previous studies indicated a moderate positive (e.g., Belicki, 1992; Böckermann et al., 2014), yet a complex relationship between nightmare frequency and nightmare distress. However, the relationship between nightmare replicativeness and suffering has been rarely investigated, with previous results indicating a positive correlation between recurring nightmares that relate to a waking-life event and nightmare distress (Schredl & Goeritz, 2019).

In their etiological model of nightmare disorders, Levin and Nielsen (2009, 2007a, 2007b) suggested that vulnerable people, e.g., those with PTSD symptomatology or primed for selective emotional reactivity (e.g., high neuroticism), who experience more frequent and/or replicative nightmares, are thus more prone to experience nightmare distress. Belicki (1992) suggests that nightmare-related suffering is influenced by a persons' preoccupation with their sleeping experience after awakening, their dysfunctional evaluations and beliefs about nightmares, and the extent of waking emotional burden. At the same time, neuroticism is linked to a threat attention bias and indirectly linked to PTSD through avoidant coping and social support (Lawrence & Fauerbach, 2003).

The potential role of neuroticism in the relationship between nightmare characteristics and suffering has so far been tested in one study by Schredl and

Goeritz (2019) who found neuroticism adds to nightmare distress beyond nightmare frequency and more than other Big 5 personality traits, although they did not control for trauma psychopathology in their study.

Theoretical rationale

This study aims at extending our knowledge of neuroticism and (post-traumatic) nightmares in a sample of traumatized war veterans. First, in a two-step model we wanted to test neuroticism as a predictor of nightmare variable and the PTSD symptom severity's potential in explaining the variance in these relationships. Results of previous studies suggest that neuroticism is linked to PTSD symptomatology (e.g., Breslau & Schultz, 2013; Cox et al., 2004) and more related to nightmare suffering (distress and impairment) than nightmare frequency, while stress-/anxiety-related psychopathology is linked to both (Miró & Martínez, 2005; Levin et al., 2011). To the best of our knowledge, none of the previous studies investigated the relationship between neuroticism and nightmare replicativity in traumatized samples. However based on results showing that nightmare replicativity may be a core feature of PTSD (e.g., De Dassel et al., 2017), one may expect that replicativity is also more closely related to PTSD psychopathology than neuroticism. Thus, we assumed that the impact of neuroticism on nightmare frequency and replicativity would be fully explained by PTSD psychopathology (Köthe & Piotrowsky, 2001; Schredl, 2003), while there would still be significant direct links between neuroticism and nightmare distress and impairment (Köthe & Pietrowsky, 2001; Miró & Martínez, 2005).

The second model was theoretically grounded on 1) a well-established positive correlation between nightmare frequency and nightmare distress (Böckermann, 2014) and emerging data on positive association between nightmare replicativity and nightmare distress (Schredl & Goeritz, 2019) and 2) the assumptions that neuroticism and PTSD psychopathology may be both predictors and moderators (Levin & Nielsen's, 2009, 2007a, 2007b) in the relationships between nightmare characteristics and nightmare suffering (models 2a and 2b).

Method

Participants

Participants were 346 patients (13.9% females[1]) admitted to a hospital-based inpatient or outpatient treatment program for veterans with psychological trauma at the Centre for Mental Health (Department VIb), Bundeswehr Hospital Hamburg, Germany. All patients were referred for additional assessment on the assumption of the existence of PTSD symptomatology. Mean age was 33.95 years (*SD* = 9.55, range 17.00 – 65.00) with males being significantly older than females (34.49 (Sd = 9.59) versus 30.56 (Sd = 8.63), χ^2 (1) = 6.04, p = .01). When it comes to education level, 19.70% of participants had a university degree, 11.60% had A levels, and 68.70% finished middle and secondary school (one missing value). The vast majority of soldiers (97.1%) received at least one ICD-10-F-diagnosis. Mean number of ICD-10 F-diagnoses was 1.50 (SD = 0.74, Range = 0 – 4) and no gender differences were found (χ^2 (1) = .88, *ns*)[2]. PTSD was diagnosed in 158 patients (47.0%), and no differences between men and women were found (χ^2 (1) = .001, *ns*).

Procedure

The study was approved by the IRB of International Psychoanalytic University Berlin. This research comprises a retrospective post hoc analysis of cross-sectional data acquired between 01/01/2014 and 31/12/2016 during routine clinical intake assessments of the Centre for Mental Health (Department VIb),

[1] Female soldiers represent about twelve percent of the German military (www.bundeswehr.de, data from 22.3.2019), which makes the gender disproportion in this study expected and representative.

[2] Most frequently, diagnoses from clusters F1 (i.e., mental and behavioral disorders due to psychoactive substance use, 18.80%), F3 (i.e., mood (affective) disorders, 39.90%), F4 (i.e., neurotic, stress-related, and somatoform disorders,76.90%) and F6 (i.e., disorders of adult personality and behavior, 10.1%) were present (numbers refer to cases with at least one diagnoses from the respective cluster).

Bundeswehr Hospital Hamburg, Germany. Research data represents the standard clinical diagnostic assessment battery of the Bundeswehr Hospital Hamburg. Participants completed questionnaires upon admission to the program and the treating psychiatric staff conducted clinical interviews with them. The clinical observations of multidisciplinary teams, including psychiatrists, psychologists, physiotherapists, and occupational therapists, in conjunction with psychometric results and clinical interviews, contributed to the final ICD-10 diagnosis (World Health Organization, 2004).

Measures

NEO Five-Factor-Inventory (NEO-FFI)

Neuroticism was assessed by the NEO Five-Factor-Inventory (NEO-FFI; Borkenau & Ostendorf, 2008). This inventory contains 60 items that build five personality traits scales: neuroticism, extraversion, openness, agreeableness, and conscientiousness. Cronbach's alpha in previous studies was $\alpha = .87$ (Borkenau & Ostendorf, 2008).

Hamburg Nightmare Questionnaire (HNQ)

Nightmare characteristics were assessed by applying the Hamburg Nightmare Questionnaire (HNQ, Gorzka, et al. 2019), a German self-report measure on nightmare characteristics in military personnel. It encompasses 30 questions/items divided into four sections. The first two sections deal with socio-demographics and general information on nightmares, i.e., frequency of nightmares in general and percentages of replicative, mixed, and non-replicative nightmares out of total nightmare frequency. In section 3, 17 Likert-type items form five scales on specific nightmare characteristics: replicativity, emotional involvement, dream recall, reorientation after awakening, and psychophysiological involvement. This study focused on nightmare frequency and replicativity and nightmare suffering, i.e., distress- and impairment-related scales, i.e., emotional and psychophysiological involvement, and impairment. The replicativity scale differentiates people by the amount of realistic and symbolic references in their nightmares. Emotional and psychophysiological involvements

represent emotional and psychophysiological aspects of nightmare-related distress. The first one measures fear, agony, and helplessness during a nightmare and after awakening, while the second refers to the experiences of sweat production, palpitations, and breathlessness after awakening. Finally, an Impairment scale can be derived from the seven items of section 4 of the HNQ, which assesses subjectively perceived impairment due to nightmares in the social, professional, family, physical, mental, and psychological contexts. Cronbach's alphas for the HNQ scales in this study were in the range of .70 - .95.

Posttraumatic Diagnostic Scale (PDS)

Trauma exposure was measured using the German version of the Posttraumatic Diagnostic Scale (PDS; Foa, 1995; Steil & Ehlers, 2000), which assesses Criterion A from the DSM-IV PTSD diagnostic criteria. The questionnaire asks which out of a list of eleven potentially traumatizing event types the respondent has experienced and allows participants to add any other traumatic event type not listed. Participants answered yes or no to each item.

Impact of Event Scale-Revised (IES-R)

Post-traumatic stress (PTSD) symptom severity was measured using the German version of the Impact of Event Scale-Revised (IES-R; Maercker & Schützwohl, 1998). The IES-R consists of 22 items assessing the severity of the three symptom clusters of PTSD corresponding with the DSM–IV PTSD diagnosis: intrusion, avoidance, and hyperarousal, related to a specific traumatic event. The global IES score was chosen for the current study as a general marker of self-reported PTSD symptomatology. Cronbach's alpha in this study was α = .91.

Data Analysis

Basic statistics were conducted in IBM SPSS Statistics (version 23.0). Descriptive statistics illustrate demographics, psychopathology, nightmare characteristics, and neuroticism. Correlations were calculated by Pearson's

coefficient and gender differences by the Kruskal-Wallis test due to the disproportion of males and females.

Hypothesized models (Models 1, 2a, and 2b) were tested by Path analysis in IBM AMOS Graphics (version 26.0). Several indices were used to assess the models, besides χ^2: 1) the Root Mean Squared Error of Approximation (RMSEA; conventional criteria are good fit: ≤ .05, adequate fit: ≤ .08), 2) the Comparative Fit Index (CFI; adequate fit: ≥ .95) and 3) the Tucker-Lewis Index (TLI; adequate fit: > .95) (Hu & Bentler, 1999). Due to the high intercorrelations between nightmare distress, i.e., emotional (EMO) and psychophysiological (PHY) involvements and impairment variables, nightmare-related suffering (NRS) was introduced as a latent variable. Intercorrelations between variables in models were allowed, which was not the case for residuals (Prado et al., 2010).

Model 1: The first two-step model tested neuroticism (N) as a predictor of nightmare frequency (NMF), replicativity (REP), and NRS in the first step, and the role of PTSD symptom severity in the second step. The bootstrapping process was used to test the mediating effects of PTSD symptom severity (i.e., indirect effects of neuroticism).

Models 2a and 2b: The moderation effects of neuroticism and PTSD symptom severity in the relationship between NMF and NRS, as well as nightmare REP and NRS were tested. Moderation effects were estimated following Hayes (2017). All predictor variables were mean-centered to control for the multicollinearity and calculate interaction scores.

Results

Descriptive statistics and linear correlations between neuroticism and nightmare characteristics

All participants reported having at least one traumatic event (Median = 4, Range 1 - 11) and no differences between men and women in respect to the number of traumatic events were found (χ^2 (1) = 0.30, *ns*). Those who were diagnosed with post-traumatic stress disorder had higher scores on self-

reported PTSD symptom severity (Mean = 65.52 (SD = 22.25) vs. Mean = 47.82 (SD = 28.37), $\chi^2(1) = 33.84$, $p < .001$).

In Table 1, descriptive statistics of nightmare characteristics, self-reported PTSD symptom severity (PTSD), and neuroticism (N), as well as their associations with age and gender, are given. No gender differences were found in neither of the variables; thus, all further analyses are done in the cohort sample. Older soldiers had slightly higher scores on replicativity (REP), emotional (EMO) and psychophysiological involvement (PHY), impairment (IMP), and PTSD symptom severity. Linear correlations between neuroticism and nightmare characteristics before and after controlling for PTSD are as well reported in Table 1. Low positive correlations were found between N and NMF and REP, while N was moderately associated with distress- and impairment-related scales, as well as PTSD. After controlling for PTSD, only correlations with EMO and IMP remained significant but small. Since moderate-to-high correlations were found between the nightmare-related distress (NRD) and impairment variables, the following models included a latent variable named nightmare-related suffering (NRS), represented by NRD variables (emotional and psychophysiological involvement) and impairment.

Table 1

Descriptive Statistics and Cross-correlations of Nightmare variables and Associations with Gender, Age and Neuroticism before and after controlling for PTSD symptom severity

	Descriptives		Gender	Age (r)	Corr. with N		Corr.			
	Mean	SD	$\chi^2(1)$[a]		r	Partial r[b]	REP	EMO	PHY	IMP	PTSD
NMF	9.59	9.00	0.00	<.01	.14*	-.01	.305**	.473**	.356**	.476**	.31**
REP	3.46	1.10	0.05	.15**	.22**	<-.01	/	.522**	.347**	.472**	.48**
EMO	3.25	1.20	0.18	.13*	.40**	.17*		/	.573**	.723**	.62**
PHY	3.07	1.05	0.89	.19**	.22**	.03			/	.531**	.43**
IMP	2.39	1.10	3.09	.13*	.35**	.11*				/	.60**
PTSD	56.49	27.00	0.93	.11*	.46**	/					/
N	61.44	9.91	0.40	<.01	/	/					

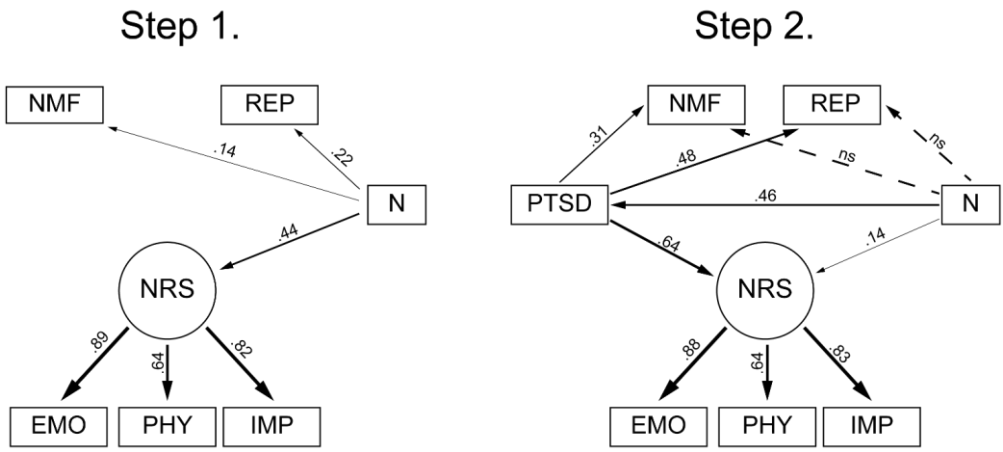
Note. * p < .05; ** p < .01; a = Kruskal-Wallis test; b = after controlling for PTSD symptom severity; NMF = Monthly nightmare frequency; N = Neuroticism; REP = replicativity; EMO = Emotional involvement; PHY = Psychophysiological involvement; IMP = Impairment; PTSD = PTSD symptom severity.

Neuroticism as a predictor (Model 1)

Model 1 failed to be rejected showing a perfect fit in both first ($\chi^2(6) = 4.98$, *ns*) and the second step, when PTSD was included as a mediator ($\chi^2(8) = 6.01$, *ns*) (Figure 1). Although N showed direct effects on NMF ($\beta = .14$, $p = .035$, 95% CI [.01, .22]) and REP ($\beta = .14$, $p = .006$, 95% CI [.13, .33]) in the first step of the model, after including PTSD, only indirect effects on these nightmare characteristics were significant: $\beta = .14$, $p = .005$, 95% CI [.10, .20] and $\beta = .22$, $p = .006$, 95% CI [.18, .29]. On the other hand, N showed both direct ($\beta = .14$, $p = .013$, 95% CI [.06, .21]) and indirect effects ($\beta = .29$, $p = .006$, 95% CI [.24, .36]) on NRS after including PTSD. Finally, the effects of PTSD on nightmare characteristics were moderate to high (Cohen, 1988).

Figure 1

Two-step Model 1 testing neuroticism as a predictor of nightmare experience (Step 1) and PTSD symptom severity as a mediator (Step 2)



Note. N = Neuroticism; REP = replicativity; EMO = Emotional involvement; PHY = Psychophysiological involvement; IMP = Impairment; NRS = nightmare-related suffering; PTSD = PTSD symptom severity; The width of the line is proportional to the strength of the association; Nonsignificant paths are indicated with dotted lines.

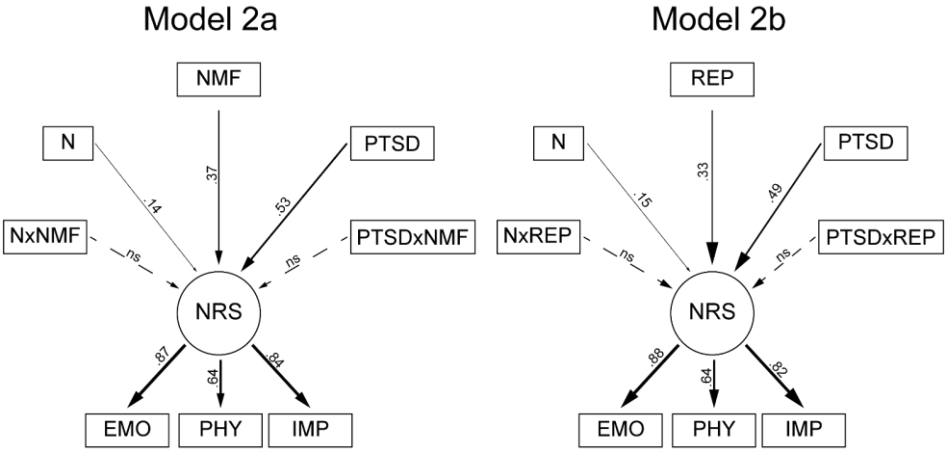
Neuroticism as a moderator of the relationships of nightmare frequency and replicativity with nightmare suffering

Model 2a (Figure 2) which tested the moderation effects of N and PTSD on the relationships between NMF and NRS showed an acceptable fit ($\chi^2(12) = 37.35$, $p < .001$, TLI = .94, CFI = .97, RMSEA = .07). Regression weights indicated no moderation effects on NRS, in addition to direct effects of N (β = .14, $p = .012$, 95% CI [.08, .21]), NMF (β = .37, $p = .018$, 95% CI [.29, .42]) and PTSD symptom severity (β = .53, $p = .007$, 95% CI [.45, .59]).

In Model 2b, neuroticism's and PTSD's moderation effects on the relationships between REP and NRS were tested. The model showed a good fit (χ^2 (12) = 28.84, p = .004, TLI = .96, CFI = .98, RMSEA = .06). Again, no significant moderation effect on NRS was found, in addition to direct effects of N (β = .15, p = .011, 95% CI [.07, .22]), REP (β = .33, p = .012, 95% CI [.24, .41]) and PTSD (β = .49, p = .007, 95% CI [.40, .58]).

Figure 2

Models 2a and 2b testing neuroticism and PTSD symptom severity as moderators of the relationships of nightmare frequency with nightmare suffering (Model 2a) and replicativity with nightmare suffering (2b)



Note. N = Neuroticism; REP = replicativity; EMO = Emotional involvement; PHY = Psychophysiological involvement; IMP = Impairment; NRS = nightmare-related suffering; PTSD = PTSD symptom severity; The width of the line is proportional to the strength of the association; Nonsignificant paths are indicated with dotted lines.

Post hoc control analyses

In order to test the potential effects of PTSD diagnostic status on our results, we repeated the main analyses (Models 1, 2a, and 2b) separately for participants with (n = 158) and without PTSD diagnosis (n = 178). In Model 1, after

controlling for PTSD symptom severity (step 2) there was no direct effect of neuroticism on nightmare suffering (*β* = .09, *ns*) in the subsample with PTSD diagnosis (Model 1, step 2). Findings were not affected in Model 2a, while in Model 2b in the subsample with PTSD diagnosis, N showed no direct effect on suffering (*β* = .09, *ns*).

Discussion

This study aimed to test the predictive and moderating role of neuroticism in the relationship between nightmare characteristics and suffering, in respect to PTSD. First, we examined linear correlations between neuroticism and nightmare characteristics. As we hypothesized based on previous findings (e.g., Köthe & Piotrowsky, 2001; Miró & Martínez, 2005), neuroticism is more strongly correlated with suffering-variables, i.e., emotional involvement and impairment, then with nightmare frequency and replicativity. After controlling for PTSD, only the correlations with emotional involvement and impairment remained significant but rather small.

Interestingly, in contrast with psychological aspects of distress (i.e., emotional involvement and impairment), psychophysiological involvement, which refers to somatic state anxiety-like symptoms related to the nightmare, did not correlate with neuroticism after controlling for PTSD. It could be that cognitive-emotional evaluations of nightmare distress, i.e., emotional involvement and impairment, as subjective experience are connected to the individual tendency toward emotional distress beyond psychopathology. In contrast, the somatic distress and physiological reactions may represent a significant source of shared variance with PTSD symptomatology. Still, this is not in line with previous research showing a positive correlation between neuroticism and physiological and psychosomatic reactions, although there is the assumption that it is not that persons with higher neuroticism are more prone to physiological experiences but that their reporting is biased by neuroticism-related styles of perceiving (Costa & McCrae, 1987). In addition, previous research (Schneider, 2004) suggests neuroticism being related to

physiological distress only in the presence of appraisals of threat, which perhaps can't be applied to retrospective accounts in a sample of soldiers.

Findings in Model 1 seem to support our hypothesis: neuroticism's relationships with nightmare frequency and replicativity were fully explained by PTSD, while it showed both indirect and direct, although rather small, effects on the latent variable nightmare-related suffering. These results are in line with the stances that neuroticism is a risk factor for the experience of trauma-related psychopathology (Breslau & Schultz, 2013), which in turn is associated with higher nightmare frequency (Köthe & Piotrowsky, 2001; Schredl, 2003) and replicativity. Contrarily, neuroticism did contribute to nightmare-related suffering beyond the effects of PTSD. These results are comparable to those from the majority of studies measuring anxiety-related symptomatology (Roberts & Lennings, 2006; Miró & Martínez, 2005). However, results of the post hoc analyses in the subsample of veterans with PTSD diagnosis show no direct effect of N on NRS. This finding might be due to the smaller sample size, but it may also indicate that, when criteria for PTSD diagnosis are met, the symptom severity becomes the only significant predictor of nightmare variables. Future studies should, thus, further test Levin and Nielsen's (2007) model suggesting the contribution of both neuroticism and PTSD psychopathology to nightmare-related suffering in both PTSD and non-PTSD samples.

To the best of our knowledge, no study investigated the moderation effects of neuroticism on the relationships between NMF and NRS, as well as between REP and NRS. We found no evidence of interaction effects on the connections between nightmare characteristics and nightmare-related suffering regardless of PTSD symptom severity (Models 2a and 2b, Fig. 2). These results suggest that although both neuroticism, PTSD and nightmare characteristics contributed to the nightmare-related suffering, they did not amplify each other's connections. However, post hoc analyses show no direct effect of N on NRS, beyond PTSD symptom severity and REP in the subsample with PTSD diagnosis, indicating the main role of trauma-related symptomatology and dream content in predicting waking distress.

This study is not without limitations, which need to be considered for any interpretation of the results. First, the study's cross-sectional nature limits

the interpretation of the relationships between variables to the level of statistical causality. Furthermore, there are indications of Model 1's overfitting, which could be the result of its complexity; however, it can be an indicator of potential limitations in the generalizability of these models to other datasets. Finally, the results were obtained in a sample of traumatized soldiers; thus, the generalizability of data to traumatized civilian populations should be investigated.

Despite these limitations, this study extends our knowledge on the relationship between neuroticism, nightmare characteristics, and trauma-related psychopathology in a sample of traumatized soldiers. Results indicate that neuroticism did not contribute to the nightmare frequency and replicativity beyond the PTSD. On the other hand, neuroticism predicts nightmare-related suffering beyond the PTSD symptomatology in traumatized veterans without a clinical diagnosis of PTSD, while it seems that in veterans with PTSD diagnosis, the nightmare-related experience is mainly explained by trauma-psychopathology. Moreover, neuroticism did not seem to make traumatized soldiers who experience frequent or replicative nightmares more prone to waking suffering. This study emphasizes the importance of nightmare experiences and encourages future research attempts to better understand the nightmare consequences in everyday life. The results on the association between neuroticism and nightmare suffering might be informative for the military selection process, as well as for nightmare and PTSD treatment. Future studies are needed to investigate these findings' generalizability to traumatized civilian samples.

Conflict of Interest

The authors have no conflicts of interest to declare.

Data availability statement

Due to regulations regarding data obtained in military settings we cannot deposit our data in an openly accessible format. However, the data file will be shared by corresponding authors in case of individual requests.

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