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# Similarity in symptom patterns of posttraumatic stress among disaster-survivors: a three-step latent profile analysis

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**ABSTRACT**
**Background:** Individuals express symptoms of posttraumatic stress in various ways, noted for example in the many symptom combinations in the diagnostic manuals. Studies aiming to examine differences of symptom presentations by extracting latent classes or profiles indicate both the presence of subtypes with differing symptomatology and subtypes distinguished by severity levels. Few studies have examined subtype associations with long-term outcomes.
**Objective:** The current study aimed to apply latent profile analysis on posttraumatic stress (PTS) in a highly homogenous sample of Swedish tourists exposed to the 2004 Southeast Asia tsunami and to examine if classes differed in their long-term outcome.
**Methods:** An latent profile analysis was conducted using self-report data collected one year after the disaster from 1638 highly exposed survivors that endorsed ≥ 1 symptom of PTS. Associations were examined between the classes and predictors of PTS (loss of a relative or friend, subjective life threat) and levels of PTS at a three-year follow up.
**Results:** The latent profile analysis indicated four classes: minimal, low, moderate, and severe symptoms. The classes were distinguished mainly by their levels of PTS. Loss of a relative or friend and subjective life threat were associated with a higher likelihood of belonging to any other class than the minimal class. The severity level of the classes at one year were predictive of PTS severity at the three-year follow-up.
**Conclusions:** Homogeneous profiles of posttraumatic stress differing mainly in symptom severity were found in this sample of disaster survivors. Profile diversity may be related to sample variation and unmeasured confounders rather than reflect qualitatively different disorders.

**HIGHLIGHTS**
• We examined symptom profiles of posttraumatic stress in a homogeneous sample of disaster survivors.
• Three symptom profiles were differentiated mainly by overall severity.
• Hyperarousal symptoms may be of discriminant value for long-term outcome.

## Similitud en patrones sintomáticos del Estrés Postraumático en sobrevivientes a desastres: un análisis de perfiles latentes en tres pasos

**Antecedentes:** los individuos expresan los síntomas de estrés postraumático de varias maneras, como se observa, por ejemplo, en las múltiples combinaciones de síntomas de los manuales de diagnóstico. Los estudios que buscan examinar las diferencias en la presentación de los síntomas mediante la extracción de clases o perfiles latentes indican tanto la presencia de subtipos con sintomatología diferente como subtipos que se distinguen por los niveles de gravedad. Pocos estudios han examinado las asociaciones de subtipos con resultados a largo plazo.
**Objetivo:** el estudio actual tuvo como objetivo aplicar el análisis de perfil latente (por su sigla en inglés) sobre el estrés postraumático (STP, por su sigla en inglés) en una muestra altamente homogénea de turistas suecos expuestos al tsunami del sudeste asiático de 2004 y examinar si las clases difirieron en su resultado a largo plazo.
**Métodos:** se llevó a cabo un LPA utilizando datos de auto-reporte recogidos un año después del desastre en 1638 sobrevivientes altamente expuestos que acreditaron uno o más síntomas de PTS. Se examinaron las asociaciones entre las clases y los predictores de PTS (pérdida de un familiar o amigo, amenaza subjetiva a la vida) y los niveles de PTS en un seguimiento a los tres años.
**Resultados:** El LPA indicó cuatro clases: síntomas mínimos, bajos, moderados y graves. Las clases se distinguieron principalmente por sus niveles de PTS. La pérdida de un familiar o amigo y la amenaza subjetiva a la vida se asociaron con una mayor probabilidad de pertenecer a cualquier otra clase que la clase mínima. El nivel de severidad de las clases en el primer año fue predictor de la severidad de PTS en el seguimiento a los tres años.
**Conclusiones:** En esta muestra de sobrevivientes de desastres se encontraron perfiles homogéneos de estrés postraumático que difieren principalmente en la gravedad de los síntomas. La diversidad de perfiles puede estar relacionada con la variación de la muestra y variables confundentes no medidas en lugar de reflejar trastornos cualitativamente diferentes.

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**灾难幸存者中创伤后应激症状模式的相似性：三步潜在剖面分析。**

**背景**：不同个体的创伤后应激的症状有不同的表现，例如在诊断手册中提到的许多症状组合。现有研究通过提取潜在类别或剖面来考察症状表现的差异，这些研究结果表明同时存在具有不同症状和不同严重水平的亚型。但很少有研究考察亚型与长期结果的关联。

**目的**：本研究旨在对一个高度同质的经历2004年东南亚海啸的瑞典游客样本中，应用潜在剖面分析考察创伤后应激（PTS）长期结果中是否存在不同的分类。

**方法**：在灾难发生后的一年后使用1638名高度暴露的幸存者的自评数据进行LPA，这些幸存者具有≥1 PTS症状。对PTS的类别和预测因素（失去亲人或朋友、主观生活威胁）和三年后PTS水平之间的关联进行了考察。

**结果**：LPA结果揭示四组分类：最轻程度，低，中，重度症状。类别的主要区别在于他们的PTS水平。失去亲人或朋友和主观生活威胁与归属于其他组的关联性高于最轻程度组。灾后一年的严重程度分组可预测三年后随访时的PTS严重程度。

**结论**：在灾难幸存者样本中发现的创伤后应激的同质剖面，但主要区别在症状严重程度上。剖面多样性可能与样本变异和未测量的混杂因素有关，而不是反映出不同的疾病。

## 1. Introduction

Exposure to potentially traumatic events (PTE) is associated with increased risk of psychopathology, the most common being posttraumatic stress disorder (PTSD). As one reflection of the many faces of traumatization, the diagnosis of PTSD has been highly heterogeneous since its inclusion in the psychiatric nosology (Galatzer-Levy & Bryant, 2013) and diagnostic definitions vary considerably across manuals (Hansen, Hyland et al., 2017). Salient symptoms of posttraumatic stress include intrusions, avoidance of stimuli associated with the event, and hyperarousal. The DSM diagnosis also includes symptoms of emotional numbing, negative affect, and cognitive distortions. Although other symptoms can be present in a posttraumatic stress response, and some of those included in the DSM definition are less prevalent than others, most studies have used the symptoms included in the DSM definition of PTSD when investigating the various symptom presentations of posttraumatic stress.

A common approach to understanding the symptoms of posttraumatic stress is factor analysis. A large number of factor analytical studies indicate pronounced heterogeneity in the factor structure of posttraumatic stress symptoms (Armour, Műllerová, & Elhai, 2016). Individuals who fulfil the criteria for PTSD may present with very diverse and non-overlapping symptomatic manifestations (Galatzer-Levy & Bryant, 2013). There is support for diverse subtypes of such manifestations, although it is unclear what factors influence symptom presentations and if they are relevant to the course of the disorder (Breslau, Reboussin, Anthony, & Storr, 2005). One possibility is that variations in exposure and secondary stressors may lead to differences in symptom presentation, and that these presentations differ in the persistence of the symptoms (Grimm, Hulse, Preiss, & Schmidt, 2012; Rosellini, Coffey, Tracy, & Galea, 2014).

Latent class analysis (LCA) or latent profile analysis are data-driven mixture modelling techniques that rely on the assumption that there are latent classes of individuals that group together in terms of similar observable data. Thus, in contrast to the variable-centred approach of confirmatory factor analysis (CFA), LCA/LPA are person-centred approaches that group individuals with similar symptom presentations into homogenous subsets. LCA is applied to categorical variables and constructs classes of individuals based on the likelihood of whether the individual endorses a symptom, whereas latent profile analysis is applied to continuous variables and categorizes individuals based on their symptom severity (Oberski, 2016).

LCA/LPA have been used to examine classes of posttraumatic symptomatology in a variety of traumatized populations, including both veteran, civilian, and task force samples (Au, Dickstein, Comer, Salters-Pedneault, & Litz, 2013; Ayer et al., 2011; Breslau et al., 2005; Hebenstreit, Maguen, Koo, & DePrince, 2015; Horn et al., 2016; Steenkamp et al., 2012). The first latent-class study was conducted by Breslau and colleagues and extracted three classes varying by symptom severity, with one class presenting with higher levels of emotional numbing. Later studies reported inconsistent findings in regard to number of extracted classes and characteristic of these. Classes have varied from two to six, and some results indicate differences mainly in symptom severity whereas others have found classes distinguished by high levels of arousal or dysphoric symptoms compared to other symptoms (Frankfurt, Anders, James, Engdahl, & Winskowski, 2015; Hebenstreit, Madden, & Maguen, 2014; Hellmuth, Jaquier, Swan, & Sullivan, 2014; Itzhaky, Gelkopf, Levin, Stein, & Solomon, 2017; Nugent, Koenen, & Bradley, 2012). It is unclear if the cause of diverging symptom profiles indicates the presence of qualitatively different types of posttraumatic stress responses or reflects other differences in the samples, such as variation in event type, exposure severity, or in external risk factors (e.g. socioeconomic status, secondary stressors).

Natural disasters provide a unique opportunity to examine the effect of a PTE on mental health because the events are transient and strike individuals with varying initial health status. However, disaster victims are often exposed to additional stressors, such as loss of home and burdened societal resources (Kessler, McLaughlin, Koenen, Petukhova, & Hill, 2012). The 2004 Southeast Asia tsunami devastated coastal regions in the area and more than 227,000 people perished (Telford & Cosgrave, 2006). Governmental agencies estimated that approximately 20,000 Swedish citizens were in Southeast Asia at the time, of which 7000 were in areas hit by the waves. During the three weeks that followed the event, 16,000 (Swedish Tsunami Commission, 2005) Swedes were repatriated. Previous studies of this cohort have found that the majority of survivors were resilient or recovered with time, although 16% were still suffering from high levels of posttraumatic stress (PTS) up to six years after the disaster (Johannesson, Arinell, & Arnberg, 2015). Notably, the Swedish tsunami survivors returned to a society not affected by the disaster, and the cohort is characterized by high socioeconomic status and few stressors in the aftermath (Arnberg et al., 2015). These features provided an opportunity to study the characteristics of PTS profiles after a disaster in a context relatively free of additional stressors and unmeasured confounders that may influence mental health beyond the event itself.

Studies that apply LCA/LPA on posttraumatic stress symptoms after natural disasters are emerging. Cao et al. (2015) studied PTSD factor scores and depression factor scores and found evidence for four subtypes distinguished by either low symptoms, primarily depression, primarily PTSD, or a combined symptomatology. In a study of children exposed to Hurricane Katrina, Lai, Kelley, Harrison, Thompson, and Self-Brown (2015) examined PTSD symptom severity, internalizing symptoms, and externalizing symptoms. Three classes emerged: one with very low level of disturbance, one with posttraumatic stress symptoms, and one with mixed internalizing symptoms (Lai et al., 2015). A perceived threat to life and exposure to community violence were associated with a higher risk of belonging to a symptomatic class. Individuals in those classes also reported greater school-related problems at follow-up. Neither of the above studies examined the presence of subtypes based on item-level scores. Rosellini et al. (2014), however, examined item-level subtypes in sample of adults exposed to Hurricane Katrina and found support for a four-class solution, with classes differing mainly in symptom severity. Participants in all classes had a high likelihood of endorsing intrusion and hyperarousal symptoms whereas only the group with severe symptoms had a high likelihood of endorsing avoidance/numbing symptoms and of fulfilling PTSD criteria. In addition, the study found that membership in the severe class was associated with a higher degree of hurricane exposure (Rosellini et al., 2014). These results suggest that experiences during the event are predictive of different symptom profiles. As seen in other studies, such predictors include physical injuries, loss of close relatives, and subjective experience of life threat (Hussain, Weisæth, & Heir, 2013; Johannesson et al., 2009).

In summary, it is unclear whether the diverse presentations of PTS reflect severity levels rather than qualitatively different symptom profiles, and there is no consensus on the optimal number of classes, as demonstrated by previously discussed results (Frankfurt et al., 2015; Hebenstreit et al., 2015; Hellmuth et al., 2014; Nugent et al., 2012) . It may be that the different symptom presentations reflect differences in the type of event, exposure proximity, and additional secondary stressors. There is also a lack of research on whether class membership predicts long-term PTS, which is an important aspect with regard to the ecological validity of different models.

The aim of the current study was to use latent profile analysis to examine if there are homogenous subsets of symptom presentations in a sample of disaster survivors with similar exposure levels and with low levels of secondary stressors. The first step was to examine whether there are classes with differing PTS symptom presentations one year after the tsunami. In the second step, the associations between such classes with established predictors of PTS (e.g. loss of relative or friend and subjective life threat) and long-term PTS symptoms were examined. We hypothesized that we would extract three or more classes. The limited amount of research in this type of sample precluded further hypotheses about the relationship between the classes and the predictors of PTSD.

## 2. Methods

### 2.1. Procedure and participants

The current study uses data from a longitudinal study of Swedish citizens repatriated from Southeast Asia during three weeks after the tsunami in 2004. Swedish authorities established receptions at the national airports and registered all Swedish citizens who returned to Sweden from Southeast Asia during the first three weeks after the disaster. Individuals ≥ 16 years of age from 10 counties in Sweden were invited to participate in a postal survey 14 months after the disaster (T1; $n$ = 10,501; 77% of registered survivors). Half of those invited agreed to participate and returned a pre-stamped written consent form (49%; $n$ = 4932). Care-giver consent was required

for individuals < 18 years of age. The T1 respondents were then invited to participate in a second survey, three years after the disaster (T2). Of these, 70% (*n* = 3457) responded.

For the current study, we selected highly exposed individuals, which was defined as reporting having been pulled or almost pulled into the waves. In order to be included, they had to have valid responses to the question about subjective life threat and the question about loss of relative or friend, and had to have reported at least one symptom of PTS at the one-year survey (defined as scoring at least one item on IES-R as 'minimal' or more). There were 2424 who were not highly exposed, 205 had missing data on subjective life threat or loss of a relative or friend, and 622 were excluded based on not having experienced any symptom of PTS. The final sample included 1638 participants (33% of the original sample). These participants had no missing data on measures from T1 whereas 409 participants had missing data on one or more variables from the follow-up assessment and were excluded from analyses concerning those variables.

## 2.2. Measures

*The Impact of Event Scale-Revised* (IES-R; Weiss, 2007) was used to assess PTS. The IES-R comprises 22 items that measure symptoms of intrusion, avoidance/numbing, and hyperarousal. The symptoms are rated in relation to a specific event, in this case the tsunami. Items are rated on a five-point Likert scale regarding how bothersome a specific symptom has been during the past week (0 = not at all, 1 = minimal, 2 = moderately, 3 = a lot, 4 = extremely), and the scores can be summed to achieve a total score and symptom cluster scores. The Swedish IES-R has been evaluated in a study on the present cohort, in which that a total score above 30 indicated the presence of PTSD (Arnberg, Michel, & Johannesson, 2014). Participants responded to IES-R at T1 and T2. In this sample, Cronbach's α for IES-R was 0.95.

Subjective experience of life threat was indicated by endorsement to the yes/no question 'Did you experience the situation as life threatening regarding your own person when the wave struck?' and loss of a relative or friend with the yes/no question 'Did you lose family members, other relatives or friends in the tsunami?'.

## 2.3. Data analysis

### 2.3.1. Latent profile analysis

A three-step latent profile analysis was conducted using the procedure suggested by Asparouhov and Muthén (2014a) to categorize participants into classes based on the IES-R item-level scores at T1 and to examine the

association between these classes and the IES-R total scores at T2. The three-step approach (1) builds a latent model for a set of response variables, (2) assigns subjects to classes based on posterior class membership probabilities, and (3) examines associations between assigned membership and external variables, taking class uncertainty into consideration. We chose the three-step approach because exporting data of most likely class membership for subsequent analysis as in a one-step procedure may introduce errors and decrease precision (Asparouhov & Muthén, 2014a, 2014b; Berlin, Williams, & Parra, 2014; Vermunt, 2010). The variables loss of a relative or friend and subjective life threat, which have a high influence on symptom severity in this sample (Johannesson et al., 2009), were included in the model as covariates and thus part of the latent model. Differences in mean IES-R total scores at T2 among classes were examined with the BCH method suggested by Bolck, Croon, and Hagennars using the AUXILIARY command in M*plus* (Asparouhov & Muthén, 2014b; Bolck, Croon, & Hagenaars, 2004; Vermunt, 2010). Figure 1 illustrates the model.

Models with one to five classes were estimated and compared based on fit indices, parsimony, and interpretability. The goodness-of-fit indices evaluated included the Bayesian information criterion (BIC) and Akaike information criterion (AIC), for which lower values correspond to better model fit; the bootstrapped likelihood ratio (BLRT) *p*-value and the Lo-Mendell Rubin adjusted likelihood ratio (LMR-A) indicate if the current model fits data better than a model with one less class; finally, a higher entropy value indicates a larger degree of separation between classes. The standard procedure is to accept the model with the largest amount of classes, smallest BIC value, and a significant LMR-A, in conjunction with the intelligibility of the profiles (Nylund, Asparouhov, & Muthén, 2007). In the event of local maxima, which occurred with the three-class and more complex models, the number of random starts were increased incrementally. Associations between covariates and class membership were evaluated by regressing the latent classes on the
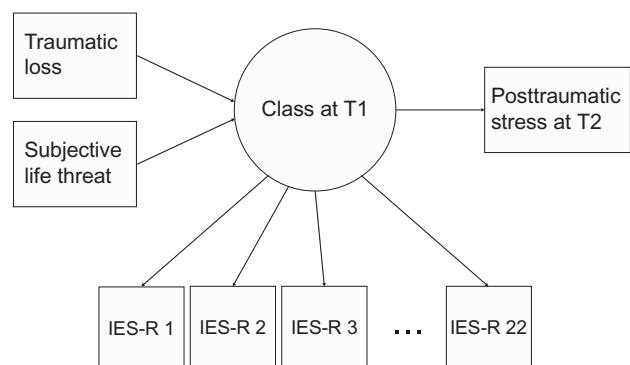


**Figure 1.** Model specification. IES-R 1 to 22 indicates the items of the impact of event scale-revised.

predictors. A Wald test was performed to compare differences in mean on the distal outcome. The latent profile analysis was conducted with MPLUS statistical modelling software 8.0 (Muthén & Muthén, 2017).

## 3. Results

### 3.1. Demographics

The participants' mean age was 42.7 years ($SD = 14$, range 17–90). The sample included 55% females and 45% males. Most participants were working full (57%) or part time (15%), 13% were students, and the remaining participants were either unemployed, retired, on parental leave, sick leave, or stated rehab/work training as their primary occupation.

### 3.2. Symptom profiles of posttraumatic stress

Fit indices for the latent profile analysis models are presented in Table 1. The models with four or five classes were superior to the two- and three-class models. The five-class solution provided best fit according to the AIC and log-likelihood. The higher entropy value indicated a larger degree of separation between the classes as compared to the other models. However, the LMR-A index indicated no statistically significant improvement over the four-class model, the BLRT draws did not converge, and the best log-likelihood value was not replicated despite an increased number of random starts. The drop in BIC value was negligible, and so the four-class solution was chosen as the best model. To further examine the influence of the predictors, the final model was run without covariates and yielded no major differences in terms of entropy or class size (data not shown).

The four-class solution was characterized by a class with minimal symptoms (34% of the sample), a low symptom class (33%), a moderate symptom class (21%), and a severe symptom class (12%). Mean IES-R total and subscale scores for each class for the first measurement point (T1) are shown in Table 2. Figure 2 illustrates the profiles in terms of the mean IES-R score for each item. A chi2 test indicated that there were different proportions of males and females in the four classes, $\chi^2(3, N = 1638) = 64.06$, $p < .01$. Age differed significantly between classes, as analysed with a one-way ANOVA, $F(3,1634) = 5.11108$, $p = .001$.

### 3.3. Loss of relative or friend and subjective life threat

The minimal symptom class was used as the reference class for the logistic regression. Endorsement of subjective life threat was associated with a higher likelihood of belonging to any other class, and the likelihood increased monotonically with symptom load: the low symptom class (OR = 1.61, 95% CI [1.22, 2.13], $p < .001$), the moderate symptom class (OR = 2.88 [2.02, 4.12], $p = .001$), and the severe symptom class (OR = 3.74 [2.37, 5.90], $p < .001$). Similarly, loss of a relative or friend was associated with a higher likelihood of belonging to the low symptom class (OR = 2.77 [1.57, 4.86], $p < .001$), the moderate symptom class (OR = 5.74 [3.39, 9.72], $p < .001$), and the severe symptom class (OR = 9.50 [5.32, 16.95], $p < .001$).

### 3.4. IES-R score at three-year follow-up

There were significant differences between all classes in mean IES-R total score at follow up (T2) (Table 3). IES-R total score was $M = 6.01$ ($SE = 0.32$) for the

**Table 1.** Fit indices for latent class analyses.

| No. of classes | Log-likelihood | AIC | ssaBIC | BIC | Entropy | LMR-A | LMR-A p-value | BLRT loglikelihood | BLRT p-value |
|---|---|---|---|---|---|---|---|---|---|
| 1[a] | −48,196 | 96,569 | 96,765 | 97,044 | – | – | – | – | – |
| 2 | −42,140 | 84,637 | 88,874 | 85,604 | 0.940 | 12,248 | < .001 | −49,885 | < .001 |
| 3 | −40,364 | 81,267 | 85,967 | 82,726 | 0.934 | 3590 | < .001 | −43,752 | < .001 |
| 4 | −39,795 | 80,313 | 82,263 | 82,263 | 0.909 | 1135 | .002 | −40,364 | < .001 |
| 5 | −39,554 | 80,011 | 82,220 | 82,453 | 0.913 | 715 | .448 | −39,795 | < .001[b] |

Note: AIC = Akaike information criteria. ssaBIC = sample-size adjusted Bayesian information criteria. LMR-A = Lo-Mendell Rubin adjusted log-likelihood ratio test. BLRT = Bootstrapped likelihood ratio test.
[a]The one-class model was run without covariates.
[b]100 out of 100 bootstrap draws did not converge. Thus, the p-value might not be trustworthy due to local maxima.

**Table 2.** Mean IES-R total and subscale scores for classes at T1.

| | | | | Total | | Intrusion | | Avoidance/Numbing | | Hyperarousal | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Class | N | % Female | Mean age | M | SD | M | SD | M | SD | M | SD |
| Minimal symptoms | 555 | 45 | 39.1 | 7.7 | 3.76 | 5.15 | 2.75 | 1.49 | 1.69 | 1.06 | 1.45 |
| Low symptoms | 543 | 55 | 42.9 | 22.25 | 5.81 | 11.65 | 3.51 | 6.68 | 4.27 | 3.92 | 2.76 |
| Moderate symptoms | 345 | 62 | 43.1 | 40.78 | 7.12 | 18.78 | 3.60 | 11.46 | 5.18 | 10.54 | 3.51 |
| Severe symptoms | 195 | 75 | 43.5 | 61.98 | 9.25 | 26.29 | 3.57 | 18.62 | 7.00 | 17.08 | 4.35 |

Note. The ranges on the total scale are 0–88, intrusion 0–32, avoidance/numbing 0–32, and hyperarousal 0–24.
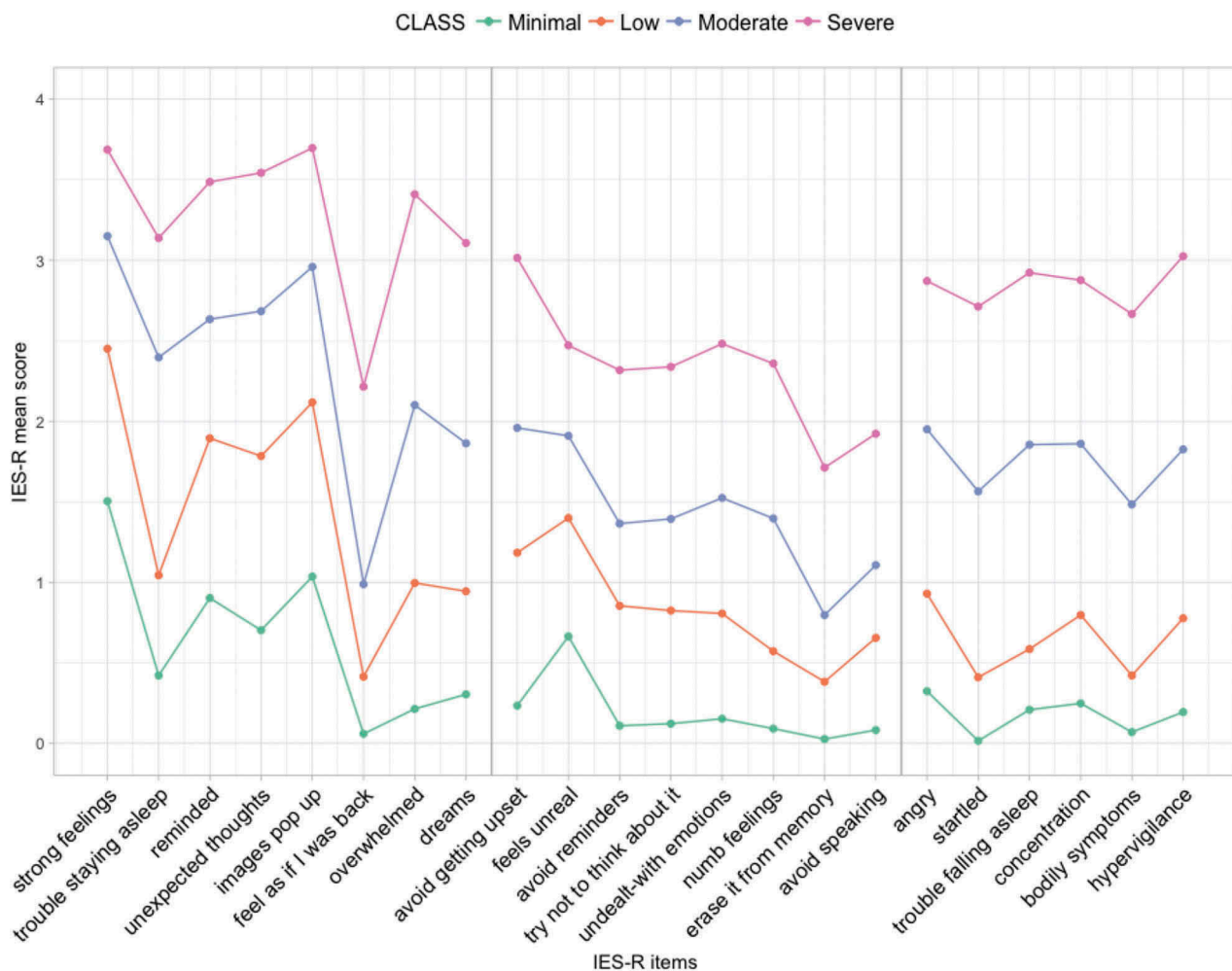
**Figure 2.** Profile plot of mean scores on the IES-R items at T1 for the respective class, sorted by IES-R clusters intrusion (left), avoidance/numbing (centre), and hyperarousal (right).

**Table 3.** Differences in mean IES-R scores between classes at follow-up (T2). $N = 1229$.

| | Overall test | Low vs. Minimal | Severe vs. Minimal | Moderate vs. Minimal |
|---|---|---|---|---|
| $\chi^2$ | 1212.173* | 202.46* | 694.853* | 471.65* |
| | | Low vs. Moderate | Severe vs. Low | Moderate vs. Severe |
| $\chi^2$ | | 103.693* | 340.771* | 88.837* |

*$p < .0001$.

minimal symptom class, $M = 15.81$ ($SE = 0.58$) for the low symptom class, $M = 27.36$ ($SE = 0.93$) for the moderate symptom class, and $M = 43.42$ ($SE = 1.38$) for the severe symptom class. To summarize, belonging to a more symptom-burdened class was associated with higher symptom levels at follow-up (T2).

## 4. Discussion

The present study examined symptom profiles of PTS in a sample of Swedish tsunami survivors. A four-class model provided best fit. The classes differed mainly in terms of PTS severity rather than symptom presentations, with one class presenting with minimal symptom levels, one with low levels of symptoms, one with moderate levels of symptoms, and one with severe levels of symptoms.

The results are in accordance with research on latent classes and profiles of PTSD that have found classes differentiated mainly by severity (Böttche, Pietrzak, Kuwert, & Knaevelsrud, 2015; Breslau et al., 2005; Guffanti et al., 2016; Hebenstreit et al., 2014). There are also, however, several studies that have found classes differing in levels of avoidance, emotional numbing, dysphoric arousal, and hypervigilance (Hebenstreit et al., 2015; Horn et al., 2016; Pietrzak et al., 2014).

Considering the homogeneity in presentations between classes, the results regarding the predictors were unsurprising. The higher probability of a participant belonging to a more symptom-burdened class if they reported loss of a relative or friend and

subjective life threat is likely explained by the predictors' influence on overall symptom burden, as is the differences in levels of posttraumatic stress symptoms at follow up. Differences in mean scores from the first to the second assessment were comparable between the symptomatic classes. However, improvement for the low class was negligible.

The main impression of the classes is that there is a homogeneity in symptomatic expression, although with some tendencies towards divergence. All classes had moderately to highly elevated symptoms of intrusion and relatively lower levels of avoidance. Although the profiles were similar overall, visual inspection of the symptom patterns indicated some divergence between classes. Only the severe class had mean item level scores of above moderate on an item corresponding to posttraumatic flashbacks and symptoms of avoidance. There was a tendency towards divergence in symptom pattern between classes, with the minimal and low symptomatic classes reported very low mean item scores levels of hyperarousal, equivalent to their mean-item scores of avoidance/numbing, whereas the moderate class and severe class reported elevated mean item scores relative to their levels of avoidance/numbing. This is congruent with a study from Hebenstreit et al. (2015) that found five classes with similar symptomatic patterns, with two classes distinguished by elevated levels of hypervigilance. Rosellini et al. (2014) found four classes with profiles similar to this study, also primarily characterized by differences in severity and pervasiveness. In that study, the patterns indicated that only the severe class had a high likelihood of experiencing avoidance/numbing symptoms. The authors hypothesized that scores in this cluster may be salient in identifying people with severe forms of PTSD and suggest the presence of subtypes of PTSD presentations following natural disasters. The current study points towards symptoms of hyperarousal, avoidance, and posttraumatic flashbacks as possibly salient features in identifying individuals with more severe and long-lasting psychopathology, and these symptoms may be worthy of further examination. However, considering the similarities in symptom patterns between classes, results should be interpreted with caution.

There are several potential reasons for the homogeneity in symptom patterns between classes in this sample. It may be that specific experiences during the event, as well as variations in the affected sample and in the number and type of stressors before and after the event, affect symptom presentation in addition to other common event-related predictors such as degree of exposure. All participants in the present study had experienced the same type of event with similar experiences in the aftermath, returned to a relatively unaffected society with few additional stressors, and were for the most part from higher socioeconomic strata.

Another possible reason for the homogeneity of presentations in this sample is that class indicators were based on the set of problems included in the IES-R. Although the IES-R items generally correspond to the symptoms in the ICD-11 and the previous versions of the DSM they does not fully reflect these conceptualization of PTSD (Arnberg et al., 2014). Using a questionnaire corresponding to DSM-5, which includes symptoms of negative alternations in cognitions and mood as well as the dissociative subtype (Hansen, Ross, & Armour, 2017), may have yielded different results.

It is also possible that the addition of symptoms commonly comorbid with PTSD would have affected the model in this sample and revealed more diverse profiles. However, at least one study has found highly similar profiles even when including comorbid disorders in an LCA (Contractor et al., 2015).

## 4.1. Limitations

There are limitations to this study that should be mentioned. First, symptoms of grief were not included in the analysis. Studies of latent classes and/or profiles of PTSD and grief have indicated the presence of subgroups distinguished by levels of grief. Including symptoms of grief in the analysis would potentially have led to more diverse profiles. However, the analysis would then risk no longer examining subtypes of PTS but instead reflect subtypes of comorbidity.

Second, the response rates in both the first and the second survey were modest. Low response rates are not uncommon in studies of disaster survivors. A thorough examination of non-response patterns in a Norwegian study of a very similar sample found that individuals less exposed were less likely to respond (Hussain, Weisaeth, & Heir, 2009). There is reason to believe that exposure has a high influence on symptom levels and, as this study only used data from individuals indicating at least one symptom of PTS, the influence of non-response in this study is likely low.

Furthermore, the participants returned to a safe environment and the ecological validity to disaster-stricken communities may therefore be limited. This could also be considered a strength, as contamination of secondary stressors was low thus permitting the examination of the PTS symptoms rather than of confounders.

### 4.2. Implications

The findings implicate that disaster survivors may have bothersome levels of intrusion without necessarily being troubled by avoidance and hyperarousal. Interestingly, the moderate and severe classes were distinguished from the low and minimal classes partly by higher levels of hyperarousal and had higher symptom levels of PTS at follow-up. This suggests that hyperarousal symptoms may be an important factor in the maintenance of symptoms over time. High levels of hyperarousal may be worthy of further investigations of specific targets for screening of disaster survivors to select people at risk of a more chronic course of symptoms. Further information about such indicators would be particularly valuable in settings such as after disasters where only brief screening measures are possible to administer.

### 4.3. Conclusions

This study indicates similarity in the symptom presentation of PTS in a sample of Swedish disaster survivors with similar event-related experiences and few secondary stressors in that the classes were distinguished mainly due to the severity of the symptoms. Despite the above discussed tendencies towards divergence between classes, it should not be taken as evidence for distinct subtypes. Rather, the results point towards similarity between classes in symptom patterns when extracting such classes from highly homogenous groups. This may indicate that there are factors apart from trauma exposure itself that affects symptom presentation.

However, it is clear from the literature that a thorough understanding of the structure and dimensionality of PTS responses, especially when applying a person-cent red approach, is still lacking. The homogeneity in this sample points towards secondary stressors and specific event experiences as possible influencers on symptomatic expression. Studies that apply these methods to heterogeneous samples may risk extracting classes that reflect unmeasured confounders such as these rather than classes that reflect subtypes of traumatized individuals. Thus, the field may benefit from a more stringent approach towards controlling for potential confounders when examining latent symptom profiles or classes.

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