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Identifying post-traumatic stress symptom typologies in clinical and non-clinical healthcare staff: a latent profile analysis

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ABSTRACT

Background: There has been growing concern regarding increasing levels of post-traumatic stress (PTS) symptoms experienced by healthcare workers (HCW) in the UK, particularly following the COVID-19 pandemic.

Objectives: PTS symptom typologies have been investigated in other adult populations using person-centred latent variable approaches, revealing profiles showing differing symptom levels and patterns. We aimed to explore typologies among clinical and non-clinical healthcare staff to elucidate heterogeneity of presentation.

Methods: This was a retrospective study using referral data from treatment-seeking healthcare staff in the North of England ($N = 1600$). We employed latent profile analysis using the PTSD International Trauma Questionnaire domains as profile indicators. We included covariates relating to role-type, depression, anxiety and mental health concerns before March of 2020.

Results: A model with six profiles fit the data best. Profile names were given as follows: 'No symptom'; 'Low symptom'; 'Low symptom (moderate Sense of current threat (Th_dx) and Functional impairment (FI))'; 'Moderate symptom (low Th_dx and high Avoidance (Av_dx))'; 'Moderate symptom'; and 'High symptom'. Covariates were shown to have differential predictive power on profile membership.

Conclusions: The finding of profiles with pattern differences suggests a need for both differential and specifically targeted treatments, as well as a consideration of early intervention for those individuals with subclinical PTS symptoms. As expected, anxiety and depression were both predictors of several of the symptomatic profiles, with anxiety producing a larger effect. Further research is required to fully understand the link between role-type and PTS symptom typologies among HCW.

Identificación de tipologías de síntomas de estrés postraumático en el personal de salud clínico y no clínico: un análisis de perfil latente

Antecedentes: Ha habido una creciente preocupación en relación al aumento de los niveles de síntomas de estrés postraumático (PTS en sus siglas en inglés) experimentados por los trabajadores de salud (HCW en sus siglas en inglés) en el Reino Unido, particularmente tras la pandemia de COVID-19.

Objetivos: Las tipologías de síntomas de PTS se han investigado en otras poblaciones adultas utilizando enfoques de variables latentes centrados en la persona, revelando perfiles que muestran diferentes niveles y patrones de síntomas. Nuestro objetivo fue explorar las tipologías entre el personal de salud clínico y no clínico para dilucidar la heterogeneidad de la presentación.

Métodos: Este fue un estudio retrospectivo que utilizó datos de derivaciones del personal de salud que buscaba tratamiento en el Norte de Inglaterra ($N = 1.600$). Empleamos análisis de perfil latente utilizando los dominios del Cuestionario Internacional de Trauma para TEPT como indicadores de perfil. Incluimos covariables relacionadas con el tipo de rol, depresión, ansiedad y preocupaciones de salud mental antes de marzo del 2020.

Resultados: Un modelo con seis perfiles se ajusta mejor a los datos. Los perfiles fueron denominados como sigue: 'Sin síntomas', 'Síntomas bajos', 'Síntomas bajos (sensación de amenaza actual (Th_dx) y Deterioro funcional (IF) moderados)', 'Síntomas moderados (bajo TH_dx y Evitación Alta (Av_dx))', 'Síntomas moderados' y 'Síntomas Altos'. Las covariables demostraron tener poder predictivo diferencial sobre la pertenencia al perfil.

Conclusiones: El hallazgo de perfiles con patrones diferentes sugiere una necesidad de tratamientos tanto diferenciados como específicamente dirigidos, así como una consideración de intervenciones tempranas para aquellos individuos con síntomas subclínicos de PTS. Como era de esperar, la ansiedad y depresión fueron predictores de varios de los perfiles sintomáticos y la ansiedad produjo un mayor efecto. Se requiere más investigación para comprender totalmente el vínculo entre tipo de rol y tipología de síntomas de PTS entre los HCW.

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Latent profile analysis; post-traumatic stress; symptom typologies; healthcare staff; non-clinical role

PALABRAS CLAVE

Análisis de perfil latente; estrés postraumático; tipologías de síntomas; personal de salud; rol no clínico

HIGHLIGHTS

- Six distinct profiles of post-traumatic stress symptoms were found in treatment-seeking healthcare staff.
- Four of the profiles differed only in terms of severity of symptoms. Two of the profiles revealed pattern differences relating to differing severity across avoidance, sense of current threat and functional impairment.
- Working in a non-clinical role (e.g. hospital porter or admin staff) predicted membership of two of the moderate symptom profiles.
- Other mental health difficulties, anxiety and depression, predicted membership of several symptomatic profiles.

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1. Introduction

Healthcare workers (HCW) are often exposed to significant levels of stress in their work environments. This has caused concern around the mental wellbeing of HCW and has led to an increase in research into post-traumatic stress (PTS) symptoms among this population (Marvaldi et al., 2021). Recent research suggests that HCW in the UK experience post-traumatic stress disorder (PTSD) at twice the rate of the general population (Scott et al., 2023). Whilst recent figures may reflect the unique difficulties experienced by HCW during the COVID-19 pandemic, research pre-dating March 2020 suggests that the higher prevalence of PTSD in HCW is not necessarily pandemic-related (Bock et al., 2020; Mealer et al., 2009). Further, in their study of UK HCW using structured clinical interviews, Wild et al. (2021) found that 76% of staff had experienced a traumatic event not related to COVID-19. This suggests that PTS symptoms in HCW are both occupationally and personally related, and that rates are worryingly high.

Most research on PTS symptoms in HCW has focused on the prevalence of diagnosable PTSD using clinic thresholds based on psychometric measures or clinical interviews (Marvaldi et al., 2021; Scott et al., 2023). Since the pandemic, there has also been some interest in the heterogeneity of symptom presentation which may exist amongst HCW. A study of Chinese HCW, during a local COVID-19 infection peak, used network analysis to model relationships between different PTS symptoms (Hoorelbeke et al., 2021). They found that the most influential node was avoidance of activities related to the traumatic event, followed by re-experiencing and anxious arousal. A recent study using data from the UK Staff Wellbeing Survey also explored HCW mental health presentations including PTSD, anxiety and depression among other difficulties (Jordan et al., 2023). They used latent class analysis and found a two-class solution characterised by low and high symptoms across each disorder respectively. The present study aims to build on current research by analysing heterogeneity in PTS symptoms specifically, using other symptoms as predictors rather than indicators. It also builds on prior research by exploring differential presentations based on clinical (patient-facing) versus non-clinical job roles.

This study is the first to explore PTS symptom typologies among HCW using latent profile analysis (LPA). LPA is a type of person-centred latent variable technique which uses mixture modelling to identify hidden groups within observed data, based on patterns of scores across indicators (Collins & Lanza, 2010). In this study, the International Trauma Questionnaire (ITQ; Cloitre et al., 2018) was used as the basis for profile indicators.

Modelling heterogeneity of PTS symptom presentation is important for understanding whether distinct

profiles of individuals exist based on both severity and patterns of symptoms. Understanding the variance between individuals in this population may help to influence the development of more tailored interventions (Cloitre, 2015). Identifying subgroups also encourages a move away from the dichotomisation of those with and without a clinical diagnosis, allowing for a much-needed exploration of sub-clinical symptom profiles (Korte et al., 2016). Previous research suggests that individuals in subclinical populations experience considerable distress and impairment in functioning, comparable to those with clinical PTSD (Cukor et al., 2010; Zlotnick et al., 2002). Moreover, there is a potential risk that individuals with subclinical PTSD may later develop a full diagnosis (Mylle & Maes, 2004).

Previous studies focusing on different adult populations have found distinct profiles of PTS symptoms using latent variable approaches. In a general sample of American adults with a lifetime PTSD diagnosis, Campbell et al. (2020) found four distinct groups based both on symptom-level severity and qualitative patterns. The same number of groups was found in a study exploring PTS symptom typologies following Hurricane Katrina, however, only quantitative differences were found relating to severe, moderate, mild and negligible symptom levels (Rosellini et al., 2014). A recent study of UK veterans found six quantitatively and qualitatively distinct profiles (Murphy et al., 2019). Two of the profiles represented low and severe symptomatology respectively, whilst the other four represented moderate symptoms with distinct pattern differences. For example, overall moderate symptoms with both low and high avoidance. Murphy and colleagues comment on the benefits of finding such heterogeneity of presentation for tailoring treatment interventions.

This is the first study to explore PTS symptoms among treatment-seeking clinical and non-clinical health and social care staff using LPA. As such, no specific hypotheses were made as to the number or qualitative nature of profiles. However, covariates relating to anxiety and depression were included in the analysis and were expected to predict membership of more severe symptom profiles based on prior research indicating that individuals with PTSD are at a great risk of developing depression and anxiety (Breslau et al., 1997; Ginzburg et al., 2010; Rytwinski et al., 2013). This is reflected in our population of interest given that HCW with a PTSD diagnosis score higher on psychometric measures of anxiety and depression than those without a diagnosis (Carmassi et al., 2021).

2. Methods

2.1. Procedure

This study is an exploratory, cross-sectional, retrospective data analysis using referral data from a staff

wellbeing service which offers psychological provision to health and social care staff in the north of England. This study was given ethical approval by the Clinical Audit and Effectiveness team at the associated NHS Foundation Trust (Reference Number: 7207AMH23). Data were collected through the online self-referral questionnaire required for initial assessment. Data were collected between 22 February 2021 and 16 May 2023.

2.2. Participants

Participants in this study were treatment-seeking health and social care staff (both clinical and non-clinical) working or living in the north of England. Participants self-referred to the staff wellbeing service between 22 February 2021 and 16 May 2023. Upon referral, staff were asked to consent to the use of their anonymised data for research purposes. 1611 participants consented to the use of their anonymised data. Eleven participants had missing data on all items of the ITQ and were therefore excluded from the analysis. Missingness was at such a low level (0.68%) that it was considered inconsequential (Dong & Peng, 2013; Schafer, 1999). The final sample size was therefore $N = 1600$.

2.3. Measures

2.3.1. The ITQ

The ITQ was used as the primary outcome measure in this study and was adapted to form the indicator variables used in the LPA. The ITQ is a self-report measure comprising 18 questions. Clients are asked to think of an experience that troubles them most and answer the questions in relation to this experience. The ITQ was designed to operate as a diagnostic measure for both PTSD and Complex PTSD (CPTSD) (Cloitre et al., 2018). The ITQ's domains are consistent with the 11th version of the International Classification of Disease (ICD-11) and its factorial and discriminant validity were assessed during its development (Hyland et al., 2017). The ITQ is of particular cultural relevance to the present study as its final symptom indicators were arrived at using both a community and a clinical sample from the United Kingdom (Cloitre et al., 2018).

As this study's primary area of interest was PTS symptoms, only the first nine questions of the ITQ were included in the analysis. Questions 10–18 explore disturbances in self-organisation and indicate a diagnosis of CPTSD. The first nine questions of the ITQ include four domains: Re-experiencing (Re_dx; questions 1–2); Avoidance (Av_dx; questions 3–4); sense of current threat (Th_dx; questions 5–6); and functional impairment (FI; questions 7–9). Each question is scored on a four-point Likert scale, where 0 = 'not

at all' and 4 = 'extremely'. For the purposes of this study, an average score was taken for each domain so that there were four indicator variables in total. By combining scores and taking an average, we have satisfied the assumption of *local independence* fundamental to LPA (Collins & Lanza, 2010).

2.4. Covariates

2.4.1. GAD-7

We used the Generalised Anxiety Disorder Assessment (GAD-7; Spitzer et al., 2006) as a covariate. The GAD-7 was completed by participants as part of the referral questionnaire and was included given evidence suggesting a link between anxiety and symptoms of PTS (Bardeen et al., 2013). For the purposes of the LPA, we used participants' composite score on the GAD-7 (out of 21) and dichotomised the variable so that those with a score of 10 or above were assigned a '1' and were considered to have moderate/severe symptoms of anxiety and those with scores of 9 or below were assigned a '0' and were considered to have mild or no symptoms of anxiety. This categorisation was based on the GAD-7 clinical cut-off score (Spitzer et al., 2006). We dichotomised the variable to aid with interpretation of the covariate analysis.

2.4.2. PHQ-9

The Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001), a screening tool used to measure the presence and severity of depression, was completed by participants upon referral as part of the questionnaire. The PHQ-9 was used as a covariate in view of previous evidence indicating an association between depression and PTS symptoms (Breslau et al., 1997; Carmassi et al., 2021; Ginzburg et al., 2010; Rytwinski et al., 2013). Scores of 15 or greater on the PHQ-9 (max score 27) usually indicate the presence of Major Depressive Disorder whilst scores of 10–14 are determined a 'grey zone' (Kroenke et al., 2001). As a result, we dichotomised the variable so that those who scored 15 or greater were assigned a '1', considered to have moderately severe symptoms of depression, and scores of 14 or below were assigned a '0', considered to have no to moderate symptoms of depression.

2.4.3. Mental health concern before March 2020

As part of the referral questionnaire, clients were asked if they were concerned about their mental health before March 2020. Clients were given three options for this question, 'yes', 'no' and 'unsure'. This variable was also made binary by combining those who answered 'no' and 'unsure' to aid in interpretation of the covariate analysis. The variable was dichotomised in this way to explore whether having a pre-pandemic mental health concern (those who answered 'yes') predicted profile membership. Combining those who

answered ‘no’ and ‘unsure’ was considered preferable to removing those who answered ‘unsure’ from the analysis as this would have significantly decreased the overall sample size for the covariate analysis.

2.4.4. Clinical/non-clinical role

Clients self-reported their roles upon referral, specifying whether they were in a clinical or non-clinical role, followed by detailing their job title. Clinical roles encompass patient-facing positions involving direct care, such as doctors, nurses, and allied health professionals. Non-clinical roles do not entail direct care, including administrators, managers, and porters. This variable was used to evaluate differences in PTS symptoms dependant on job role. Given the limited research on non-clinical healthcare staff’s experiences of PTS, associations between a non-clinical role and PTS symptoms are of particular interest.

2.5. Data analysis

2.5.1. Latent profile analysis

This study used latent profile analysis to exploratorily investigate typologies of PTS symptoms among clinical and non-clinical healthcare staff. Statistical modelling software, *Mplus* Version 8 (Muthén & Muthén, 2017) was used to estimate the models. As this is an exploratory study, an iterative process was used to select the best-fitting model. The final model was chosen based on a variety of fit statistics and diagnostic criteria (Weller et al., 2020). The Bayesian Information Criterion (BIC; Schwarz, 1978), Akaike Information Criterion (AIC; Akaike, 1987) and the sample-size adjusted Bayesian Information Criterion (SABIC; Sclove, 1987) were used to compare models with different numbers of profiles. Across each of these diagnostic criteria a lower value indicates a better fit. The Bootstrap likelihood ratio test (BLRT; McLachlan & Peel, 2000) and the Lo-Mendell-Rubin likelihood test (LMR; Lo et al., 2001) were used to compare a model with K profiles to a model with $K-1$ profiles. A non-significant ($p > .05$) LMR or BLRT value for a model with $K+1$ profiles indicates that this model does not outperform a model with K profiles. Entropy values and smallest average latent posterior probability were also used as diagnostic criteria for assessing how accurately the models predicted profile membership (Tein et al., 2013). Higher values (preferably, $>.80$) indicate better profile separation and homogeneity (Collins & Lanza, 2010). The size of profiles was also considered as profiles containing few individuals may be over-extracted and unstable (Nylund-Gibson & Choi, 2018). Finally, the interpretability of the final profile model as well as evidence of expected relationships with theoretically relevant external variables (e.g. GAD-7 and PHQ-9) were considered (Spurk et al., 2020).

The final profile solution was also validated using a technique called splitting (Naldi & Cazzaniga, 2020). This involves selecting a smaller randomised sample ($n = 800$) of the used data and then running the analyses again with the original syntax files to see if a model with the same number of profiles fit the data best (see Supplementary Materials 1 for validation results).

In this study, variance was constrained across profiles to reduce the computational intensity of the model (Johnson et al., 2020). Variance is typically constrained in LPA as this method can aid in obtaining stable and parsimonious models and is the default in *Mplus* (Tein et al., 2013). See Supplementary Materials 2 for *Mplus* syntax used in the analysis.

2.5.2. Covariate analysis

Covariates were included in the LPA using the maximum likelihood three-step approach in *Mplus* through the R3STEP command (Asparouhov & Muthén, 2014; Vermunt, 2010). The first step estimates the model using only the indicator variables. A new variable representing participants’ most-likely profile membership is then created in the second step. The third step involves regressing the most-likely-profile-membership variable onto the covariates whilst incorporating classification uncertainty (for equations see Asparouhov & Muthén, 2014). The R3STEP command allows for multiple covariates and controls for all other covariates during each regression. It is the recommended approach for person-centred latent variable studies (Weller et al., 2020). Missing data points in the covariate analysis were removed using list-wise deletion. This is the default procedure in *Mplus* when using the R3STEP command and avoids using multiple imputation which may result in biased results (Afghari et al., 2019). Missingness for the covariate analysis did not exceed 7%; missingness under 10% is considered unlikely to cause bias (Bennett, 2001).

3. Results

3.1. Descriptive statistics

The sample consisted of 1,315 (82.2%) females and 270 (16.8%) males. Eight people (0.5%) selected non-binary or ‘other’ and eight people (0.5%) had missing data for gender identity. The average age of the sample was 40 years ($SD = 11$ yrs). Most participants identified as White ($n = 1507$; 94.1%). Eleven participants (0.7%) identified as Black, 30 (1.9%) as Asian, 28 (1.8%) as mixed, 11 (0.7%) as ‘other’ and 13 people (0.8%) had missing data for ethnicity. The majority of participants were working in a clinical role ($n = 951$; 59.4%) whilst 538 (33.6%) participants were working a non-clinical

role, and 111 (7.0%) participants had missing data for role-type.

Over a third of participants reached clinical threshold for PTSD based on the ITQ ($n = 571$, 35.7%). The sample had a mean score of 12.2 (SD = 5.6) on the GAD-7 and a mean score of 13.9 (SD = 6.01) on the PHQ-9. 1,034 (64.6%) participants answered 'no' or 'unsure' when asked if they had been concerned about their mental health before March of 2020, whilst 562 (35.1%) answered 'yes'. Four participants had missing data for this question. The final sample size for the covariate analysis was $n = 1489$.

3.2. Latent profile analysis model selection

Fit statistics for the LPA are shown in Table 1. An iterative process was used to estimate models between one and eight profiles. Models with more than eight profiles were not estimated due to the failed convergence of the eight-profile solution. The AIC, BIC and SABIC values continues to decrease with the addition of more profiles, however the magnitude of the decrease became insubstantial after the five-profile model. The p BLRT was significant for each model and the LMR statistic was significant for all except the five-profile solution. The three-, four- and five-profile solutions had an entropy value below the recommended 0.80. Solutions with two, six and seven profiles all had satisfactory entropy values. Taken together, the fit statistics necessitated a closer inspection of the six- and seven-profile solutions. Whilst the BLRT and LMR suggested a better fit with the seven-profile solution, there was a minimal decrease in AIC, BIC and SABIC values with the addition of a seventh profile. A closer inspection of the seven-profile solution also indicated confusingly similar profiles which could lead to difficulty in interpretation. This, combined with the successful validation (see Supplementary Materials 1), meant we selected the more parsimonious six-profile solution.

3.3. The six-profile solution

Figure 1 represents the individual profiles determined by the six-profile solution. Profile one – 'No symptom' ($n = 342$, 21.38%) indicated negligible symptom presentations across symptom domains, however, FI was slightly raised. Profile two – 'Low symptom' ($n = 358$, 22.38%) was the largest profile which represented low symptom presentations across all symptom domains. Profile three – 'Low symptom (moderate Th_x and FI)' ($n = 159$, 9.94%) indicated moderate symptoms relating to Th_x and FI. Profile four – 'Moderate symptom (low Th_dx and high Av_dx)' ($n = 160$, 10.00%) was characterised by

moderate symptoms relating to Re_dx and FI, low symptoms of Th_dx, and high symptoms relating to Av_dx. Profile five – 'Moderate symptom' ($n = 255$, 15.94%) represented an overall moderate symptom profile. Profile six – 'High symptom' ($n = 326$, 20.38%) was characterised by high symptom presentations across all symptom domains. PTS symptom profiles were distinct both quantitatively and qualitatively.

3.4. Covariate analysis

The results of the covariate analysis are presented in Table 2. The 'No symptom' profile was used as the reference group for comparing the predictive effect of covariates as this profile was taken to be the 'normative' group. Thus, the coefficients and odds ratios (ORs) presented in Table 2 reflect the effect of covariates on likelihood of membership of the symptomatic profiles relative to the 'No symptom' profile, whilst controlling for all other covariates. The significance of the coefficients is also provided, with the OR included to aid interpretation.

Having a mental health concern before March 2020 did not significantly predict profile membership, with coefficients and ORs remaining close to one.

Having a score of ten or above on the GAD-7 predicted membership of all of the symptomatic profiles except the 'Moderate symptom (low Th_dx and high Av_dx)' profile. The OR for the 'High symptom' profile was particularly raised (11.41) indicating that participants were much more likely to belong to the 'High symptom' profile than the 'No symptom' profile if they had raised GAD-7 scores.

Having a score of 15 or above on the PHQ-9 predicted membership of the 'Moderate Th_dx and FI' profile, the 'Moderate symptom' profile and the 'High symptom' profile. The OR values for this covariate were lower than for the GAD-7, suggesting that anxiety may be a more significant predictor of PTS symptoms than depression.

Having a non-clinical role predicted membership of two profiles: 'Moderate Th_dx and FI' and 'Moderate symptom'. The negative coefficients and ORs below one reflect that a value of '1' was given for 'clinical role' and '0' for 'non-clinical role'.

4. Discussion

This study investigated patterns of PTS symptoms in a sample of treatment-seeking clinical and non-clinical HCW from the north of England. We employed latent profile analysis and found that a six-profile model fit the data best. Four of the groups differed quantitatively in terms of symptom level, corresponding to the following profiles: 'No symptom'; 'Low symptom'; 'Moderate symptom'; 'High symptom'. Two of the

Table 1. Fit and diagnostic statistics for profile solutions 1–8.

Profiles	LL	#fp	AIC	BIC	SABIC	Entropy	Smallest average LPP	N in smallest profile	% in smallest profile	pBLRT	pLMR
1	-10843.09	8	21702.17	21745.19	21719.78	–	–	–	–	–	–
2	-9783.66	13	19593.31	19663.22	19621.92	0.83	0.95	805	50.3	<.001	<.001
3	-9591.95	18	19219.90	19316.70	19259.52	0.76	0.85	439	27.4	<.001	<.001
4	-9483.023	23	19012.05	19135.74	19062.68	0.79	0.79	284	17.8	<.001	<.001
5	-9435.18	28	18926.36	19076.94	18987.99	0.76	0.74	212	13.3	<.001	.12
6	-9375.64	33	18817.27	18994.74	18889.91	0.80	0.78	159	9.9	<.001	<.001
7	-9144.72	38	18365.44	18569.80	18449.08	0.89	0.77	117	7.3	<.001	<.001
8	Log likelihood value not replicated.										

Note. $n = 1600$. LL = log likelihood. #fp = number of free parameters. LPP = latent posterior probability. BLRT = Bootstrapped likelihood ratio test. LMR = Lo-Mendell-Rubin likelihood test.

profiles differed qualitatively, corresponding to symptom presentations characterised by the following profile names: ‘Low symptom (moderate Th_dx and FI)’; ‘Moderate symptom (low Th_dx and high Av_dx)’.

The four quantitatively different profiles in this study accord with previous research which has found three or four profiles/classes which differ predominantly by severity of PTS symptoms (Bondjers et al., 2018; Böttche et al., 2015; Breslau et al., 2005; Hebenstreit et al., 2015). The four quantitatively distinct profiles showed relative homogeneity in symptom expression across domains with little fluctuation in scores between re-experiencing, avoidance, sense of current threat and functional impairment.

Individuals belonging to the ‘Moderate symptom (low Th_dx and high Av_dx)’ profile showed moderate symptoms for re-experiencing and functional impairment, high scores for avoidance and low scores

for sense of current threat. A similar profile was found in a sample of UK veterans experiencing moderate PTS symptoms with high avoidance (Murphy et al., 2019). Ehlers and Clark’s (2000) cognitive model of PTSD suggests that individuals who have experienced a traumatic event may engage in safety behaviours such as physical avoidance and thought suppression. These two types of safety behaviours map onto questions in the ITQ relating to avoidance of internal and external reminders of an index event; high scores on Av_dx may indicate frequent use of safety behaviours. Commonly experienced self-stigmatisation in HCW, exacerbated by a unique pandemic-related stigma such as virus transmission, may contribute towards avoidance symptoms in this population (Riegel et al., 2022; Sachdeva et al., 2022; Zandifar et al., 2020). Whilst research suggests that, in the long-term, avoidance may contribute to the maintenance of symptoms (Blakey et al., 2020; Ehlers & Clark,

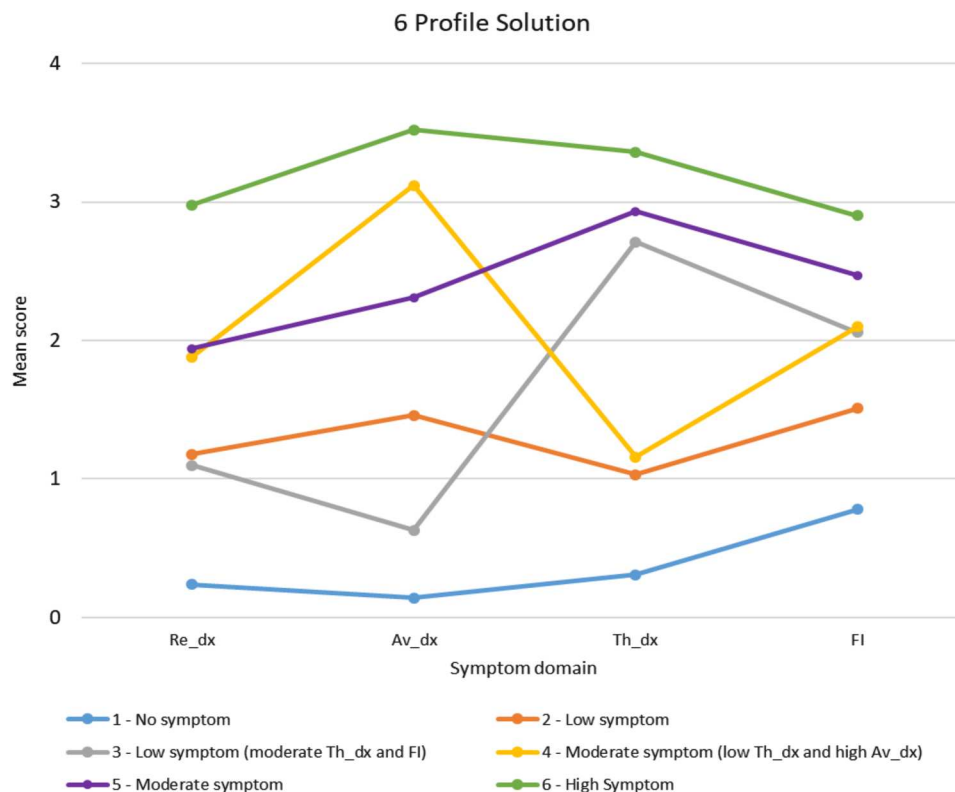
**Figure 1.** Line graph showing results of the six-profile solution.

Table 2. Table showing predictors of profile membership.

Covariate	'Low symptom' vs 'No symptom'		'Low symptom (moderate Th_dx and FI) vs 'No symptom'		'Moderate symptom (low Th_dx and high Av_dx) vs 'No symptom'		'Moderate symptom' vs 'No symptom'		'High symptom' vs 'No symptom'	
	Coef.	OR [95% CI]	Coef.	OR [95% CI]	Coef.	OR [95% CI]	Coef.	OR [95% CI]	Coef.	OR [95% CI]
Role	0.10	1.10 [0.71, 1.70]	-0.93***	0.39 [0.24, 0.64]	-0.14	0.87 [0.54, 1.40]	-0.53*	0.59 [0.39, 0.91]	-0.13	0.88 [0.58, 1.33]
PHQ-9	-0.28	0.75 [0.47, 1.23]	0.54*	1.71 [0.99, 2.94]	0.18	1.29 [0.68, 2.11]	0.75***	2.12 [1.35, 3.35]	1.26***	3.52 [2.27, 5.49]
GAD-7	0.62**	1.86 [1.22, 2.84]	1.37***	3.93 [2.16, 7.15]	0.42	1.53 [0.91, 2.58]	1.97***	7.14 [4.04, 12.60]	2.44***	11.41 [5.87, 22.20]
Mental health concern	0.04	1.04 [0.68, 1.60]	0.34	0.71 [0.19, 0.42]	-0.01	0.99 [0.61, 1.62]	0.24	1.27 [0.82, 1.98]	0.21	1.24 [0.82, 1.87]

Note. Coef. = coefficient. OR = Odds Ratio. CI = Confidence Interval. The coefficients and ORs reflect the effect of the covariates on likelihood of membership of the first listed profile relative to the second listed profile. * $p < .05$. ** $p < .01$. *** $p < .001$.

2000; Ehlers & Clark, 2008), individuals who engage in safety behaviours may, in the short-term, experience lower levels of hyperarousal due to lack of contact with internal/external threats (Sharpe et al., 2022; Stephenson et al., 2009). Notably, membership of the 'Moderate symptom (low Th_dx and high Av_dx)' profile was not predicted by raised GAD-7 scores, as with all other symptomatic profiles. This may suggest that the low sense of current threat experienced by this profile impacts on anxiety levels, reducing hyperarousal.

The 'Low symptom (moderate Th_dx and FI)' profile was characterised by individuals experiencing low symptoms of re-experiencing and avoidance, and moderate symptoms of sense of current threat and functional impairment. Consistent with the 'Moderate symptom (low Th_dx and high Av_dx)' profile, the presentation of this profile is reflective of a relationship between avoidance as a safety behaviour and levels of hyperarousal. This finding resonates with previous research suggesting a link between hyperarousal and functional impairment (Maguen et al., 2009). HCW continue to face increased workload and demand as a result of the pandemic, confronting internal and external reminders of traumatic events related to occupational trauma. Unable to avoid or safely process reminders, increased hyperarousal in the workplace may manifest as functional impairment at work. Notably, this profile exhibits subclinical PTSD symptoms. There is currently limited research surrounding specific symptom profiles for subclinical PTSD. However, research has shown that symptoms of hyperarousal are highly influential on the development of other PTSD symptoms, indicating a risk of developing clinical PTSD (Mylle & Maes, 2004; Schell et al., 2004). Moreover, in comparison to clinical PTSD, treatment of subclinical PTSD has demonstrated greater improvements in symptoms, particularly hyperarousal (Korte et al., 2016).

Similarly, the low mean score for sense of current threat in the 'Moderate symptom (low Th_dx and high Av_dx)' profile may indicate that individuals within this group would not meet diagnostic criteria for PTSD, potentially precluding them from treatment. Given that the use of safety behaviours in people with PTS symptoms may contribute to the maintenance of such symptoms (Birch, 2023; Blakey et al., 2020) and even impede natural recovery (Pineles et al., 2011), it is important that such individuals are considered for treatment. In the context of HCW, it is particularly important to prioritise early intervention without the need for diagnosable levels of symptoms to improve staff retention (Søvold et al., 2021).

Given the recent research highlighting increased rates and severity of PTSD in clinical HCW, we expected HCW in a clinical role to predict moderate

or high symptom profiles (Bock et al., 2020; Carmassi et al., 2020; Lee et al., 2018; Levin, 2019; Marvaldi et al., 2021; Mealer et al., 2009; Scott et al., 2023). However, this was not the case. On the contrary, having a non-clinical role predicted membership of the 'Low symptom (moderate Th_dx and FI)' profile and 'Moderate symptom' profile. An explanation for a clinical role not predicting higher symptom profiles may be due to under-reporting of self-reported symptoms, as suggested in Wild et al.'s (2021) study.

The assumption that clinical staff may experience PTS symptoms at a higher rate is based on the idea that HCW are more likely to be exposed to traumatic events, given their job role. There is limited research into the occupational trauma that may be experienced by non-clinical HCW. However, non-clinical HCW such as cleaners or IT workers may have had limited medical training and resources for psychological preparedness compared to clinical HCW such as doctors and psychologists, particularly during the pandemic (Zhang et al., 2021). Our findings point towards a need for exploration of this given that many non-clinical staff interact with service users daily. Moreover, Wild et al.'s (2021) study indicates that experiences of a personal traumatic event were almost equal to experiences of occupational trauma. Regarding occupational trauma, interpersonal environment in the workplace and support provided following a traumatic incident were more influential on PTSD development (Laposa & Alden, 2003). Experiences of PTS in HCW appear to be unrelated to the level of care provided in their respective roles, and more indicative of personal trauma, workplace environment or access to resources. In view of these findings, associated risk factors should be investigated further.

The covariate analysis revealed that scores of 10 or greater on the GAD-7 and scores of 15 and above on the PHQ-9 predicted membership of symptomatic profiles. Aligned with prior research, this study points towards an association between PTS and both anxiety and depression (Breslau et al., 1997; Carmassi et al., 2021; Ginzburg et al., 2010; Rytwinski et al., 2013). Reflective of Longo et al. (2020) study, the results indicate a stronger relationship between anxiety and PTS compared to the relationship between depression and PTS, as indicated by the relative OR values.

Although anxiety significantly predicted membership of the 'Low symptom' profile, the low OR value suggests a weaker predictive effect compared to other symptomatic profiles. Despite its classification as a low symptom group, the 'Low symptom (moderate Th_dx and FI)' profile is notable. The predictive effect of depression and anxiety related to this group is not unusual given the strong relationship between hyperarousal symptoms and both depression and anxiety compared to other symptom clusters (Horesh et al., 2017; Price & van Stolck-Cooke, 2015).

Mental health concerns pre-existing March 2020 did not predict membership of any of the profiles. This variable was used as a measure of whether PTS symptoms were influenced by pre- or post-pandemic mental health concerns. This finding diverges from research which suggests a link between the pandemic and an increase in PTS symptoms among HCW (Marvaldi et al., 2021; Scott et al., 2023). However, the null finding for this covariate may accord with research which posits that the majority of staff have experienced trauma unrelated to the pandemic (Wild et al., 2021). The finding may also be due to the crude measure of pandemic-relatedness used (see Limitations).

5. Implications

This study's findings have important implications for researchers and clinicians working in the field. The heterogeneity of PTS symptom presentations, as demonstrated by the six profiles, underscores the importance of targeted interventions (Cloitre, 2015; Steenkamp, 2016). For example, memory processing interventions such as prolonged exposure are particularly effective in addressing avoidance symptoms, while meditation-based interventions effectively target hyperarousal (Crawford et al., 2019; Stevens et al., 2020). Furthermore, the impact of hyperarousal on functional impairment among HCW is likely to affect staff retention. Given hyperarousal symptoms' resistance to general treatment, their unaddressed impact may perpetuate the cyclic pattern of increased workload in healthcare settings (Miles et al., 2023). The present study was cross-sectional but future research should replicate findings and focus on longitudinal studies to investigate if differential profile membership impacts on treatment response.

To improve staff retention in healthcare, early intervention or preventative treatment for those meeting subclinical thresholds should be considered. Low to Moderate symptom profiles in this study suggest that HCW below clinical threshold are still struggling but are unlikely to receive treatment. Clinicians should be encouraged to provide preventative treatment to mitigate the risk of developing clinical PTSD and reduce comparable levels of distress (Cukor et al., 2010; Mylle & Maes, 2004; Zlotnick et al., 2002). As part of this, healthcare settings should enhance social support through supervision and increase training and awareness, particularly for non-clinical HCW.

Future research should aim for more comprehensive representations of PTS symptoms amongst non-clinical HCW, especially considering the predicted membership of symptomatic profiles highlighted in this study. Additionally, as this study worked with a homogenous sample, diversifying samples across the UK would enhance the generalisability of findings.

6. Limitations

This study used the ITQ which is a self-reported screening tool and therefore susceptible to reporting bias (Rosenman et al., 2011). Research has shown that clinical interviews are preferable for accurately assessing symptom levels, as self-report measures for PTS symptoms may be susceptible to both under-reporting (Wild et al., 2021) and over-reporting (Stevens et al., 2013). Further, use of the ITQ means that this study lacks comparability with other latent variable studies which have used measures from the ICD-11 or DSM-5. However, the use of a quantitative measure was necessary for the data analysis method and the ITQ has been validated using the ICD-11 (Hyland et al., 2017).

As Wild et al. (2021) highlight, there is a need for determining index events (trauma incidents) when considering PTSD rates amongst this population. As this study used quantitative secondary data, there was no appropriate measure of index events. As such, we were limited in our ability to report on a causal relationship between PTS and trauma exposure associated with respective roles or the pandemic. However, this study highlights the varied levels of PTS symptomology within HCW regardless of index event.

Following the pandemic, Complex PTSD (CPTSD) has been suggested as a more prevalent concern than PTSD in HCW (Greene et al., 2023). As CPTSD often arises from sustained or repeated traumatic events, the pandemic may have compounded existing trauma or prolonged trauma due to continued exposure. Given the computational intensity of including further indicators in the LPA, this study was unable to consider CPTSD-specific symptoms. Nonetheless, given that criteria for PTSD must be met for a CPTSD diagnosis, it was important to highlight PTS symptom differences among healthcare staff who may not have met diagnostic thresholds for PTSD or CPTSD.

This study is limited in its generalisability, due to the overrepresentation of White females, which does not accurately reflect the demographic composition of HCW in the UK; NHS data from 2022 indicates that 26% of HCW do not identify as White (NHS Digital, 2023), whereas only 6% of individuals in this study identified as non-White. Furthermore, the disproportionate representation of female participants in this study skews the results towards the experiences of female HCW. However, in recognising that women are at a higher risk of experiencing PTSD (Olff, 2017), this study makes a valuable contribution to understanding the experiences of this demographic subgroup. Further, sample bias identified in this study relates to participants being treatment-seeking individuals. Given that HCW have reported barriers

to seeking treatment such as organisational pressures and internalised reservations around stress as an expectation of the role (Allsopp et al., 2023), HCW suffering from PTS may not access support. Further explanations for not accessing support may point towards levels of avoidance in non-treatment seeking individuals.

7. Conclusion

This study is the first to investigate PTS symptom typologies in treatment-seeking UK HCW using a person centred latent variable approach. A six-profile solution fit the data best and showed heterogeneity in presentation both in terms of overall symptom severity and qualitative patterns of symptom expression. The six-profile model was validated by re-running the analysis on a random sample of the data and by observing expected relationships with covariates; high scores on the GAD-7 and PHQ-9 predicted membership of several symptomatic profiles. The diversity of presentations elucidated by this study suggests a need for diverse interventions among HCW.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

Anonymised data are available upon reasonable request, please contact the Humber and North Yorkshire Resilience Hub via email hny.resiliencehub@nhs.net, or telephone 03300 022 044. Due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting data is not available.

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