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Factor structure of the posttraumatic stress disorder checklist (PCL-17) in 279,897 million veteran program participants

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Abstract

The Million Veteran Program (MVP) uses the posttraumatic stress disorder symptoms (PTSD) Checklist 17 (PCL- 17) self-report to assess PTSD. Existing literature suggests that the five-factor dysphoric arousal model best represents the PTSD symptom clusters; this can be tested within MVP, one of the largest samples collected with suitable data. We compared factor models within MVP across genetically defined subsamples (ancestry [European, African, admixed American, and East Asian], sex) via multi-group Confirmatory factor analyses in a sample of 279,897

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CRediT authorship contribution statement

Cassie Overstreet: Conceptualization, Formal analysis, Writing – original draft. **Daniel F. Levey:** Writing – review & editing. **Hang Zhou:** Writing – review & editing. **Kelly M. Harrington:** Data curation, Writing – review & editing. **Rachel Quaden:** Data curation, Writing – review & editing. **Murray B. Stein:** Writing – review & editing, Supervision. **Joel Gelernter:** Conceptualization, Writing – review & editing, Supervision. **Robert H. Pietrzak:** Conceptualization, Writing–review & editing, Supervision.

Declaration of Competing Interest

C.O., D.L., H.Z., K.H., R.Q., J.G., and R.P. have no conflicts of interest to declare. M.B.S has in the past 3 years received consulting income from Acadia Pharmaceuticals, Aptinyx, atai Life Sciences, Boehringer Ingelheim, Bionomics, BioXcel Therapeutics, Clexio, Eisai, EmpowerPharm, Engrail Therapeutics, Janssen, Jazz Pharmaceuticals, Neuro-Trauma Sciences, PureTech Health, Sumitomo Pharma, and Roche/Genentech. Dr. Stein has stock options in Oxeia Biopharmaceuticals and EpiVario. He is paid for his editorial work on *Depression and Anxiety* (Editor-in-Chief), *Biological Psychiatry* (Deputy Editor), and *UpToDate* (Co-Editor-in-Chief for Psychiatry). He is on the scientific advisory board for the Brain and Behavior Research Foundation and the Anxiety and Depression Association of America.

participants. The five-factor dysphoric arousal model best fit the PCL-17 data, consistent with previous findings. The factor structure could also be imposed across all groups tested. Verifying the factor structure provides a framework for future phenotypic and genotypic analyses within MVP and other samples.

Keywords

Posttraumatic stress disorder; Five factor dysphoric arousal model; Multi-group confirmatory factor analysis

1. Introduction

Multiple large-scale studies assess symptoms of posttraumatic stress disorder (PTSD) using the PCL-17, the *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed. (*DSM-IV;*American Psychiatric Association [APA], 1994) version of the Posttraumatic Stress Checklist (PCL; Weathers et al., 1991). The Million Veteran Program (MVP), a large-scale epidemiologic study of psychosocial and biological variables relevant to health in veterans, includes this self-report instrument in about half of its participants recruited to date. Significant associations between genetic loci and the re-experiencing symptom cluster of PTSD have been identified using these PCL-17 data in MVP (Gelernter et al., 2019). Differential findings based on multiple PTSD subphenotypes, and also electronic health record-based diagnosis vs. quantitative PCL trait definition, have also been demonstrated within the dataset (Stein et al., 2021).

A three-factor model of PTSD is implicit in the *DSM-IV* (re-experiencing, avoidance, hyperarousal), but alternative factor structures have been proposed (Harpaz-Rotem et al., 2014). The literature regarding the latent architecture of the PCL-17 includes models ranging from one to five factors (see Armour, Műllerová, and Elhai, 2016 for review), with differences largely present within the avoidance and hyperarousal clusters. Significant support has emerged for the five-factor dysphoric arousal model, which includes separate clusters of re-experiencing, avoidance, emotional numbing, dysphoric arousal (e.g., sleep disturbance) and anxious arousal (e.g., hypervigilance), as this model has demonstrated superior fit to symptom-level PTSD data relative to other models (Elhai et al., 2011; Armour et al., 2012; Pietrzak et al., 2012; Harpaz-Rotem et al., 2014). The sample sizes included in these studies range from 294 to 323,903 subjects. The five-factor dysphoric arousal model has not been empirically evaluated in MVP.

The most empirically supported factor models of the PCL-17 include the three-factor *DSM-IV* model, the four-factor dysphoria and numbing models, and the five-factor dysphoric arousal model. The three-factor *DSM-IV* model reflects the reexperiencing, avoidance, and hyperarousal symptom clusters per the *DSM-IV* diagnostic criteria. The four-factor dysphoria model maintains the same re-experiencing items as the three-factor model, while the majority of the remaining items fall under a dysphoria factor with two items pertaining to avoidance and two pertaining to hyperarousal (Simms et al., 2002). In the four-factor numbing model, the re-experiencing and hyperarousal items derived from the *DSM-IV* are retained while the avoidance subcluster is divided into avoidance and numbing items (King

et al., 1998). Finally, in the five-factor dysphoric arousal model each of the re-experiencing items load onto a single factor, consistent with the *DSM-IV*. The avoidance items broadly load onto two separate factors reflecting avoidance and emotional numbing symptom clusters. One item pertaining to sense of foreshortened future (falling under the avoidance cluster per the *DSM-IV*) loads onto the dysphoric arousal cluster along with many of the hyperarousal items while the remaining two items within the hyperarousal cluster load onto an anxious arousal factor rather than a single hyperarousal factor per the *DSM-IV* (Elhai et al., 2011).

Inferences regarding PCL-17 factor structure as it relates to demographic variables including self-reported race and sex have been mixed. Although the factor structure was determined to be consistent across non-Hispanic African Americans and Caucasians [sic] in a sample of 413 participants, severity of symptoms within specific clusters varied by self-reported race, with non-Hispanic African Americans reporting greater symptoms of re-experiencing (Coleman et al., 2019). Other research supports statistical invariance across groups when the five-factor dysphoric arousal model was examined in a sample of 6,248 subjects (Contractor et al., 2015). Different rates of exposure to certain types of potentially traumatic events (e.g., men more likely to be exposed to combat while women are at greater risk of exposure to sexual violence) and symptom severity (e.g., women often present with greater severity of PTSD symptoms (Breslau et al., 1997)) suggest potential variability regarding latent factor structure. Although there is some support for sex differences in PCL-17 factor structure (Hall et al., 2012), a systematic review (Armour, Műllerová, and Elhai, 2016) demonstrated that the five-factor dysphoric arousal model provided superior fit across multiple studies. But arguably, all studies to date have had substantial power limitations. Well-powered statistical comparisons are needed to determine if the same factor structure can be applied across groups.

To address these gaps, we sought to determine the best fitting structural model of PTSD symptoms by comparing the three-factor *DSM-IV* model, the four-factor dysphoria and numbing models, and the five-factor dysphoric arousal model in a large cohort of more than 279,000 veterans in the MVP. Taking a nuanced approach to examining the latent factor structure of the PCL-17 may aid in improving PTSD gene finding efforts which would otherwise be missed when PCL-17 items are summed to yield a single total score and/or separated into the standard three symptom cluster solution per the *DSM-IV*. Thus, the aims of the present study were to: (1) compare factor models of PTSD within the MVP dataset; and (2) compare the factor structure across ancestry (European, African, Admixed American, and East Asian ancestry) and sex (men and women) via multi-group confirmatory factor analyses (CFA).

2. Methods

2.1. Subjects

The MVP has been previously described (Gaziano et al., 2016). To date, the MVP Lifestyle survey, which includes the PCL-17 was completed by 285,062 participants. Following removal of any participants with missingness on the PTSD Checklist described below or information regarding ancestry and/or sex (as determined by genotype data), the sample

consisted of 279,897 participants (92.2% male, M_{age}=65.7, SD=11.3, range=19-112). Reference population groups in the 1000 Genomes samples were used to define European (EUR), African (AFR), admixed American (AMR), and East Asian (EAS) ancestry groups genetically. The EUR sample consisted of 233,707 participants, AFR sample 31,690 participants, AMR sample 12,250 participants, and EAS sample 2,250 participants.

2.2. Measures

2.2.1. Posttraumatic Stress Disorder Checklist (PCL-C)—The 17-item PCL version utilized in MVP is similar to the civilian version (PCL-C) in that it asks respondents to report how much they have been bothered in the past 30 days by symptoms in response to "stressful experiences". Responses were made on a Likert-based scale between 1 "Not at all" and 5 "Extremely." In the current sample, Cronbach's alpha on the PCL was 0.96.

2.3. Data Analysis

Multi-group CFAs were conducted using robust maximum likelihood estimation with the Satorra and Bentler (S–B) χ^2 scaling correction (Satorra and Bentler, 2001) to compare the three-factor *DSM-IV* model, the four-factor dysphoria and numbing models, and the five-factor dysphoric arousal model (item mapping across models presented in Table 1) because PCL item scores were non-normally distributed (14/17 items; Table 2). This procedure estimates standard errors under conditions of multivariate non-normality and calculates other χ^2-dependent fit statistics based on the S–B χ^2 statistic. In the CFA models, PCL items were specified to load only on one of the proposed factors and all factors were allowed to correlate. Model fit was evaluated using the S–B χ^2 comparative fit index (CFI), Tucker Lewis Index (TLI), Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) values. Higher CFI and TLI values and lower S–B χ^2, AIC, BIC, RMSEA, and SRMR values indicate a better fitting model. The following conventions were also considered when evaluating model fit: CFI and TLI ≥ 0.90 indicate adequate fit and ≥ 0.95 an excellent fit; RMSEA ≤ 0.08 as an adequate fit and ≤ 0.06 as indicative of excellent fit; and SRMR ≤ 0.08 suggesting good fit (Hu and Bentler, 1999).

Additionally, given use of the S–B χ^2 statistic, χ^2 difference tests were calculated for nested models with a correction factor to compare the relative fit of the five-factor model to the three-factor *DSM-IV* model and four-factor dysphoria and numbing models (Fan and Sivo, 2009). Non-nested models (i.e., *DSM-IV* vs. dysphoria model; numbing vs. dysphoria model) were compared using BIC (Schwarz, 1978) whereby models with a lower BIC value suggest better fit (difference of 6–10 indicates strong support and a difference >10 indicates very strong support; Raftery, 1995). Analyses were conducted in R (R Core Team, 2020) using the "lavaan" package (Rosseel, 2012).

We tested measurement invariance for both ancestry (EUR, AFR, AMR, EAS) and sex (men, women) in the following manner: (1) determine if the best fitting model identified by the CFA procedure described above could be constrained to equality across groups (similar number of factors and general pattern of loadings or configural invariance), (2) constrain model so that loadings are equal across groups (metric invariance), (3) constrain model so

that loadings and intercepts are equal across groups (scalar invariance), (4) constrain model so that the loadings, intercepts, and residuals are equal across groups (strict invariance). Multi-group CFA is an iterative process which stops at any step that is noninvariant. Because there was a large sample size, fit statistics were evaluated with a particular focus on decreases in CFI (>.01) and RMSEA (>.015) to determine invariance across groups (Chen, 2007; Hirschfeld and Von Brachel, 2014).

3. Results

The mean, standard deviation, correlations, and additional descriptive information for each PCL item are provided in Table 2.

3.1. Confirmatory Factor Analyses

In the full sample, the CFA results for the three-factor *DSM-IV* model, the four-factor dysphoria and numbing models, and the five-factor dysphoric arousal model are presented in Table 3. Results indicated that the five-factor dysphoric arousal model provided a better fit to the data relative to the three-factor *DSM-IV* model and four-factor dysphoria and numbing models as demonstrated by lower S–B χ^2, AIC, BIC, RMSEA, and SRMR values, as well as higher CFI and TLI values. Per the CFI and TFI results, the four-factor dysphoria, four-factor numbing, and five-factor dysphoric arousal models provided excellent fit (CFI and TLI ≥ 0.95) while the three-factor *DSM-IV* model demonstrated only adequate fit. Item loadings and factor covariances for the five-factor dysphoric arousal model are presented in Fig. 1.

Additionally, the five-factor dysphoric arousal model's CFI difference from the three-factor and numbing models was greater than 0.01, indicating a better fit (Fan and Sivo, 2009).The five-factor model was the only model demonstrating excellent fit per the RMSEA (RMSEA ≤ 0.06). χ^2 difference tests further demonstrated that the five-factor model fit significantly better than the three-factor *DSM-IV* model, $\Delta\chi^2(7) = 114743.86$, $p < .001$; the four-factor dysphoria model, $\Delta\chi^2(3) = 83352.77$, $p < .001$; and the four-factor emotional numbing model, $\Delta\chi^2(3) = 72467.98$, $p < .001$. For non-nested models (DSM-IV vs. dysphoria model; numbing vs. dysphoria model), the dysphoric arousal model had a lower BIC (>10 indicating very strong support) when compared to the DSM-IV model and the numbing model (Table 3).

3.2. Multi-Group Confirmatory Factor Analyses

Following identification of the best-fitting factor model (Fig. 1), multi-group invariance models (Table 4) were examined to identify potential differences across groups (ancestry [EUR, AFR, AMR, EAS] and sex). Although χ^2 difference tests were each significant (p <.001), this was not surprising considering the large sample size, and greater consideration was placed on differences in CFI and RMSEA. Multi-group CFA results for ancestry demonstrated configural, metric, scalar, and strict invariance. The same pattern of findings was also seen for sex. Standardized estimates and standard errors for the five-factor dysphoric arousal model in each group are provided in Tables 5 (ancestry) and 6 (sex).

4. Discussion

The present study aimed to (1) compare factor models of PTSD within the MVP dataset and (2) compare the factor structure across ancestry (EUR, AFR, AMR, EAS) and sex (men, women). Consistent with the literature (Elhai et al., 2011; Armour et al., 2012; Pietrzak et al., 2012) and our hypotheses, the five-factor dysphoric arousal model provided the best fit for the data and was consistent across groups (ancestry and sex). Each of the re-experiencing items loaded onto a single factor, consistent with the *DSM-IV*. However, rather than a single avoidance factor as suggested by the *DSM-IV*, the majority of avoidance items loaded onto two separate factors reflecting avoidance and emotional numbing symptom clusters with the exception of the item regarding foreshortened future which loaded onto the dysphoric arousal factor along with many of the hyperarousal items as defined by the *DSM-IV*. Hyperarousal items were also divided into separate factors, representing dysphoric arousal and anxious arousal rather than a single hyperarousal factor per the *DSM-IV*. The factor structure was invariant across groups, indicating that the same general pattern of item loadings onto the five latent factors per the five-factor dysphoric arousal model did not differ significantly by ancestry or sex.

These findings highlight the utility of a nuanced five-factor dysphoric arousal model when examining PTSD symptoms using the *DSM-IV* version of the PTSD Checklist, rather than the three-factor model explicit in the *DSM-IV* criteria and implicit in the PCL-17's conception. The five-factor dysphoric arousal model splits items typically subsumed within the avoidance cluster per the *DSM-IV*, as well as the items falling under the *DSM-IV* hyperarousal cluster. Collapsing these items together to create avoidance and hyperarousal scores as per the *DSM-IV* may obscure identification of phenotypic and biological associations that may otherwise be identified if the factors were divided into more phenotypically distinct avoidance, emotional numbing, dysphoric arousal, and anxious arousal subdomains as suggested by the five-factor dysphoric arousal model. This five factor solution may be particularly useful in research settings that continue to utilize the PCL-17 such as the MVP, a very large sample that continues to ascertain PTSD via the PCL-17. Abbreviated measures are also frequently utilized in large datasets, for example the Post-Traumatic Checklist – 6-item Civilian Version (PCL-6, Lang and Stein, 2005). The PCL-6 taps into each of the three *DSM-IV* domains (two from re-experiencing, one pertaining to avoidance, and three from hyperarousal). The PCL-6 also includes items that reflect the re-experiencing, avoidance, dysphoria, and hyperarousal domains of the dysphoric arousal five-factor model; however, it does not include any items reflecting the emotional numbing factor present in the five-factor model. Additional research is warranted to investigate whether abbreviated PTSD measures may better capture symptoms when reflecting the five-factor dysphoric arousal model compared to the three-factor *DSM-IV* model. It is noteworthy that although the PCL-6 does not tap into each domain reflected by the five-factor dysphoric arousal model, many studies demonstrate that it effectively serves its purpose of screening for PTSD (Lang et al., 2012) and inclusion of each domain may not be necessary given the purpose of the measure. Multiple studies have been published using MVP data, including genetic analyses focused on PTSD symptom clusters as defined by the *DSM-IV* (Pathak et al., 2022; Stein et al., 2021; Gelernter et al., 2019 [focused on

the re-experiencing cluster alone]). A more refined approach to examination of PTSD could reduce heterogeneity and reveal unique and shared genetic and biological features associated with each symptom cluster. Notably, the present analyses utilized genotypic definitions of ancestry and sex, future studies may also want to consider excluding related individuals to further enhance phenotypic precision if the traits will be used for genetic studies.

Multi-group measurement invariance model results indicated invariance at a configural level, demonstrating that the five-factor dysphoric arousal model could be imposed across groups. This is consistent with the literature suggesting that the five-factor model could be applied across some demographic groups with limited concern regarding number of factors and pattern of loading varying greatly across groups (Armour et al. 2016). To control for population stratification, genetic analyses (e.g., genome-wide association studies) are conducted by ancestry group and then meta-analyzed. If the multi-group models were non-invariant this would have critical implications on genetic analyses (e.g., the avoidance cluster may include different items depending on group). Demographic features remain important factors to be considered within the context of PTSD given variable prevalence rates of certain types of trauma and PTSD symptom severity.

There are a number of noteworthy limitations of this study. First, the present analyses focus on the PCL-17, which corresponds to *DSM-IV* PTSD criteria. Alterations in the criteria made in the *DSM-5* (e.g., inclusion of items pertaining to negative cognitions and mood) are not reflected in the PCL-17. However, large datasets including MVP continue to use the *DSM-IV* version; and CFA studies have largely supported a separation of avoidance symptoms, as well as dysphoric and anxious arousal (Armour et al., 2015; Lee et al., 2019; Wang et al., 2017). Future research investigating an empirical “crosswalk” between *DSM-IV* and *DSM-5* responses may be useful, even if current methods only focus on total scores (Moshier et al., 2019). Exploration of potential methods of translating DSM-IV PTSD symptoms to DSM-5 may also prove beneficial. Second, the sample is focused on military veterans and the specific trauma histories were not assessed. Trauma type and cumulative trauma load (i.e., number of traumatic events one is exposed to within one’s lifetime) have been shown to have an impact on PTSD symptom presentation (Kessler et al., 2017; Scott et al., 2013) and additional research evaluating invariance of the latent structure of PTSD in relation to specific index traumas is needed. Future inclusion of measures such as the Life Events Checklist for DSM-5 (Weathers et al., 2013) would also be useful in providing a thorough assessment and consideration of trauma history. Additionally, the predominantly male sample may also limit generalizability of the findings to female veterans. Other variables (e.g., cognition, inhibition, level of social support, schemas regarding the world, themselves, and others) may also influence results and could be helpful to consider in future studies of the five-factor dysphoric arousal model. Finally, although there is sufficient power to examine these variables on a phenotypic level, genetic analyses within non-EUR and female subsamples may prove difficult due to relatively lower sample sizes. Many prior factor analytic studies included relatively small sample sizes; however, Harpaz-Rotem and colleagues (2014) compared the factor structure in a large sample of individuals receiving services at VA medical centers (N=323,903). Given that this study was conducted among veterans utilizing services at the VA, it is possible that there is some overlap across participants (VA and MVP). This concern, which cannot be evaluated

empirically, is somewhat mitigated by the ongoing nature of data collection in MVP and that PCL data were collected from each sample independently: i.e. even if there is overlap in subjects there is no overlap in the phenotypic measures. MVP data collection is ongoing which will tend to address the power issue over time.

Despite these limitations, these findings aid in refining understanding of the PTSD phenotype assessed using the *DSM-IV* version of the PTSD Checklist. In addition to adding to the literature examining the factor structure in large samples, this detailed approach to phenotyping may improve our understanding of the biological factors underlying PTSD symptoms by allowing us to define evidence-based diagnosis subphenotypes that may be sued in future GWAS analyses. Previous phenotypic research suggests that there are differences across symptom clusters (Rusch et al., 2019) and although high genetic correlations were demonstrated across the three *DSM-IV* PTSD subdomains in a previous study conducted within MVP (Stein et al., 2021), it is possible that a re-analysis focused on the five factor model symptom clusters (with a larger sample size) may identify important differences and improve gene-finding efforts.

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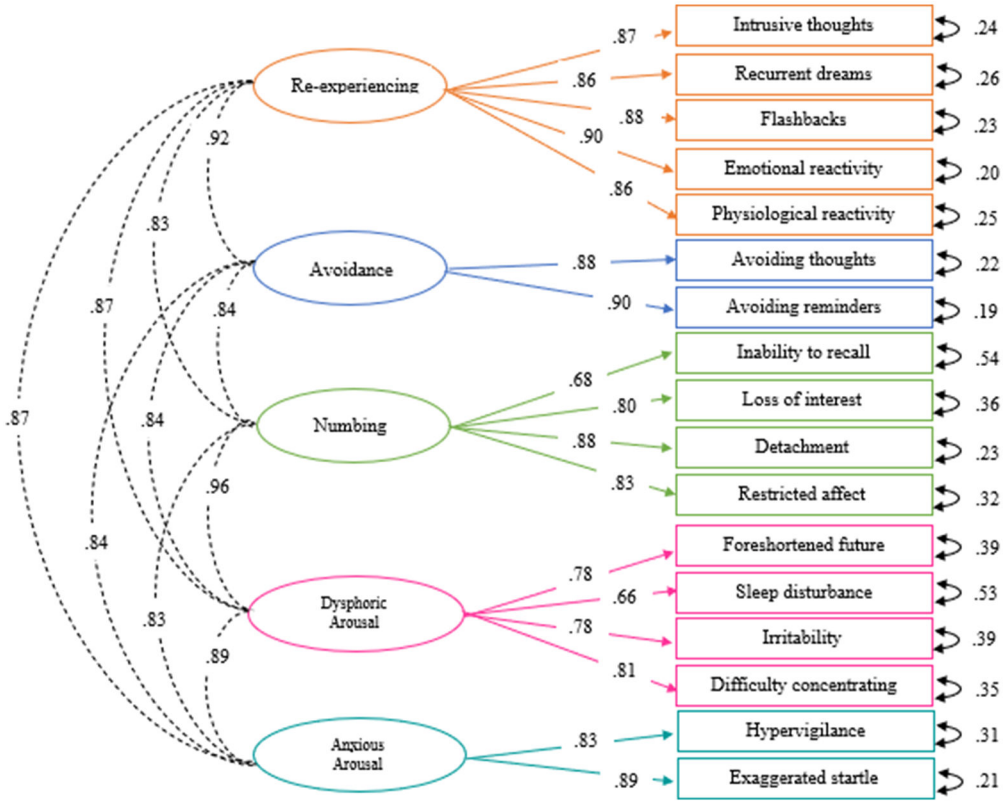

Fig. 1.
Loadings for Five-factor Model in Full Sample (N = 279,897).

Table 1

Item Mapping across DSM-IV, Dysphoria, Numbing, and Five-factor Models.

PCL Items		Model DSM-IV	Dysphoria	Numbing	5-factor
1.	Intrusive thoughts of trauma	R	R	R	R
2.	Recurrent dreams of trauma	R	R	R	R
3.	Flashbacks	R	R	R	R
4.	Emotional reactivity to trauma cues	R	R	R	R
5.	Physiological reactivity to trauma cues	R	R	R	R
6.	Avoiding thoughts of trauma	A	A	A	A
7.	Avoiding reminders of trauma	A	A	A	A
8.	Inability to recall aspects of trauma	A	D	N	N
9.	Loss of interest	A	D	N	N
10.	Detachment	A	D	N	N
11.	Restricted affect	A	D	N	N
12.	Sense of foreshortened future	A	D	N	DA
13.	Sleep disturbance	H	D	H	DA
14.	Irritability	H	D	H	DA
15.	Difficulty concentrating	H	D	H	DA
16.	Hypervigilance	H	H	H	AA
17.	Exaggerated startle response	H	H	H	AA

Note. DSM-IV = Diagnostic and Statistical Manual of Mental Disorders, 4th edition; R = Re-experiencing; A = Avoidance; N = Emotional numbing; H=Hyperarousal; D = Dysphoria; DA = Dysphoric Arousal; AA = Anxious Arousal

Table 2

Spearman Correlations across 17 items of the Posttraumatic Stress Disorder Checklist (N = 279,897).

Items		Mean (SD)	Skewness	Kurtosis	Spearman Correlation															
					1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
1.	Intrusive thoughts of trauma	1.97 (1.14)	.99	−.05	-															
2.	Recurrent dreams of trauma	1.77 (1.09)	1.34	.82	.76	-														
3.	Flashbacks	1.58 (0.98)	1.75	2.27	.71	.72	-													
4.	Emotional reactivity to trauma cues	1.79 (1.10)	1.34	.85	.75	.69	.74	-												
5.	Physiological reactivity to trauma cues	1.61 (1.02)	1.71	2.07	.67	.67	.73	.73	-											
6.	Avoiding thoughts of trauma	1.91 (1.21)	1.16	.17	.71	.66	.66	.72	.68	-										
7.	Avoiding reminders of trauma	1.51 (1.17)	1.51	1.17	.67	.65	.69	.71	.70	.76	-									
8.	Inability to recall aspects of trauma	1.59 (1.01)	1.75	2.27	.55	.54	.56	.57	.57	.58	.59	-								
9.	Loss of interest	2.13 (1.23)	.86	−.36	.54	.50	.52	.55	.52	.54	.55	.50	-							
10.	Detachment	2.00 (1.24)	1.05	−.09	.60	.54	.57	.61	.58	.60	.60	.52	.69	-						
11.	Restricted affect	1.77 (1.16)	1.43	.91	.56	.53	.56	.58	.57	.58	.58	.50	.60	.71	-					
12.	Sense of foreshortened future	1.81 (1.19)	1.38	.74	.56	.53	.56	.57	.56	.56	.56	.49	.60	.64	.62	-				
13.	Sleep disturbance	2.13 (1.31)	.68	−.76	.51	.49	.48	.50	.50	.49	.48	.41	.50	.52	.48	.50	-			
14.	Irritability	1.93 (1.12)	1.14	.45	.55	.52	.54	.58	.55	.55	.54	.47	.53	.59	.58	.54	.51	-		
15.	Difficulty concentrating	1.90 (1.09)	1.18	.59	.57	.53	.56	.58	.56	.56	.57	.56	.62	.63	.59	.57	.53	.61	-	
16.	Hypervigilance	2.01 (1.28)	1.04	−.15	.60	.58	.60	.61	.60	.60	.60	.50	.51	.56	.54	.53	.48	.55	.53	-
17.	Exaggerated startle response	1.83 (1.18)	1.33	.68	.63	.61	.64	.64	.65	.62	.63	.54	.54	.59	.57	.56	.50	.60	.60	.70	-

Note. Items separated to reflect *DSM-IV* clusters of re-experiencing (items 1-5), avoidance (items 6-12), and hyperarousal (items 13-17)

Table 3

Fit Statistics for the DSM-IV, Dysphoria, Numbing, and Five-factor Models in the Full Sample (n =279,897).

Model	S–B χ^2	χ^2	df	CFI	TLI	RMSEA	AIC	BIC	SRMR
DSM-IV	140113.742	253422.261	116	.939	.929	.088	10842188.714	10842578.775	.034
Dysphoria	68382.580	121689.164	113	.971	.965	.062	10710461.317	10710883.004	.025
Numbing	79099.212	140885.299	113	.966	.960	.067	10729657.452	10730079.139	.029
5-factor	59837.644	106163.370	109	.975	.968	.059	10694943.523	10695407.379	.025

Note. S–B χ^2 = Satorra-Bentler Scaled Correction Chi-square, χ^2 = Chi-square, df = degrees of freedom, CFI = comparative fit index, TLI = Tucker Lewis Index, RMSEA = root square error of approximation, AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion, SRMR = standardized root mean square residual, EUR = European Ancestry, AFR = African Ancestry

Table 4

Results of Multi-group Confirmatory Factor Models by Ancestry and Sex.

Model	χ^2	df	CFI	TLI	RMSEA	AIC	BIC	SRMR
5-Factor Model	106163.4	109	.975	.968	.059	10694944	10695407	.025
Ancestry								
Configural Invariance	106590.5	436	.974	.968	.059	10652808	10655380	.025
Metric Invariance	109313.6	572	.973	.969	.057	10655459	10657651	.027
Scalar Invariance	114450.0	508	.972	.970	.056	10660523	10662336	.028
Strict Invariance	129828.4	559	.968	.969	.057	10675799	10677075	.029
Sex								
Configural Invariance	106978.5	218	.974	.968	.059	10672487	10673773	.024
Metric Invariance	108486.2	230	.974	.969	.058	10673971	10675131	.026
Scalar Invariance	114855.6	242	.973	.969	.058	10680316	10681349	.026
Strict Invariance	123639.4	259	.970	.969	.058	10689066	10689920	.027

Note. Configural Invariance = groups constrained to equality, Metric Invariance = loadings constrained to equality, Scalar Invariance = loadings and intercepts constrained to equality, Strict Invariance = loadings, intercepts, and residuals constrained to equality

Table 5

Factor Loadings for Five-factor Model for each Ancestry Groups.

Items		Standardized Factor Loadings			
		EUR (*n* = 233,707)	**AFR (*n* = 31,690)**	**AMR (*n* = 12,250)**	**EAS (*n* = 2,250)**
Factor 1: Re-experiencing					
1.	Intrusive thoughts of trauma	.867 (.001)	.889 (.001)	.889 (.002)	.889 (.005)
2.	Recurrent dreams of trauma	.849 (.001)	.885 (.001)	.884 (.002)	.868 (.006)
3.	Flashbacks	.869 (.001)	.900 (.001)	.901 (.002)	.909 (.004)
4.	Emotional reactivity to trauma cues	.890 (.001)	.907 (.001)	.906 (.002)	.911 (.004)
5.	Physiological reactivity to trauma cues	.855 (.001)	.868 (.002)	.882 (.002)	.880 (.005)
Factor 2: Avoidance					
6.	Avoiding thoughts of trauma	.878 (.001)	.904 (.001)	.895 (.002)	.913 (.005)
7.	Avoiding reminders of trauma	.890 (.002)	.912 (.001)	.915 (.002)	.922 (.004)
Factor 3: Emotional Numbing					
8.	Inability to recall aspects of trauma	.667 (.002)	.696 (.003)	.714 (.005)	.740 (.010)
9.	Loss of interest	.793 (.001)	.829 (.002)	.842 (.003)	.834 (.007)
10.	Detachment	.873 (.001)	.880 (.002)	.887 (.002)	.882 (.006)
11.	Restricted affect	.819 (.001)	.845 (.002)	.843 (.003)	.858 (.007)
Factor 4: Dysphoric Arousal					
12.	Sense of foreshortened future	.769 (.001)	.809 (.002)	.816 (.003)	.814 (.008)
13.	Sleep disturbance	.666 (.001)	.732 (.003)	.743 (.004)	.746 (.010)
14.	Irritability	.768 (.001)	.832 (.002)	.822 (.003)	.829 (.007)
15.	Difficulty concentrating	.793 (.001)	.847 (.002)	.846 (.003)	.851 (.007)
Factor 5: Anxious Arousal					
16.	Hypervigilance	.828 (.001)	.804 (.002)	.835 (.003)	.824 (.008)
17.	Exaggerated startle response	.882 (.001)	.897 (.002)	.915 (.002)	.918 (.006)

Note. EUR = European Ancestry, AFR = African Ancestry, AMR = Ad Mixed ancestry, EAS = East Asian ancestry

Table 6

Factor Loadings for Five-factor Model for Men and Women.

Items		Standardized Factor Loadings	
		Men (*n* = 257,986)	**Women (*n* = 21,911)**
Factor 1: Re-experiencing			
1.	Intrusive thoughts of trauma	.873 (.001)	.869 (.002)
2.	Recurrent dreams of trauma	.864 (.001)	.835 (.002)
3.	Flashbacks	.882 (.001)	.869 (.002)
4.	Emotional reactivity to trauma cues	.895 (.001)	.906 (.001)
5.	Physiological reactivity to trauma cues	.861 (.001)	.884 (.002)
Factor 2: Avoidance			
6.	Avoiding thoughts of trauma	.884 (.001)	.882 (.002)
7.	Avoiding reminders of trauma	.897 (.001)	.907 (.002)
Factor 3: Numbing			
8.	Inability to recall aspects of trauma	.682 (.001)	.656 (.004)
9.	Loss of interest	.800 (.001)	.843 (.002)
10.	Detachment	.875 (.001)	.883 (.002)
11.	Restricted affect	.827 (.001)	.830 (.002)
Factor 4: Dysphoric Arousal			
12.	Sense of foreshortened future	.787 (.001)	.733 (.003)
13.	Sleep disturbance	.685 (.001)	.670 (.004)
14.	Irritability	.782 (.001)	.781 (.003)
15.	Difficulty concentrating	.805 (.001)	.817 (.003)
Factor 5: Anxious Arousal			
16.	Hypervigilance	.826 (.001)	.876 (.002)
17.	Exaggerated startle response	.886 (.001)	.880 (.002)

Posttraumatic Stress Disorder Checklist (Million Veteran Program)

How much have you been bothered by that problem in the past month?

Not at all *A little bit* *Moderately* *Quite a bit* *Extremely*

1. Repeated, disturbing memories, thoughts or images of a stressful experience from the past?

2. Repeated, disturbing dreams of a stressful experience from the past?

3. Suddenly acting or feeling as if a stressful experience were happening again (as if you were reliving it)?

4. Feeling very upset when something reminded you of a stressful experience from the past?

5. Having physical reactions (e.g., heart pounding, trouble breathing, sweating) when something reminded you of a stressful experience from the past?

6. Avoiding thinking about or talking about a stressful experience from the past or avoiding having feelings related to it?

7. Avoiding activities or situations because they reminded you of a stressful experience from the past?

8. Trouble remembering important parts of a stressful experience from the past?

9. Loss of interest in activities you used to enjoy?

10. Feeling distant or cutoff from other people?

11. Feeling emotionally numb or being unable to have loving feelings for those close to you?

12. Feeling as if your future will somehow be cut short?

13. Trouble falling or staying asleep?

Items	Standardized Factor Loadings	
	Men (*n* = 257,986)	Women (*n* = 21,911)
14. Feeling irritable or having angry outbursts?		
15. Having difficulty concentrating?		
16. Being 'super alert' or watchful or on guard?		
17. Feeling jumpy or easily startled?		