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Symptom severity in PTSD and comorbid psychopathology: A latent profile analysis among traumatized veterans

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ABSTRACT

Individuals diagnosed with posttraumatic stress disorder (PTSD) show remarkably different symptom presentations. Identification of diagnostic profiles of PTSD may contribute to knowledge about treatment modifications to enhance treatment effectiveness. The present study aimed to identify symptom severity classes among 236 Dutch veterans based on a broad range of psychopathology outcomes, including PTSD, using Latent Profile Analysis (LPA). Moreover, multinomial logistic regression was used to test whether class membership could be predicted by the number and characteristics of traumatic event types, coping and personality dimensions. LPA identified three classes of individuals, defined as average, severe, and highly severe symptom severity classes, respectively. No qualitative differences in the symptom dimensions emerged between classes. Veterans with higher amounts of traumatic experiences and specifically with regard to lack of basic human needs, as well as those using more avoidant and problem-focused coping strategies and with more dysfunctional personality characteristics regarding neuroticism and agreeableness were significantly more often in the severe and/or highly severe symptom classes. In conclusion, general symptom severity was found to be an important diagnostic characteristic in this population. Integrated treatments targeting the broad spectrum of mental health problems may be of importance in treating patients that show low therapeutic recovery.

1. Introduction

Individuals with posttraumatic stress disorder (PTSD) (American Psychiatric Association, 1994) can have remarkably different symptom presentations (Galatzer-Levy & Bryant, 2013), and often exhibit a variety of comorbid symptoms or disorders (Ginzburg, Ein-Dor, & Solomon, 2010). Heterogeneity of psychopathology in traumatized individuals is likely to affect treatment outcome (Dalenberg, Glaser, & Alhassoon, 2012). This is especially pertinent for veterans with PTSD who have been found to show lower treatment recovery rates compared to other traumatized populations (Bradley, Greene, Russ, Dutra, & Westen, 2005; Forbes et al., 2012; Steenkamp, Litz, Hoge, & Marmar, 2015). Approximately two-thirds of veterans retained the PTSD diagnosis posttreatment (Steenkamp et al., 2015). Identification of PTSD patient profiles or subtypes could provide more insight into this heterogeneity, may help to explain differences in treatment response, and contribute to treatment modifications and enhance treatment effectiveness (Dalenberg et al., 2012; Flood et al., 2010; Galatzer-Levy & Bryant, 2013; Gerger, Munder, & Barth, 2014).

Recent studies on the heterogeneity in symptom presentations among traumatized patients used Latent Profile Analysis (LPA) to determine how individuals, based on shared symptom patterns, group together in classes. LPA has the advantage of using the full range of symptoms instead of categorical diagnoses and using continuous indicators of symptom severity instead of the dichomotized presence or absence of symptomatology (Au, Dickstein, Comera, Salters-Pedneault, & Litz, 2013). LPA-studies have identified simple vs complex (Cloitre, Gavert, Brewin, Bryant, & Maercker, 2013; Elklit, Hyland, & Shevlin, 2014), externalizing vs internalizing (Forbes, Elhai, Miller, & Creamer, 2010), dissociative (Armour, Elklit, Lauterbach, & Elhai, 2014; Tsai, Armour, Southwick, & Pietrzak, 2015), and depressive classes (Cao et al., 2015; Contractor, Roley-Roberts, Lagdon, & Armour, 2017) of PTSD.

Several LPA-studies have found evidence for a classification of PTSD and sometimes comorbid disorders based on the severity rather than the nature of different forms of psychopathology. These severity classes,

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often characterized by high, moderate, and low symptom severity, were reported for traumatized military populations (Armour et al., 2015; Contractor et al., 2015; Contractor, Caldas, Fletcher, Shea, & Armour, 2018; Steenkamp et al., 2012) as well as for victims of sexual assault (Au et al., 2013). All these studies identified three or four classes of symptom severity levels and did not report any qualitative differences in symptom distribution.

Little research has been conducted on class membership predictors of traumatized individuals with different symptom profiles. An important predictor for the severity of PTSD symptomatology is the amount and accumulation of traumatization (Renshaw, 2011). Perhaps even more important are the qualitative aspects of the traumatization, including the number of different traumatic event types experienced (Wilker et al., 2015). Two recent reviews reported the importance of distinguishing qualitative trauma classes instead of only a summative trauma event score. Not only high-trauma versus low-trauma classes but also specific trauma classes like e.g., childhood maltreatment differed on mental health correlates. Also, the risk for specific psychiatric disorders differed across these classes (Contractor et al., 2018; O'Donnell et al., 2017).

Besides trauma characteristics, the way a person copes with traumatic situations and their aftermath affects the course of posttraumatic psychopathology. These abilities can be defined by coping styles and personality characteristics. Coping refers to a variety of cognitive and behavioral strategies individuals use to manage external and internal stressors and includes problem-focused (active) coping, emotion-focused coping, avoidant coping and social support seeking (Litman, 2006). It has been demonstrated that active coping is associated with fewer PTSD symptoms, even in a group of veterans with substantial combat exposure (Wolfe, Keane, Kaloupek, Mora, & Wine, 1993), whereas avoidant coping is associated with greater PTSD severity (Badour, Blonigen, Boden, Feldner, & Bonn-Miller, 2012; Lawrence & Fauerbach, 2003; Sharkansky et al., 2000).

Personality traits are defined as patterns of behavior, thoughts, and emotions that remain stable over time. Dysfunctional personality traits have found to be positively related to PTSD (Bramsen, Dirkzwager, & Van der Ploeg, 2000; Gil & Caspi, 2006; Jakšić, Brajković, Ivezić, Topić, & Jakovljević, 2012). A commonly used personality concept is that of the five-factor model of personality (FFM; also, Big Five personality traits), that includes neuroticism, extraversion, openness, conscientiousness, and agreeableness (Costa & McCrae, 1992). Several studies examined this personality concept in relation to PTSD (see e.g., Jakšić et al., 2012; Stevanović, Frančišković, & Vermetten, 2016). These studies reported a significant correlation between neuroticism and the risk of developing PTSD symptoms, and poor mental health after exposure to trauma. As for other personality dimensions, the results are inconsistent, but several studies showed an association between PTSD and lower scores on agreeableness, extraversion, and openness (Jakšić et al., 2012).

The aim of this study was two-fold. First, using LPA, this study aimed to identify classes or profiles of psychopathology in a large sample of treatment seeking, trauma-exposed veterans. Previous LPA-studies examined PTSD and co-occurring Major Depressive Disorder (MDD) (Armour et al., 2015; Au et al., 2013), PTSD, MDD, and General Anxiety Disorder (Contractor et al., 2015) or PTSD and specific co-occurring symptoms like anger or impulsive behavior (Contractor et al., 2018). To our knowledge, this is the first study to examine a broad range of symptoms of psychopathology next to PTSD in traumatized patients. Second, this study examined how the different symptom classes were associated to several predictors not previously investigated in LPA-studies, including the number of qualitatively different traumatic events, the specific types of events, as well as different coping styles and personality characteristics.

Based on previous research, it was hypothesized that a three-class solution representing increased levels of overall symptom severity was best-fitting. Secondly, it was hypothesized that a higher total amount of different traumatic events, more avoidant coping and more dysfunctional personality traits, especially neuroticism, and less agreeableness, extraversion and openness would predict membership of the more severe symptom classes.

2. Methods

2.1. Participants and procedure

Participants were trauma-exposed Dutch military veterans referred for treatment at Foundation Centrum' 45, the Dutch national center for diagnostics and treatment of patients with long-lasting trauma related disorders.

All questionnaires were administered as part of a routine diagnostic assessment during the intake procedure to all patients applying for treatment at Centrum' 45. Assessments were primarily conducted for diagnostic procedures and secondarily for research purposes. To identify classes or profiles of psychopathology using LPA, cross-sectional data on general psychopathology and PTSD symptoms were used. These were available for 236 participants. Questionnaires with regard to general psychopathology and PTSD symptoms were continuously part of the test battery since Centrum' 45 started the routine diagnostic assessment procedure in 2001. To predict membership of the identified classes of psychopathology, data on the predictor variables (i.e., potential traumatic experiences, coping strategies, and Big Five personality traits) were used. Because the measures on these constructs were substituted or excluded from the test battery during the period in which data for the present study were collected, data on these constructs were available for part of the total sample of 236 participants for whom data on general psychopathology and PTSD symptoms were available. Specifically, data on potential traumatic experiences were available for a subsample of 112 participants, and data on coping strategies and Big Five personality traits were available for a subsample of 118 participants. Participants in the total sample were almost exclusively male (97%) and had a mean age of 41.6 years (SD = 10.0). No significant differences with regard to sex and age were found between both subsamples and the total sample. All participants were exposed to combat-related traumatic events, such as life-threatening situations, combat, violence, injury, and witnessing suffering and death. Table 2 shows that the majority of the participants scored above the clinical cut-off score of PTSD indicating a clinical level of PTSD symptom severity.

Data have been archived anonymously for scientific research purposes. The institutional review board of Leiden University stated that no review of the ethical merits of the study was needed because assessments were conducted primarily for diagnostic purposes within the institution and only secondarily for data analysis.

Severity of symptoms regarding nine symptom dimensions assessed with the Brief Symptom Inventory were compared to a large Dutch reference group consisting of 4650 adult outpatients who were referred for mood, anxiety, and somatoform complaints to a large center for mental health care in The Netherlands (De Beurs, 2011). The majority of the outpatients were female (63%) and had a mean age of 37.7 years (SD = 12.2). When interpreting the results the reader should realize that the reference group is representative of Dutch outpatients with mood, anxiety, and somatoform complaints (De Beurs, 2011) but not for military veterans and patients with psychotrauma related complaints.

2.2. Measures

2.2.1. Psychopathology

Self-reported severity of different symptom dimensions of psychopathology was assessed using the Dutch translation of the Brief Symptom Inventory (BSI; De Beurs, 2011; Derogatis & Melisaratos, 1983). Participants are asked how much they are bothered by 53 symptoms, rated on a 5-point scale (*not at all*, *a little bit*, *moderately*,

quite a bit, *extremely*). Symptom severity scores regarding nine symptom dimensions, i.e. *somatization*, *obsessive-compulsive*, *interpersonal sensitivity*, *depression*, *anxiety*, *hostility*, *phobic anxiety*, *paranoid ideation*, and *psychoticism*, were computed by averaging responses on the corresponding items. Scores could range between 0 and 4 with higher scores reflecting more severe symptoms. Good psychometric properties were reported for the Dutch translation of the BSI (De Beurs, 2011). The internal consistency of the symptom dimensions in the present study sample was acceptable to good (Cronbach's alpha ranging between 0.72–0.89). To enable interpretation of the symptom severity scores, symptom severity levels were used. Based on percentiles in the distribution of symptom severity scores in the reference group, seven symptom severity levels were established for each symptom dimension: *very low* (0–5%), *low* (5–20%), *below average* (20–40%), *average* (40–60%), *above average* (60-80%), *high* (80–95%), *very high* (95–100%) (De Beurs, 2011). In the present study, symptom severity on each of the symptom dimensions was considered low if a participant's score was below the 20th percentile in the distribution of symptom severity scores in the reference group; it was considered average if it fell into the 20-80th percentile; and it was considered high if it was above the 80th percentile. Gender differences in symptom severity scores were taken into account, since symptom severity levels for the reference group were specified for males and females separately.

2.2.2. PTSD symptoms

Self-reported PTSD symptoms were assessed with the Self-Rating Inventory for PTSD (SRIP; Hovens, Bramsen, & Van der Ploeg, 2002) or the second part of the Harvard Trauma Questionnaire (HTQ; Mollica et al., 1992). About half of the participants, participating before 2010, completed the SRIP, whereas the other half was assessed after 2010 with the HTQ. The SRIP asks participants how much they were bothered by 22 PTSD-symptoms during the past 4 weeks, whereas the HTQ asks how much participants were bothered by 16 PTSD-symptoms during the past week. Both instruments use the same 4-point response scale (*not at all*, *a little bit*, *quite a bit*, or *extremely*) and the items of both scales were based on and closely resemble the DSM-IV symptoms of PTSD. The PTSD symptom severity score was computed by averaging responses on the list of 22 PTSD-symptoms of the SRIP, or on the list of 16 symptoms of the HTQ, into one single score. The PTSD symptom severity score could range between 1 and 4 with higher scores reflecting more severe PTSD symptoms. Combining the data from both instruments was considered feasible because of the following reasons. First, both instruments had similar item content derived from DSM-IV PTSD symptoms. Second, both instruments had identical response scales. Third, correlations between PTSD severity and severity of the BSI dimensions were similar when PTSD was assessed with the SRIP or HTQ. Table 1 presents the correlations between PTSD symptom severity assessed with the HTQ and SRIP and the nine symptom dimensions of the BSI. It can be seen that the correlations were mostly positive, large, and significant, although some correlations of the SRIP with BSI dimensions were weaker compared to the correlations of the HTQ with these dimensions. Fourth, variation in and the distribution of scale PTSD symptom severity scores on both instruments were very similar (details can be obtained from the first author). Finally, good psychometric properties have been reported for both the SRIP (Hovens et al., 2002) and HTQ (Mollica et al., 1992) and internal consistencies of the SRIP and HTQ (Cronbach's alpha = 0.94 and 0.92 respectively) in the present study sample were also good.

Table 1
Pearson correlation coefficients between PTSD symptom severity scores as assessed with the SRIP and HTQ with the severity scores on the symptom dimensions of the BSI.

	SRIP PTSD symptom severity	HTQ PTSD symptom severity
Somatization	0.52*	0.70*
Obsessive-compulsive	0.70*	0.78*
Interpersonal sensitivity	0.53*	0.72*
Depression	0.63*	0.83*
Anxiety	0.74*	0.80*
Hostility	0.63*	0.62*
Phobic anxiety	0.71*	0.75*
Paranoid ideation	0.59*	0.72*
Psychoticism	0.65*	0.78*

* $p < 0.001$.

2.2.3. Exposure to potential traumatic events

Self-reported degree of exposure to traumatic events was assessed with the first part of the HTQ. Participants were asked to indicate their level of exposure to 19 types of potential traumatic events on a 4-point scale (*experienced, witnessed, heard of* or *no exposure)*. The total number of potential traumatic events was calculated by counting the number of self-experienced traumatic events. The resulting score has a potential maximum of 19. In a population of refugees it has been shown that traumatic events as assessed with the Harvard Trauma Questionnaire (HTQ) cluster on four separate domains of traumatic events (Knipscheer, Sleijpen, Mooren, Ter Heide, & Van der Aa, 2015). These four domains were events concerning "human right abuses" (e.g., torture, watching torture, serious injury, kidnapping, imprisonment), "traumatic loss" (murder of family member or friend, unnatural death of family or friend, murder of strangers), "lack of basic human needs" (lack of shelter, lack of food or water, ill health without access to medical care) and "separation from others" (forced separation from family members, forced isolation from others). The total number of potential traumatic events within each domain was calculated by counting the number of self-experienced traumatic events within the domains (the potential maximum scores were 7 for human right abuses; 3 for traumatic loss; 3 for lack of basic human needs; 2 for separation from others).

2.2.4. Coping strategies

Coping strategy was assessed with the Cope-Easy (Kleijn, Van Heck, & Van Waning, 2000), an adapted version of the COPE inventory (Carver, Scheier, & Weintraub, 1989). Participants are asked to indicate how inclined they are to respond to difficult situations with 32 coping-related behaviors, rated on a 4-point scale (*not applicable to me, a little applicable to me, quite a bit applicable to me, very much applicable to me*). Responses were classified into 15 subscales which, according to Litman (2006), could be further classified into four broad coping strategies: *problem-focused coping* (active coping, planning, suppression), *emotion-focused coping* (restraint coping, positive reinterpretation, acceptance, humor), *avoidant coping* (denial, behavioral disengagement, mental disengagement, substance abuse), and *social support seeking* (instrumental social support, emotional social support, venting). Scores on each subscale and coping strategy scale were calculated by averaging the corresponding item and subscale scores and could range between 1 and 4 with higher scores reflecting more frequent use of the corresponding coping strategy. Psychometric properties of the Cope-Easy were comparable to those reported with regard to the COPE inventory (Kleijn et al., 2000). Internal consistency of the coping strategy scales in the present study sample was acceptable to good (Cronbach's alpha ranging between 0.65–0.83).

2.2.5. Personality traits

The FFM of personality was assessed with the NEO Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992). Participants were asked to indicate to what extent they agreed with 60 personality-related statements, rated on a 5-point scale (*strongly disagree, disagree, neutral, agree, strongly agree*). Scores on the five personality traits, i.e. *neuroticism*, *extraversion*, *openness*, *agreeableness*, and *conscientiousness*, were computed by summing responses on the corresponding items. Scores could range between 12 and 60 with higher scores reflecting higher levels of

the corresponding personality trait. Internal consistency of the personality trait scales in the present study sample was acceptable to good (Cronbach's alpha ranging between 0.65–0.89).

2.3. Statistical analyses

Since the range of the scale of the PTSD symptom dimension (1–4) was different from the range of the scale of the symptom dimensions regarding psychopathology (0–4), scores on all symptom dimensions were standardized to simplify interpretation of the LPA results. LPA in MPlus version 7.3 (Muthén & Muthén, 1998-2012; Muthén and Muthén, 1998) was used to identify classes based on severity of psychopathology. LPA is a statistical technique used to classify individuals into homogeneous latent classes or subgroups. The robust maximum likelihood estimator (MLR) was used, in combination with full information maximum likelihood estimation to include participants with missing data. Complete data were available for 94.5% of the participants. To avoid local likelihood maxima 1000 random sets of starting values in the first and 100 in the second step of optimization were requested and 50 initial stage iterations were used. In LPA it is common to estimate a series of models with increasing numbers of latent classes until a model is not identified or when no acceptable model fit is achieved (DiStefano & Kamphaus, 2006; Masyn, 2013). Model fitting was terminated after estimating a model with seven latent classes because the majority of model fit indices indicated a worse fit of this model compared to the model with six latent classes. The model with the least number of latent classes with acceptable model fit and classification quality, as well as theoretical substantive meaning was selected as the most optimal solution. The Bootstrapped Likelihood Ratio Test (BLRT), Lo-Mendell-Rubin adjusted likelihood ratio test (LMR-A), and the Bayesian Information Criterion (BIC) were used as model fit criteria to compare models with different class solutions. Using the BLRT and LMR-A test, the estimated model is compared to a model with 1 class less. A significant p-value indicates that the estimated model fits the data better than the model with 1 class less (Nylund, Asparouhov, & Muthén, 2007). Regarding the BLRT, 500 bootstrap samples were requested with 50 sets of starting values in the first and 20 in the second step of optimization to avoid local likelihood maxima in each bootstrap sample. BIC makes a trade-off between model fit and model complexity with a lower value of BIC indicating a better fit of the model to the data (Van der Schoot, Lugtig, & Hox, 2012). BLRT did not yield a significant p-value and the lowest value of BIC was reached in a highly complex model with six latent classes – a situation common to LPA (Masyn, 2013). As an alternative, diminishing gains in model fit according to the log likelihood and BIC across models with increasing number of latent classes were explored. When increasing the number of latent classes is starting to be accompanied by a diminishing gain in model fit this indicates a marginal and non-substantive gain in information; it is therefore likely that the minimal number of classes with substantive meaning and acceptable model fit is reached at this point (Masyn, 2013; Nylund et al., 2007). To evaluate classification quality the entropy statistic was used, in combination with the average assignment probabilities for each individual class. Classification quality is considered adequate when entropy values are > 0.80 (Celeux & Soromenho, 1996).

Class membership was predicted by regressing the latent classes in the optimal class solution on a set of observed predictor variables (i.e., number and domains of potential traumatic event types, coping strategies, and Big Five personality traits) by conducting a series of multinominal logistic regression models using the three-step procedure in Mplus (Asparouhov & Muthén, 2014). Because data on the predictor variables were available for subsamples of different composition and MPlus handles missing values in the predictor variables with list wise deletion in this context, separate multinomial regression models were estimated for each of the 4 predictor variable domains (i.e. total number of potential traumatic events, types of potential traumatic events, coping strategies, and Big Five personality traits).

Table 2
Mean symptom severity scores and the percentage of participants with clinical symptom severity with regard to 10 symptom dimensions of psychopathology.

	Mean (SD)	% in clinical range
PTSD	2.69 (0.66)	63.4
Somatization	1.22 (0.80)	78.4
Obsessive-compulsive	2.19 (0.98)	88.8
Interpersonal sensitivity	1.48 (0.99)	74.7
Depression	1.92 (0.98)	89.3
Anxiety	2.01 (1.01)	91.8
Hostility	1.67 (1.03)	88.0
Phobic anxiety	1.65 (1.20)	83.6
Paranoid ideation	1.67 (1.02)	78.5
Psychoticism	1.43 (0.86)	84.5

Note: Mean (SD): Mean levels and standard deviations of symptom severity based on the scores of the BSI (range: 0–4) and HTQ (range: 1–4); PTSD = Posttraumatic Stress Disorder.

3. Results

3.1. Overall symptom severity

Symptom severity and endorsement with regard to all symptom dimensions are presented in Table 2. With regard to all symptom dimensions, the large majority of participants scored above the clinical cut-off score, indicating clinical levels of symptom severity. This indicates that participants in the present study did not suffer with regard to one single symptom dimension, but rather suffered with regard to multiple co-morbid symptom dimensions.

3.2. Latent profile analysis

Table 3 presents the model fitting results of the LPA with 10 symptom dimensions. The 2- and 3-class solutions yielded significant BLRT and LMR-A tests, indicating that fit of the 2-class solution was better than the single-class solution and that the fit of the 3-class solution was better than the 2-class solution. This was also supported by the BIC. The 4- to 7-class solutions showed mixed results. The 4- to 7-class solutions yielded significant BLRT tests, indicating the best fit for the 7-class solution. The LMR-A was not significant in the 4- to 7-class solution, suggesting that the 3-factor solution fitted the data best. BIC indicated the 6-class solution as the best fitting model. Since BLRT did not yield a significant p-value and the lowest value of BIC was reached in the highly complex model with six latent classes, gain in model fit according to the log likelihood and BIC across models with increasing numbers of latent classes was also explored. In Table 3 the following pattern can be seen: the log likelihood and BIC increase by a substantial amount when moving from one class to two classes and from two classes to three classes. When moving from three classes to four classes and across subsequent classes there is a diminishing gain in log likelihood and BIC. According to the log likelihood and BIC, the model with 3 latent classes is the most parsimonious model with acceptable model fit, which is also in line with LMR-A.

Fig. 1 depicts the mean symptom severity on the symptom dimensions in each of the classes for the 3-, 4-, 5-, and 6-class solution. Because all scores on the symptom dimensions were standardized, the mean symptom severity scores in Fig. 1 are also standardized. The 3-class solution was preferred over the 4-class solution because the second and third class in the 4-class solution were very similar to the second class in the 3-class solution. The 3-class solution was also preferred over the 5- and 6-class solution because the class sizes in the 5- and 6-class solutions were small and did not add to the interpretability of the results. The entropy value of 0.916 indicated that classification quality of the 3-class solution was adequate. The average assignment

Table 3
Model fitting results for latent profile analysis of severity of psychopathology.

	Entropy	BIC	Log-likelihood	BLRT		LMR-A	
				−2LL difference	p-value	Value	p-value
1 Class	1.000	6688.809	−3289.766	–	–	–	–
2 Classes	0.926	5562.158	−2696.390	1186.740	< 0.001	11167.330	< 0.001
3 Classes	**0.916**	**5222.392**	**−2496.456**	**399.889**	**< 0.001**	**393.324**	**0.002**
4 Classes	0.888	5161.290	−2435.853	121.195	< 0.001	119.221	0.337
5 Classes	0.866	5147.880	−2399.097	73.506	< 0.001	72.309	0.450
6 Classes	0.870	5137.499	−2363.856	70.486	< 0.001	69.329	0.276
7 Classes	0.892	5153.969	−2342.040	43.629	< 0.001	42.918	0.195

Note: Best fitting model is printed in bold. BIC = Bayesian Information Criterion; BLRT = Parametric bootstrapped likelihood ratio test; -2LL difference = -2 times log-likelihood difference between a N class solution and N – 1 class solution; LMR-A = Lo-Mendell-Rubin adjusted likelihood ratio test.

probabilities for each individual class also indicated a high precision of the classification for the 3-class solution: 0.959 for the first class, 0.974 for the second class, and 0.956 for the third class. The 3-class solution was therefore selected as the most meaningful and parsimonious model.

In Fig. 1A can be seen that participants in the first class showed the lowest symptom severity on the symptom dimensions compared to participants in the second and third class. Fig. 2 presents the percentage of participants in each class reporting low (non-clinical), average and high severity on the symptom dimensions compared to a large reference group of Dutch outpatients. Fig. 2A shows that most participants endorsed in the first class reported low or average symptom severity on the symptom dimensions compared to the reference group. The first class was therefore labeled as the average severity symptom class. Participants in the second class reported lower symptom severity compared to those in the third class but more severe symptom severity than participants in the first class as can be seen in Fig. 1A. Fig. 2B shows that most participants in the second class reported average or severe symptom severity compared to the reference group. The second class was therefore labeled as the severe symptom class. Fig. 1A showed that the third class consisted of participants reporting the most severe symptoms of all classes. Fig. 2C shows that the large majority of participants in the third class reported higher symptom severity compared to the reference group. The third class was therefore labeled as the highly severe symptom class. Overall, 30.5% (N = 72) of participants were classified into the average symptom class, 39.4% (N = 93) in the severe symptom class, and 30.1% (N = 71) into the highly severe symptom class.

3.3. Predictors of class membership

Means and standard deviations of the total number of types of potential traumatic events, number of potential traumatic events within the trauma domains, coping strategies, and personality traits are presented in Table 4. Results of the multinomial logistic regression analyses are presented in Table 5. The B coefficients (log odds) indicate how much more or less likely it becomes to be in a symptom severity class compared to the other symptom severity classes, with every unit increase in the predictor variable. In the first and second model the latent classes were regressed on the total number and domains of potential traumatic event types respectively. In the third and fourth model the latent classes were regressed on coping strategies and Big Five personality traits respectively.

Participants with higher levels of problem-focused and avoidant coping, and those who reported more potential traumatic event types and lack of basic human needs were significantly more often in the highly severe symptom class compared to the average severity symptom class. Participants with higher levels of agreeableness were significantly less often in the highly severe symptom class compared to the average severity symptom class. Traumatic event types of human right abuses, traumatic loss, and separation from others, as well as the coping

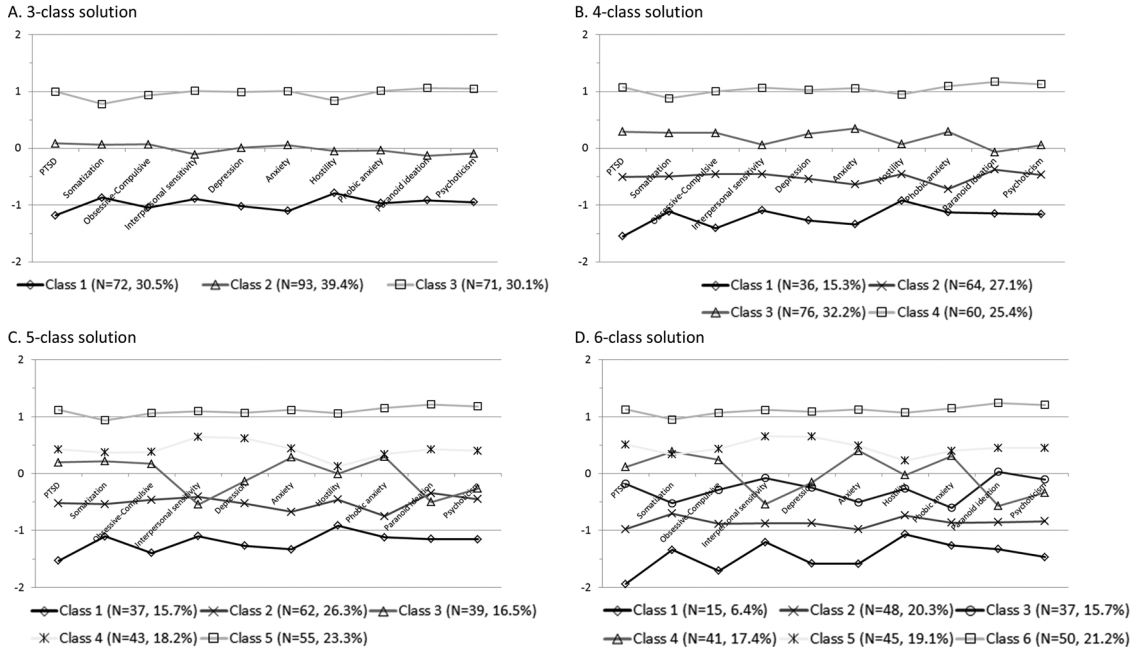

Fig. 1. Mean scores (standardized) on the symptom dimensions in each of the classes for the 3-, 4-, 5-, and 6-class solution.

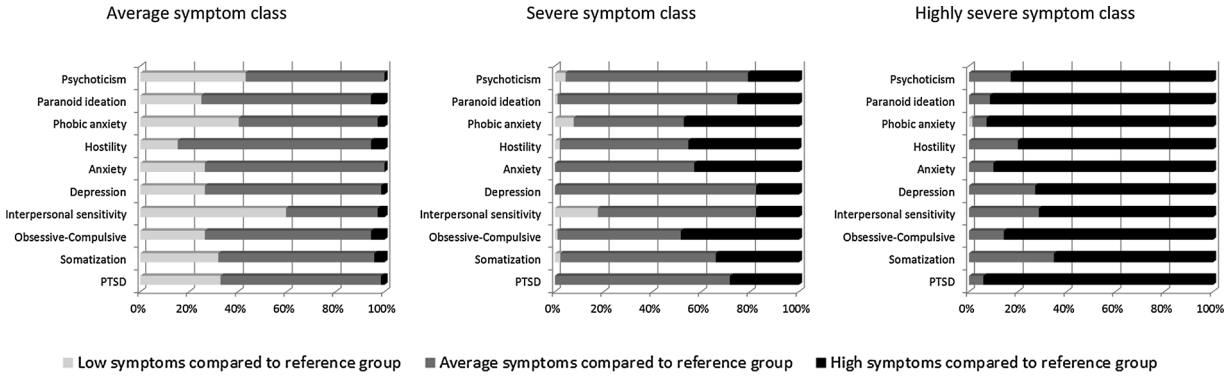

Fig. 2. Percentage of participants with low, average, and high symptom severity with regard to the symptom dimensions compared to a reference group of outpatients for each of the three classes.

strategies social support seeking and emotion-focused coping, and the personality traits neuroticism, extraversion, openness, and conscientiousness did not differentiate between the highly severe and average severity symptom class.

Participants reporting higher levels of avoidant coping and lower levels of agreeableness were significantly more often in the highly severe symptom class compared to the severe symptom class. The number of potential traumatic event types, as well as the trauma domains did not differentiate between the highly severe and severe symptom class. The same holds for the coping strategies and personality traits except avoidant coping and agreeableness.

Participants who reported more potential traumatic event types and those with higher levels of avoidant coping and neuroticism were significantly more often in the severe symptom class compared to the average symptom class. The trauma domains did not differentiate between the severe and average symptom class. The same holds for the coping strategies problem-focused coping, social support seeking, and emotion-focused coping, as well as all personality traits except neuroticism.

4. Discussion

In a clinical sample of 236 treatment seeking traumatized Dutch veterans with long-lasting PTSD and general psychopathology, LPA identified three classes of individuals with different severity levels of psychopathology. By comparing our findings to a large reference group of male mental health care outpatients in the Netherlands, our three classes were labelled as an “average”, a “severe” and a “highly severe” symptom severity class.

As far as we know, this is the first LPA-study that not only investigated PTSD and MDD, but a broad range of general psychopathology domains. Also, testing whether class membership could be predicted by potential traumatic event types, coping styles and personality traits was done for the first time.

4.1. Diagnostic characteristics

Differences between the identified classes could only be characterized by differences in symptom severity with regard to a broad spectrum of symptom dimensions. No qualitative differences with regard to the symptom dimensions have emerged between the classes (see Fig. 1). This signifies that not only PTSD or MDD, as found in previous studies (Armour et al., 2015; Au et al., 2013; Contractor et al., 2015), but a broad spectrum of mental health symptoms is associated with the psychological distress found in a severe traumatized population. An important consequence of this findings is that classification of overall symptom severity is more important compared to classification of separate mental disorders like PTSD or MDD when diagnosing traumatized patients with enduring complaints.

Based on this finding it could be argued that not just the severe traumatic experiences, but perhaps even more the long-lasting post-traumatic symptomatology and the subsequent stressors cause diffuse psychopathology and comorbidity. Prior research showed that soldiers with high levels of combat exposure and high PTSD severity levels

Table 4
Means scores (M) and standard deviations (SD) of predictor variables for each latent class.

	Average severity class		Severe symptom class		Highly severe class	
	N	M (SD)	N	M (SD)	N	M (SD)
Traumatic event types						
Total number	27	5.44 (4.16)	41	9.15 (3.85)	40	10.23 (4.09)
Human right abuses	27	1.30 (2.02)	41	2.73 (1.86)	40	2.60 (2.00)
Traumatic loss	27	0.67 (0.92)	41	0.88 (0.90)	40	1.33 (1.14)
Separation from others	27	0.33 (0.56)	41	0.78 (0.79)	40	0.93 (0.83)
Lack of basic human needs	27	0.93 (1.07)	41	1.85 (1.17)	40	2.18 (0.98)
Coping strategies						
Problem-focused coping	44	2.78 (0.55)	49	2.73 (0.60)	23	2.82 (0.65)
Avoidant coping	43	1.75 (0.32)	47	1.99 (0.38)	25	2.25 (0.48)
Social support seeking	43	2.15 (0.57)	48	2.15 (0.66)	24	2.01 (0.68)
Emotion-focused coping	43	2.26 (0.51)	47	2.14 (0.51)	25	2.14 (0.47)
Personality traits						
Neuroticism	43	34.19 (7.87)	47	41.83 (7.12)	26	47.62 (7.41)
Extraversion	44	37.77 (7.46)	46	33.46 (6.26)	26	27.65 (6.19)
Openness	43	36.58 (5.42)	45	36.27 (6.54)	26	34.19 (4.78)
Agreeableness	41	41.22 (5.18)	47	39.51 (6.13)	25	33.12 (5.53)
Conscientiousness	44	44.20 (5.46)	47	39.77 (6.23)	26	37.08 (8.00)

Table 5
Multinomial regression analysis of severity of psychopathology classes on number of potential traumatic event types, coping styles, and personality traits.

	Severe symptom class			Highly severe symptom class					
	Versus average symptom class			Versus average symptom class			Versus severe symptom class		
	B	SE	95% CI B	B	SE	95% CI B	B	SE	95% CI B
Traumatic event types									
Total number	0.49*	0.24	0.02– 0.95	0.53*	0.23	0.08– 0.98	0.05	0.06	−0.06–0.16
Human right abuses	0.53	1.25	−1.92–2.98	0.30	1.16	−1.97–2.57	−0.23	0.18	−0.59–0.13
Traumatic loss	0.12	0.78	−1.41–1.65	0.60	0.70	−0.77–1.97	0.48	0.28	−0.08–1.03
Separation from others	0.57	0.81	−1.02–2.16	0.80	0.70	−0.58–2.17	0.23	0.39	−0.53–0.99
Lack of basic human needs	0.55	0.31	−0.05–1.15	0.78*	0.29	0.21–1.35	0.23	0.25	−0.25–0.72
Coping strategies									
Problem-focused coping	0.26	0.53	−0.78–1.30	1.36*	0.66	0.06– 2.66	1.10	0.61	−0.08–2.29
Avoidant coping	1.97*	0.68	0.63–3.31	4.46*	1.12	2.26–6.66	2.49*	1.09	0.36–4.63
Social support seeking	−0.17	0.41	−0.97 –0.64	−0.78	0.55	−1.85–0.30	−0.61	0.54	−1.67–0.45
Emotion-focused coping	−0.45	0.60	−1.62–0.72	−0.29	0.85	−1.95–1.37	0.16	0.76	−1.33–1.64
Personality traits									
Neuroticism	0.10*	0.04	0.02–0.17	0.21	0.12	−0.02–0.44	0.11	0.12	−0.13–0.35
Extraversion	−0.02	0.05	−0.11–0.07	−0.11	0.06	−0.23–0.00	−0.09	0.05	−0.20–0.01
Openness	−0.03	0.05	−0.13–0.06	−0.04	0.07	−0.18–0.09	−0.01	0.06	−0.13–0.11
Agreeableness	0.00	0.06	−0.11–0.11	−0.22*	0.08	−0.38–−0.05	−0.22*	0.09	−0.39–−0.05
Conscientiousness	−0.07	0.05	−0.17–0.04	−0.01	0.08	−0.16–0.15	0.06	0.07	−0.08–0.20

* $p < 0.05$.

reported more post-deployment stressors (Sharkansky et al., 2000) and reacted stronger to stressors in general (Smid, Kleber, Rademaker, Van Zuiden, & Vermetten, 2013). Severe PTSD and subsequent stressors lead to enduring posttraumatic stress responses, causing a mix of psychopathology and gradual loss of adaptive abilities, lower levels of occupational and social adjustment, detrimental effects on psychosocial functioning and poorer health related functioning (Armour et al., 2015; Au et al., 2013; Sareen et al., 2007; Stander, Thomson, & Highfill-McRoy, 2014; Tsai, Harpaz-Rotem, Pietrzak, & Southwick, 2012). These findings support the previously described concept of a cascade of symptoms or syndromes evolving over time, initiated by either the original traumatic events or by PTSD itself (Alarcon, Glover, & Deering, 1999).

4.2. Predictors of severity classes

Participants with a higher amount of different traumatic event types were significantly more often in the highly severe and severe symptom class compared to the average severity symptom class. This indicates that the number of traumatic event types appeared to be a general predictor of overall symptom severity. Looking more in detail to qualitative aspects of traumatic events, we clustered the HTQ-events in four qualitative domains of traumatic experience according to the findings of Knipscheer et al. (2015). Only traumatic events related to “lack of basic human needs” appeared to differentiate between the highly severe symptom class and the average severity symptom class. The other domains of traumatic event types did not differentiate between the classes. Lack of basic human needs can be defined by a lack of material supportive kind of needs. A possible explanation for this finding can be that material (and social) support during and after trauma experiences is perceived as an important factor influencing severity and duration of psychopathology (Sripada, Lamp, Defever, Venners, & Rauch, 2016; Tsai et al., 2012).

With respect to coping mechanisms we found that participants with higher levels of avoidant coping were more often in the severe and highly severe symptom class compared to the average severity symptom class. This finding is in line with previous studies. Avoidance in general interferes with the normal processing of traumatic memories, and is associated with high levels of PTSD, persistence of psychopathology and poor adjustment and this is also the case for avoidant coping (Badour et al., 2012; Sharkansky et al., 2000; Tsai et al., 2012). Remarkably, participants with higher levels of problem-focused coping were also more often in the highly severe symptom class compared to the average severity symptom class. This is not in line with previous findings (Sharkansky et al., 2000), though overlap in use of active, problem-focused and avoidant coping styles are reported (Schnider, Elhai, & Gray, 2007). Veterans in the highly severe symptom class may have more urge to deal with perceived threats, psychopathology and their dysfunctioning. Increased coping behaviour reflects a certain degree of mastery over the situation. In the face of overwhelming stress related demands, the individual is forced to employ several coping strategies simultaneously, amongst them also problem-focused coping strategies (Wind & Komproe, 2017).

For personality characteristics according to the FFM, we found that participants in the highly severe symptom class showed lower ‘agreeableness’ compared to the average symptom class. Agreeableness did not differentiate between the severe and average symptom class. Persons with the characteristic ‘less agreeableness’ are usually less warm and friendly, get along less well with others and have a less optimistic view of human nature (Costa & McCrae, 1992). Individuals with such personality characteristics may be more vulnerable because they are more prone to be socially isolated and hence receive less social support. In general, less social support is associated with poor mental health and poor psychosocial functioning. Participants in the severe symptom class showed significantly higher levels of neuroticism compared to the average severity class. Participants in the highly severe symptom class showed even higher levels of neuroticism. However, neuroticism appeared not to differentiate significantly between the highly severe and average symptom class, which is most likely due to the small sample size of the highly severe symptom class. Persons with higher levels of neuroticism tend to react with strong emotions to stressful events, suffer more from depressive moods and feelings of anger and anxiety, have a higher level of threat appraisal and distress to stressful events and tend to have less social support. Each of these factors make neuroticism to be a risk factor for psychopathology in general and more specific for PTSD, symptom severity and poor mental health outcomes (Breslau & Schultz, 2013; Jakšić et al., 2012; Stevanović et al., 2016).

Taken together, we can conclude in line with previous research, that participants in the average symptom class had experienced less traumatic event types, and had less dysfunctional personality characteristics in comparison to participants in the severe and highly severe classes, with higher scores on agreeableness and lower levels of neuroticism. Comparing the two higher symptom severity classes, higher levels of

avoidant coping and lower levels of agreeableness but not the trauma characteristics differentiated between these two classes. This suggests that personality characteristics are of more importance in differentiating between highly severe and severe symptom classes than the experienced amount or nature of traumatic events.

4.3. Clinical implications

The results have implications for the classification of PTSD. In the DSM-5, severity subtypes for several mental health disorders are included (APA, 2013). Next to existing PTSD-subtypes like the dissociative subtype, the description of subtypes on the continuum of severity could also be an important way to classify PTSD. Further, clinicians should not only focus on specific DSM-diagnoses, but they should also keep in mind a broad diagnostic perspective, with attention to comorbid symptoms, disorders and significant psychosocial dysfunctions. This is especially important for patients with a high amount of different traumatic event types experienced and with enduring mental health complaints.

Classification of subtypes should have implications for treatment outcomes (Dalenberg et al., 2012). Whether differences in severity levels have consequences for treatment efficacy could not be investigated in this study. In several previous studies, high severity and chronic PTSD but also poor adjustment levels, mental defeat, feelings of less hope, extensive comorbidity and feelings of anger in combat veterans are associated with poor treatment outcome results (Forbes, Creamer, Hawthorne, Allen, & McHugh, 2003; Haagen, Smid, Knipscheer, & Kleber, 2015; Lloyd et al., 2014). As these predictors are likely to be associated with severe psychopathology, especially the veterans who belong to the highly severe symptom class might not benefit fully from regular PTSD treatment approaches.

We found that especially an avoidant coping style, and personality characteristics with high levels of neuroticism and low levels of agreeableness were more often in the severe symptom classes compared to the average symptom class. As previous studies suggested, avoidant coping not only predicts greater PTSD severity but also a poorer treatment response. Adapting trauma treatment programs, specifically targeting dysfunctional avoidant coping mechanisms could be advantageous, especially in case of highly severe, chronic traumatized patients with low recovery rates (Badour et al., 2012). High neuroticism is associated with a tendency to utilize less social support, a higher sensitivity to stress, and a higher level of threat appraisal and negative affect. Each of these factors is associated with poorer mental health outcomes (Jakšić et al., 2012; Stevanović et al., 2016). Together with the findings of less agreeableness and a higher amount of the trauma characteristic 'lack of basic human needs' in the highly severe symptom class, our findings suggest that it would be useful if treatment focused on helping patients to strengthen their skills in seeking social support and handle their sensitivity to cope with stressful events.

In summary, the occurrence of high and enduring levels of PTSD and a wide range of co-morbid psychopathology can lead to chronic mental health problems, protracted loss of general adaptive abilities and poor treatment response. For these patients, the frequently used treatment protocols that usually target either just PTSD, just depression, or just any other disorder should be adapted. In case of long-lasting psychopathology in traumatized patients, clinicians must keep in mind that there is not merely a distinct disorder requiring a specific intervention. The additional host of emotional problems, mental health symptoms and disorders, but also dysfunctions in coping and personality should become an important focus in treatment and can improve treatment efficacy in patients that show reduced therapeutic recovery.

4.4. Strenghts and limitations

The strengths of this study are the relatively large sample size of treatment seeking veterans with long-lasting psychopathology, the use of LPA, and looking beyond PTSD into a broad range of psychopathology. Also, the comparison of the study sample with a large reference group of outpatients, and the investigation of several predictors of class membership are strengths of this study. Limitations are, that predictors can merely be interpreted as class characteristics as our study could not demonstrate a longitudinal or causal relation. Other limitations are the use of self-report questionnaires that could give a response bias. Also combined HTQ and SRIP scores were used, though combining both instruments was considered feasible since both instruments had similar content and identical response scales. Finally, the sample existed of treatment seeking and predominantly male veterans with enduring symptoms. Generalization to other populations has therefore to be done with caution.

5. Conclusion

In this LPA among a large sample of treatment seeking severe traumatized war veterans with long-lasting mental health problems, three classes were found with different levels of severity of PTSD but also of a broad range of general psychopathology next to PTSD. Classes differed with regard to symptom severity but no qualitative differences between symptom dimensions have emerged. This corresponds with previous findings among veterans (e.g., Armour et al., 2015; Contractor et al., 2015). Accumulation of different traumatic event types in general and regarding the trauma domain 'lack of basic human needs', as well as avoidant and problem-focused coping strategies and personality traits of neuroticism and agreeableness appeared to differentiate between the classes. Veterans with higher amounts of traumatic experiences in general and with regard to lack of basic human needs were more often in the severe and/or highly severe symptom class, as well as those using more avoidant and problem-focused coping strategies and with more dysfunctional personality characteristics with regard to neuroticism and agreeableness.

In case of treatment, the results suggest that only focussing on PTSD will hide attention to other important emotional and psychosocial problems and may lead to inadequate treatment approaches. Moreover, focussing on a broader perspective then merely on separate disorders and focussing also on dysfunctional coping styles and personality characteristics can be of major importance in treatment efficacy of patients with chronic and severe PTSD that show lower therapeutic recovery.

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