

Latent Profiles of PTSD, Anxiety and Depression and association with Trauma Exposure
within Prison Personnel

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Conflict of Interest: Authors declare that they have no conflict of interest.

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Abstract

Objective: The aim of the study was to identify meaningful subtypes of anxiety, depression, and PTSD symptomology amongst Prison Personnel. A further aim was to estimate the association between anxiety, depression and PTSD class membership and typology of Prison Trauma Exposure (Self-Harm/Death, Violent, Environmental) age and years of service, and differentiations between male and female personnel.

Method: A non-probability convenience sample of 1995 Prison Personnel in the UK completed the Prison Personnel Trauma Measure (PPTM), Hospital Anxiety and Depression Scale (HADS) and the Posttraumatic Stress Disorder Checklist – Civilian Version (PCL-C).

Results: Latent profile analysis revealed seven distinct classes in male personnel including a ‘heightened symptom’ (16.8%) and a ‘high symptom group’ (10.3%) and five distinct classes in female personnel including a ‘above moderate symptom group’ (28.4%) and a ‘high symptom group’ (18.1%). Multinomial logistic regression showed that male prison personnel in the ‘moderate with increased PTSD-C and low PTSD-B group’ and the ‘heightened symptom group’ were more likely to be exposed to environmental trauma, whereas male prison personnel in the ‘high symptom group’ were more likely to be exposed to environmental trauma, self-harm/death in prison and have significantly less years of service. Female prison personnel in the ‘moderate symptom group’ were more likely to be exposed to environmental and violent trauma, whereas in the ‘high symptom group’ females were more likely to be exposed to violent trauma.

Conclusion: Findings suggest distinctions between anxiety, depression and PTSD symptomology amongst male and female prison personnel and typology of prison trauma

exposure. The significance of the present findings is discussed in relation to past and future research as well as policy implications and practice.

KEYWORDS: Prison, Trauma Exposure, PTSD, Anxiety, Depression, Violence

Highlights

- Aim was to identify meaningful subtypes of anxiety, depression, and PTSD symptomology amongst Prison Personnel.
- Measures were administered to 1995 prison personnel (mostly prison officers) in the UK.
- Latent profile analysis revealed seven distinct classes in male personnel and five distinct classes in female personnel.
- Male personnel were more likely to have been self-harm / death trauma exposed, female personnel violent trauma exposed.

Introduction

Posttraumatic stress disorder (PTSD) is a heterogeneous syndrome characterised by relatively disparate symptom clusters which can cause long standing psychological illness (APA, 2013). The current diagnosis of PTSD requires exposure to a traumatic event and that the symptom clusters are present for at least one month, causing significant distress or impairment (APA, 2013).

Prevalence rates of 3.5% for PTSD have been found in the US with 0.5 – 1.0% in European, Asian, African, and Latin American countries (APA, 2013). The highest rates have been found in areas of armed conflict (Bisson et al., 2015) and in occupations whose roles entail a higher risk of trauma exposure (Perrin et al., 2007; Fulton et al., 2015). Many individuals who are exposed and react to traumatic events may also show similar symptoms of posttraumatic stress without meeting full criteria for diagnosis, such trauma-exposed individuals develop subthreshold PTSD (Stein et al., 1997; McLaughlin et al., 2015). Subthreshold PTSD is clinically relevant, and is associated with significant impairment (Cukor et al., 2010). Subthreshold PTSD may be particularly relevant to chronically trauma exposed occupations, research on Police Officers has indicated a prevalence rate of PTSD between 4.5 and 9% (Berger et al., 2012; Maia et al., 2007) with rates of 15-16% with subthreshold PTSD (Maia et al., 2007; Marmar et al., 2006).

Individuals with PTSD are also 80% more likely to present with symptoms that meet diagnostic criteria for at least one other mental disorder (Brady et al., 2000). Military and civilian studies show PTSD rarely occurs in isolation (Kozaric-Kovacic et al., 2001; Orsillo et al., 2002). High rates of comorbid anxiety, depression or both with PTSD have been reported (Ginzburg et al., 2010). Previous latent class analyses of PTSD comorbidity (Galatzer-Levy et al., 2013) have revealed classes of lifetime comorbidity with PTSD. Within trauma exposed occupations, comorbid symptomology has been found to be prevalent (Ginzburg et al., 2010; Jones et al., 2018; Petrie et al., 2018). Typology of trauma event exposure has also been shown to be significantly linked with higher numbers of comorbid disorders (Leskin, 2002; Rees, 2011).

Disparities within gender and PTSD and other comorbid disorders are well documented (Kessler et al., 2005). Prevalence rates of potentially traumatic events and PTSD vary with men reporting higher exposure than women (Breslau, 2002; Breslau et al., 1998; Tolin & Foa, 2006).

However women are more likely to develop PTSD than men (Kilpatrick et al., 2013; Pineles et al., 2017) as well as have double the prevalence rates (Chapman et al., 2012; Nemeroff et al., 2006). It has been found that trauma typology may account for some of this disparity (Breslau et al., 1997, 1998; Tolin & Foa, 2006) with women more likely to develop PTSD because of interpersonal violence (Breslau et al., 1997) as well as more likely to develop PTSD overall despite being exposed to the same trauma typologies as men (Tolin & Foa, 2006).

Findings from research across several countries suggest working in a prison environment to be traumatic (Johnson et al., 2005; Spinaris et al., 2012; Denhof & Spinaris, 2013; Boudoukha et al., 2013; Denhof et al., 2014; Kinman et al., 2014) with Prison Officers reporting poorer physical and psychological health than other trauma exposed occupational groups (Johnson et al., 2005; Kinman et al., 2014). The experiencing of violence and aggression, from prisoners has been highlighted as a particularly problematic area (Spinaris et al., 2012). Prison related occupations have not received comparable research attention to other at-risk occupations, and it is evident that prison personnel are exposed to many of the same or similar work-related traumatic events as Police Officers (Perrin et al., 2007), Firefighters (Corneil et al., 1999), and military personnel (Fulton et al., 2015). Given that Prison Officers are directly exposed to events involving violence, injury, or death as well as repetitive indirect exposure as part of one's job role (Denhof & Spinaris, 2013; Denhof et al., 2014; Konda et al., 2013; Spinaris et al., 2012; Stadnyk, 2003), there is the potential for development of adverse psychological outcomes such as PTSD, subthreshold PTSD, anxiety, and depression. Research shows Prison Officers demonstrate high levels of PTSD symptoms, burnout, and stress, with violent interactions with prisoners leading to experienced traumas of all types (Boudoukha et al., 2013) Furthermore, whilst a variety of health-related consequences have been linked to traumatic exposure in prison settings, Denhof and Spinaris (2013) have highlighted that the presence of comorbid depression and anxiety symptomology and PTSD appears to be

particularly consequential. Prison personnel with comorbid status demonstrate significantly higher negative health conditions than prison staff with either PTSD or depression and anxiety alone. As well as this it was found that male personnel met criteria for comorbid PTSD more frequently than female personnel despite being exposed to similar prison related potentially traumatic events (Denhof & Spinaris, 2013) a finding at odds with the general PTSD literature (Tolin & Foa, 2006).

The aims of the current study were to address the limitations of existing research surrounding comorbid PTSD symptomology in trauma exposed occupations within a sample of prison personnel. The primary aim being to uncover meaningful subtypes of trauma exposed prison personnel with PTSD as well as comorbid anxiety and depression symptomology and differentiation regarding male and female personnel using latent profile analysis. The secondary aim of the analysis was to identify associations between typology of the three trauma factors that are measured by the PPTM; self-harm/death, violent, and environmental exposure (Woodfield et al., 2019) and classes of symptomology identified by a latent profile analysis, and further differentiation within male and female personnel.

Owing to the limitations of previous research, a formulation of any a priori hypotheses was not made, regarding the numbers or distinctions between classes, however it was expected that classes scoring high and low on all symptomology subsets would be identified in both male and female participants. It was also expected that associations between identified symptomology classes and typologies of trauma would exist, and differentiations would occur between male and female participants. In an attempt to verify the prevalence of comorbidity in prison personnel without relying on cut off points calculated for total scores, a further goal was to establish what percentage of prison personnel would be classed in the higher symptom latent classes.

Method

Sample

Participants were recruited opportunistically from prison personnel based in the United Kingdom. In total $N = 1995$ prison personnel responded and returned completed surveys. Due to some of the returned surveys having significant missing data, $N = 1562$ respondents were included in the final analysis. The sample consisted of $n = 948$ male and $n = 614$ female participants. Their age ranged from 19 to 71 years ($M = 43.06$, $SD = 10.72$, $Median = 45$) and reported length of prison work experience ranged from 1 to 43 years ($M = 14.24$, $SD = 8.58$, $Median = 13$). One thousand and thirty-nine ($n = 1039$) of the participants were prison officers, $n = 288$ supervising officers, $n = 128$ custodial managers and governor grades, and $n = 107$ operational support grades. In typology of security classification $n = 284$ participants were from Category A establishments (prisoners whose escape would be highly dangerous to the public or national security), $n = 732$ from Category B (prisoners who do not require maximum security, but for whom escape still needs to be made very difficult), and $n = 546$ from Category C (prisoners who cannot be trusted in open conditions but who are unlikely to try to escape). Ninety ($n = 90$) participants were from female prison establishments, $n = 1002$ from male prisons, $n = 87$ from male young offending institutes, and $n = 383$ from mixed adult and young offending establishments. In relation to amount of direct contact with prisoners $n = 972$ of participants reported contact all the working day, $n = 362$ most of the working day, $n = 152$ half of the working day, $n = 67$ approx. two hours per working day and $n = 9$ of participants reported no direct contact with prisoners.

Measures

Prison Personnel Trauma Measure (PPTM) – is a 15-item self-rating questionnaire measuring prison personnel’s occupational trauma exposure (Woodfield et al., 2019). The PPTM utilizes a Likert-type rating scale for each item (from 1 "never" to 4 "21 or more times"), encapsulating three factors, exposure to Death and Self-Harm, Violence, and Environment. Items encapsulate a scenario specific to the occupational role requirement of prison personnel with relevance to prison officers (i.e., in their interactions with prisoners) as opposed to the organizational stressors that may be a consequence of managerial practices, institution policies, designated workloads, and influences of government policies and resource injection. The death and self-harm factor encapsulates witnessing of self-harm behaviour as well as witnessing death through self-inflicted or lethal force by prisoners. The environment factor encapsulates work in a prison that entails stress through isolation with little peer support as well as poor architecture with low visibility to peers whilst being surrounded by unlocked prisoners. The violent factor encapsulates witnessing as well as being subjected to violence directly and indirectly. The psychometric properties of the PPTM have been reported in previous studies (Woodfield et al., 2019). Internal consistency using Cronbach’s alpha in the current study for PPTM was .81 for self-harm/death, .83 for violent and .80 for environment, subscales.

Hospital Anxiety and Depression Scale (HADS) is a 14-item self-rating questionnaire measuring 'depression' and 'anxiety' (Zigmond & Snaith, 1983). The HADS uses seven days as reference period. The depression scale (7 items, score range 0–21) measures mostly anhedonia (inability to feel pleasure in normally pleasurable activities) a phenomenon considered to be the central characteristic of major depressive disorder. The anxiety scale (7 items, score range 0–21) measures mostly symptoms of generalized anxiety disorder. The psychometric properties of the HADS have been reported in previous studies (Spinhoven et al., 1997, Hermann, 1997, Bjelland et al., 2002). The HADS is a well-established and widely used

measure of anxiety and depression. Internal consistency using Cronbach's alpha in the current study was .86 for anxiety and .82 for depression subscales.

The Posttraumatic Stress Disorder Checklist – Civilian Version (PCL-C) is a 17-item self-rating questionnaire (Weathers et al., 1994) based upon the Diagnostic and Statistical Manual of Mental Disorders criteria for PTSD (APA, 2000). The PCL-C utilizes a Likert-type rating scale (from 1 "not at all" to 5 "extremely") for each item, where respondents indicate the extent of symptoms experienced during the past 30 days. The quality of measurement characteristics of the PCL-C (Blanchard et al., 1996; Orsillo, 2002; Ruggiero et al., 2003) and its diagnostic utility (Bertelson et al., 2011; Gardner et al., 2012; Keen et al., 2008; McDonald & Calhoun, 2010) are well substantiated. The PCL-C is among the most widely used PTSD screening devices in clinical and research settings (Elhai et al., 2005). Internal consistency using Cronbach's alpha in the current study for PTSD scale was .96.

Analytical Procedures

Latent profile analysis (LPA) was used to identify homogeneous groups (latent classes) from a sample ($N = 1562$) of prison personnel, using three dimensions of the PPTM. A two-stage procedure was applied. First, LPA was conducted to determine the number of anxiety, depression and PTSD symptom classes and verify whether they differed qualitatively or quantitatively. The LPA part of the model used three total scores for anxiety, depression, and PTSD. Second, using a multinomial logistic regression (MLR), associations between latent classes of anxiety, depression and PTSD and type of trauma exposure (Self – Harm / Death, Environmental and Violent Exposure) were calculated. Eight alternative models for male participants were assessed (a 1-class model through to a 8-class model) and five alternative models for female participants were assessed (a 1-class model through to a 5-class model) using robust maximum likelihood (Yuan & Bentler, 2000). To avoid solutions based on local maxima, 500 random sets of starting values were used initially and 100 final stage

optimizations. The relative fit of the models was compared using the Akaike Information Criterion (AIC; Akaike, 1987), the Bayesian Information Criterion (BIC; Schwarz, 1978), and sample size adjusted Bayesian Information Criterion (SSA-BIC; Sclove, 1987). The model with the lowest value indicates the best latent profile solution. Strong evidence from simulation studies have suggested that the BIC is the best information criterion for identifying the correct number of latent classes (Nylund et al., 2007). Entropy value was also calculated which indicates the ability of the model to correctly classify participants, with higher value indicating better classification (Ramaswamy et al., 1993). In addition, the Lo-Mendell-Rubin adjusted likelihood ratio test (LRT; Lo, Mendell, & Rubin, 2001) was used to compare models with increasing numbers of latent classes. A non-significant value ($p > 0.05$) suggests that the model with one less class should be accepted. All analyses were conducted using Mplus version 7.14 (Muthén & Muthén, 2015).

Results

The fit statistics for the LPA of anxiety, depression, PTSD model for males is presented in Table 1 and for females in Table 2. The lowest BIC value is observed for the 7-class solution for males and 5 class solution for females and the LRT test shows that there is no significant improvement in fit for the 8-class solution for males and 6 class solution for females. The entropy test confirms the above solutions. Based on the results, the 7-class solution (for males) and 5 class solution (for females) are considered the best fitting models.

Table 1

Fit Indices for the Latent Profile Analysis of Males

Model	AIC	BIC	SSABIC	LRT	<i>p</i>	Entropy
2 classes	26877.20	26954.87	26904.05	2156.18	<.001	.89
3 classes	26169.22	26276.02	26206.15	702.88	<.001	.86
4 classes	25923.16	26059.08	25970.15	251.94	<.05	.84
5 classes	25691.75	25856.79	25748.81	237.63	<.001	.86
6 classes	25586.14	25780.32	25653.28	114.81	<.001	.84
7 classes	25466.47	25689.77	25543.68	128.55	<.05	.84
8 classes	25412.19	25664.62	25499.47	64.71	.132	.84

Note. AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion, SSABIC = Sample Size Adjusted BIC, LRT = Lo-Mendell-Rubin's Adjusted Likelihood Ratio Test.

Table 2*Fit Indices for the Latent Profile Analysis of Females*

Model	AIC	BIC	SSABIC	LRT	<i>p</i>	Entropy
2 classes	17496.89	17567.62	17516.82	1395.22	<.001	.90
3 classes	17125.25	17222.49	17152.65	373.93	<.001	.86
4 classes	16959.82	17083.58	16994.69	172.94	<.001	.84
5 classes	16797.15	16947.43	16839.48	170.25	<.001	.87
6 classes	16742.83	16919.63	16792.64	64.64	.49	.85

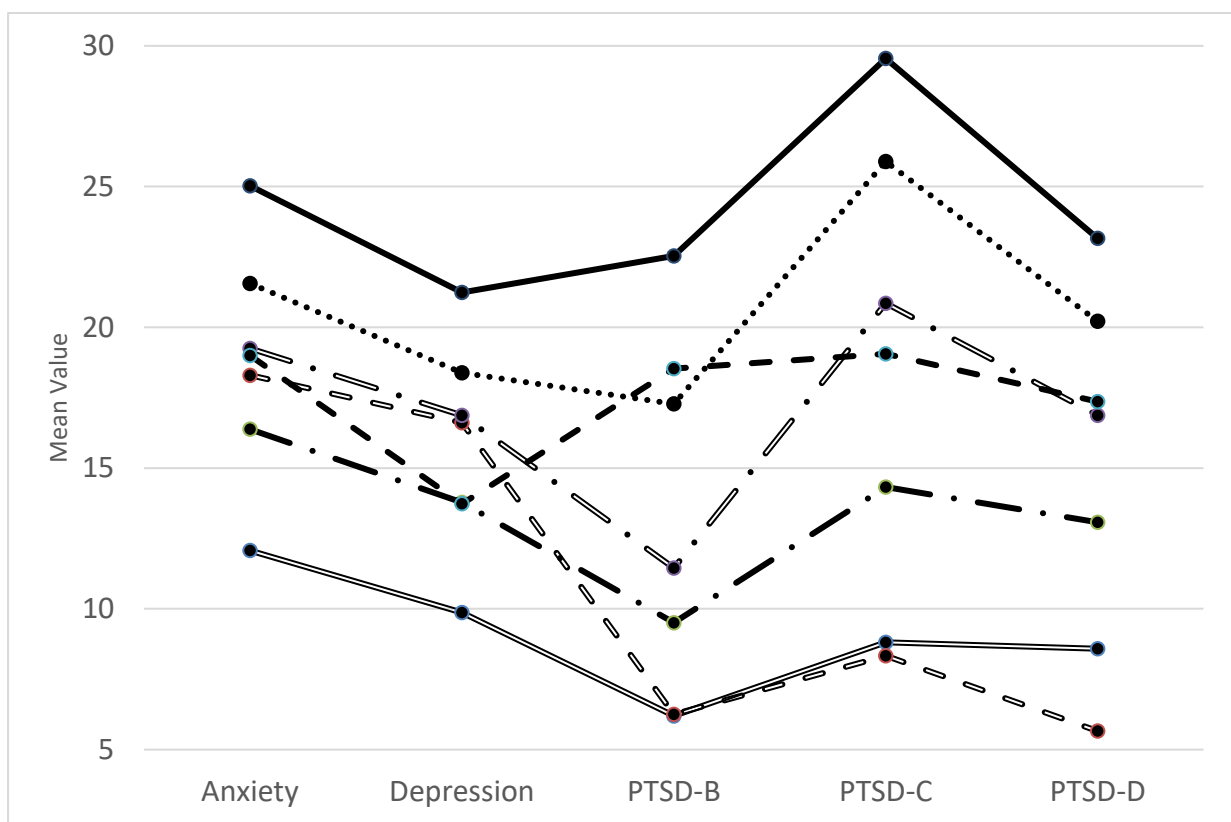
Note. AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion, SSABIC = Sample Size Adjusted BIC, LRT = Lo-Mendell-Rubin's Adjusted Likelihood Ratio Test.

Figure 1 shows the profile plot for the 7-class solution for males. Descriptive statistics with mean differences for the entire sample are presented in Table 3. Means and standard deviations for the LPA are presented in Table 4. Class 1 ($n = 135$, 14.2% of Male Personnel) is characterised by low mean scores on all 5 symptom dimensions (Anxiety, Depression, PTSD-B, PTSD-C and PTSD-D symptom clusters) and is labelled the 'low symptom group'. Class 2 ($n = 72$, 7.6% of Male Personnel) is characterised by moderate mean scores on anxiety and depression and low mean scores on PTSD – B, C and D this class is labelled the 'moderate anxiety / depression group'. Class 3 ($n = 248$, 26.2% of Male Personnel) is the largest group and is characterised by moderate mean scores on anxiety, depression, PTSD-C and PTSD-D and low PTSD-B scores and is labelled the 'moderate with low PTSD-B group'. Class 4 ($n =$

175, 18.5% of Male Personnel) is characterised by moderate mean scores for anxiety and depression, below moderate PTSD-B mean scores, high PTSD-C mean scores and moderate PTSD-D scores, this class is labelled the ‘moderate with increased PTSD-C and low PTSD-B group’. Class 5 ($n = 61$, 6.4% of Male Personnel) is characterised by moderate mean scores on depression, anxiety and PTSD and is labelled the ‘moderate symptom group’. Class 6 ($n = 159$, 16.8% of Male Personnel) is characterised by higher mean scores for anxiety, depression moderate PTSD – B, heightened PTSD-D and higher characterised scoring on PTSD-C and is labelled the ‘heightened symptom group’. Class 7 ($n = 98$, 10.3% of Male Personnel) is characterised by the highest mean scores for anxiety, depression, and PTSD –B, C, D and is labelled the ‘high symptom group’.

Figure 1

Latent Profile Plot for Males



Class 1 = double straight line ($n = 135$, 14.2% of participants); Class 2 = double dashed line ($n = 72$, 7.6%); Class 3 = dashed dotted solid line ($n = 248$, 26.2%); Class 4 - dashed dotted unsolid line ($n = 175$, 18.5%); Class 5 = solid dashed line ($n = 61$, 6.4%); Class 6 = dotted line ($n = 159$, 16.8%); Class 7 = solid line ($n = 98$, 10.3%).

Table 3*Descriptive Statistics for all Participants (Total) and Differences between Males and Females*

Variable	Total					Males	Females	<i>t</i> value (Cohen's d)
	<i>M</i>	<i>SD</i>	<i>Mdn</i>	Mode	Observed Scores Min-Max	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	
Age	43.08	10.76	45	49	19-71	45.22 (10.36)	39.77(10.54)	10.05*(.52)
Years of Service	14.25	8.58	13	1	1-43	15.98 (8.80)	11.59 (7.49)	10.56*(.54)
Trauma – Death / Self Harm	7.58	1.88	8	7	3-12	7.73 (1.77)	7.34 (2.02)	3.86*(.20)
Trauma - Violent	21.24	4.24	22	25	8-32	21.88 (3.91)	20.27 (4.54)	7.45*(.38)
Trauma - Environmental	9.76	2.58	10	9	4-16	10.14 (2.47)	9.17 (2.64)	7.37*(.38)
Anxiety	18.49	4.46	18	18	7-28	18.39 (4.44)	18.64 (4.50)	-1.10(-.06)
Depression	15.32	4.27	15	15	7-28	15.55 (4.31)	14.95 (4.19)	2.70(.14)
Criterion B PTSD	12.20	5.81	11	5	5-25	12.41 (5.85)	11.88 (5.73)	1.75(.09)
Criterion C PTSD	17.65	7.46	17	7	7-35	18.14 (7.57)	16.90 (7.23)	3.19*(.16)
Criterion D PTSD	14.89	5.79	15	5	5-25	15.14 (5.72)	14.50 (5.89)	2.12(.11)

Note. Bonferroni correction (* $p < .005$). Cohen (1977) suggested that $d = 0.2$ be considered a small effect size, 0.5 represents a medium effect size, and 0.8 denotes a large effect size.

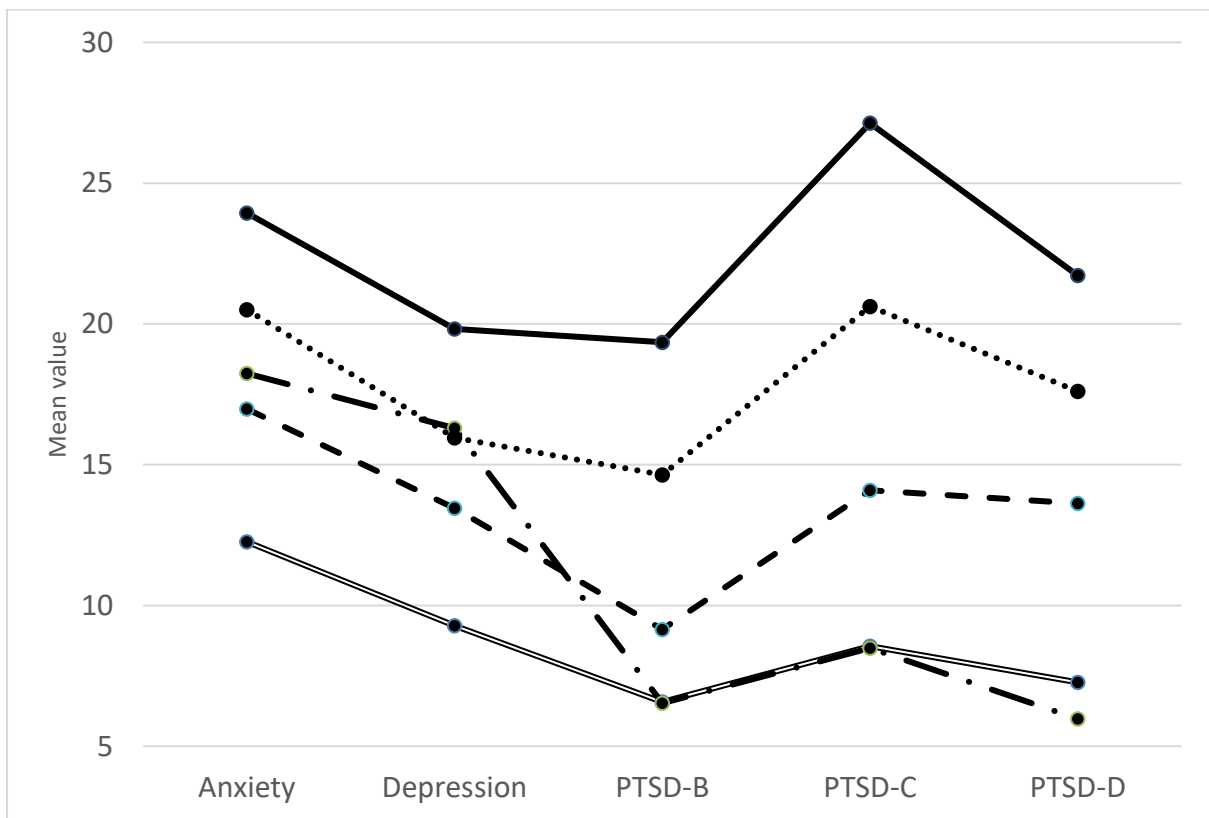
Table 4*Descriptive Statistics (M and SD) for LPA Males*

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
Anxiety	12.07	18.30	16.38	19.25	19.00	21.56	25.03
	(2.56)	(2.56)	(2.56)	(2.56)	(2.56)	(2.56)	(2.56)
Depression	9.87	16.61	13.78	16.87	13.73	18.39	21.24
	(2.79)	(2.79)	(2.79)	(2.79)	(2.79)	(2.79)	(2.79)
PTSD-B	6.20	6.25	9.51	11.45	18.53	17.28	22.54
	(2.53)	(2.53)	(2.53)	(2.53)	(2.53)	(2.53)	(2.53)
PTSD-C	8.81	8.33	14.33	20.86	19.06	25.89	29.55
	(3.02)	(3.02)	(3.02)	(3.02)	(3.02)	(3.02)	(3.02)
PTSD-D	8.58	5.66	13.08	16.87	17.36	20.22	23.16
	(2.58)	(2.58)	(2.58)	(2.58)	(2.58)	(2.58)	(2.58)

Figure 2 presents the latent profile plot for the 5-class solution for females. M and SDs for the LPA are presented in Table 5. Class 1 ($n = 95$, 15.4% of Female Personnel) is characterised by low mean scores on all 5 symptom dimensions (anxiety, depression, PTSD-B, PTSD-C and PTSD-D symptom clusters) and is labelled the ‘low symptom group’. Class 2 ($n = 60$, 9.7% of Female Personnel) is characterised by moderate mean scores on anxiety and depression and low mean scores on PTSD – B, C and D this class is labelled the ‘moderate anxiety / depression group’. Class 3 ($n = 174$, 28.4% of Female Personnel) is the joint largest group and is characterised by moderate mean scores on anxiety, depression, and low PTSD-B, PTSD-C and PTSD-D scores and is labelled the ‘moderate with low PTSD group’. Class 4 ($n = 174$, 28.4% of Female Personnel) is also the joint largest group and is characterised by moderate mean scores on depression, anxiety and PTSD and is labelled the ‘moderate symptom group’. Class 5 ($n = 111$, 18.1% of Female Personnel) is characterised by the highest mean scores for anxiety, depression and PTSD –B, C, D and is labelled the ‘high symptom group’.

Figure 2

Latent Profile Plot for Females



Class 1 = double straight line ($n = 95$, 15.4% of participants); Class 2 = dashed dotted solid line ($n = 60$, 9.7%); Class 3 = solid dashed line ($n = 174$, 28.4%); Class 4 = dotted line ($n = 174$, 28.4%); Class 5 = solid line ($n = 111$, 18.1%).

Table 5*Descriptive Statistics (M and SD) for LPA Females*

	Class 1	Class 2	Class 3	Class 4	Class 5
Anxiety	12.26 (2.66)	18.24 (2.66)	16.98 (2.66)	20.50 (2.66)	23.94 (2.66)
Depression	9.28 (2.69)	16.30 (2.69)	13.46 (2.69)	15.96 (2.69)	19.82 (2.69)
PTSD-B	6.57 (3.36)	6.53 (3.36)	9.15 (3.36)	14.64 (3.36)	19.35 (3.36)
PTSD-C	8.55 (3.11)	8.49 (3.11)	14.09 (3.11)	20.62 (3.11)	27.13 (3.11)
PTSD-D	7.27 (2.72)	5.97 (2.72)	13.62 (2.72)	17.61 (2.72)	21.72 (2.72)

The association between anxiety, depression, PTSD-B, PTSD-C and PTSD-D class membership and trauma exposure type, age, and years of service in Male and Female Personnel was estimated using a multinomial logistic regression (MLR) (see Table 6 for males, Table 7 for females). Multicollinearity was assessed via the tolerance statistic and variance inflation factor (VIF). The tolerance values were greater than 0.10 and the VIF values were below 10 as suggested acceptable (Tabachinck & Fidell, 2013) therefore, as the obtained values did not meet the thresholds set this suggested multicollinearity was unlikely to be a cause for concern.

In both samples the low symptom latent class was a reference group. Results suggest that male personnel in the ‘moderate with increased PTSD-C and low PTSD-B group’ (class 4) are significantly more likely to be exposed to environmental trauma (OR = 1.21, 95% CI = 1.05/1.39, $p < 0.05$) in comparison to the ‘low symptom group’ (class 1). Male personnel in

the 'heightened symptom group' (class 6) are significantly more likely to be exposed to environmental trauma (OR = 1.16, 95% CI = 1.01/1.33, $p < 0.05$) in comparison to the 'low symptom group' (class 1). Finally male personnel in the 'high symptom group' (class 7) are significantly more likely to be exposed to environmental trauma (OR = 1.23, 95% CI = 1.05/1.44, $p < 0.01$) Self – Harm / Death Trauma (OR = 1.31, 95% CI = 1.04/1.66, $p < 0.05$) and have significantly less years of service (OR = 0.93, 95% CI = 0.88/0.99, $p < 0.01$) in comparison to the 'low symptom group' (class 1). Results suggest that female personnel in the 'moderate symptom group' (class 4) are significantly more likely to be exposed to environmental trauma (OR = 1.23, 95% CI = 1.05/1.44, $p < 0.01$) and violent trauma (OR = 1.16, 95% CI = 1.03/1.31, $p < 0.01$) in comparison to the 'low symptom group' (class 1). Finally, females in the 'high symptom group' (class 5) are significantly more likely to be exposed to violence trauma (OR = 1.23, 95% CI = 1.08/1.42, $p < 0.001$) in comparison to the 'low symptom group' (class 1).

Table 6*Associations between Classes and Covariates (Males)*

	7 with 1	6 with 1	5 with 1	4 with 1	3 with 1	2 with 1
Variable	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Trauma – Death / Self Harm	1.31* (1.04/1.66)	1.14 (.90/1.44)	1.08 (.87/1.34)	1.11 (.89/1.37)	1.01 (.85/1.20)	.92 (.73/1.17)
Trauma - Violent	1.11 (.96/1.27)	1.09 (.95/1.26)	1.08 (.92/1.27)	1.03 (.92/1.16)	1.06 (.96/1.17)	1.07 (.94/1.23)
Trauma - Environmental	1.23** (1.05/1.44)	1.16* (1.01/1.33)	.90 (.74/1.10)	1.21* (1.05/1.39)	1.00 (.87/1.15)	1.05 (.90/1.23)
Age	1.03 (.99/1.07)	.99 (.95/1.03)	1.02 (.96/1.08)	0.98 (.94/1.02)	.97 (.93/1.01)	.99 (.95/1.03)
Years of Service	.93** (.88/.99)	.98 (.92/1.04)	.99 (.93/1.05)	.97 (.93/1.01)	1.00 (.97/1.04)	.97 (.92/1.03)

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

Male sample, PTSD-B, C, D, Anxiety, Depression; Tolerance Value (Self-Harm/Death; .41; Violent; .35; Environmental; .65; Age; .43 Years of Service; .42) VIF (Self-Harm/Death; 2.43; Violent; 2.84; Environmental; 1.53; Age; 2.34; Years of Service; 2.36). Female sample, PTSD-B, C, D, Anxiety, Depression; Tolerance Value (Self-Harm/Death; .34; Violent; .34; Environmental; .58; Age; .46 Years of Service; .45) VIF (Self-Harm/Death; 2.97; Violent; 2.97; Environmental; 1.72; Age; 2.16; Years of Service; 2.25).

Table 7*Associations between Classes and Covariates (Females)*

Variable	5 with 1 OR (95% CI)	4 with 1 OR (95% CI)	3 with 1 OR (95% CI)	2 with 1 OR (95% CI)
Trauma – Death / Self Harm	.95 (.75/1.20)	.97 (.78/1.20)	.99 (.80/1.23)	.90 (.68/1.18)
Trauma - Violent	1.23*** (1.08/1.42)	1.16* (1.03/1.31)	1.03 (.91/1.16)	1.07 (.92/1.25)
Trauma - Environmental	1.16 (.97/1.39)	1.23** (1.05/1.44)	1.15 (.98/1.35)	1.08 (.87/1.34)
Age	1.00 (.96/1.04)	.97 (.93/1.01)	.98 (.94/1.02)	.98 (.94/1.02)
Years of Service	.98 (.92/1.04)	1.01 (.95/1.07)	.98 (.92/1.04)	.98 (.92/1.04)

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

Male sample, PTSD-B, C, D, Anxiety, Depression; Tolerance Value (Self-Harm/Death; .41; Violent; .35; Environmental; .65; Age; .43 Years of Service; .42) VIF (Self-Harm/Death; 2.43; Violent; 2.84; Environmental; 1.53; Age; 2.34; Years of Service; 2.36). Female sample, PTSD-B, C, D, Anxiety, Depression; Tolerance Value (Self-Harm/Death; .34; Violent; .34; Environmental; .58; Age; .46 Years of Service; .45) VIF (Self-Harm/Death; 2.97; Violent; 2.97; Environmental; 1.72; Age; 2.16; Years of Service; 2.25).

Discussion

The aim of the current study was to uncover meaningful subtypes of trauma exposed prison personnel with PTSD, anxiety, and depression symptomology within male and female participants, with a further aim being to identify associations between the typology of three trauma factors (as measured by the PPTM). Using LPA, seven and five classes of male and female prison personnel respectively, with comorbid PTSD, anxiety, and depression symptomology were identified, with both a male and female class characterised by high PTSD anxiety and depression symptomology. MLR also revealed differential associations between PTSD, anxiety, and depression symptomology and typology of prison trauma (self-harm/death, violent, environmental). The findings showed that overall male and female classes differed quantitatively as well as qualitatively with distinct patterned symptom groups. The classes further differed between males and females in terms of typology of symptoms and their associations with the three factors of trauma (self-harm/death, violence, environmental) as measured by the PPTM (Woodfield et al., 2019).

Evidence is presented within the current study that supports previous findings (Konda et al., 2013; Schlosser et al., 2010; Spinaris et al., 2012; Denhof & Spinaris, 2016) that prison work is traumatic and prison personnel are at significant risk of trauma exposure. The current findings support previous work that frontline staff are particularly at risk in relation to other prison personnel (Denhof & Spinaris, 2013; Obidoa et al., 2011; Spinaris et al., 2012; Stadnyk, 2003). Furthermore, the current study supports previous findings that show PTSD, depression and anxiety comorbidity may be particularly problematic amongst prison personnel (Spinaris et al., 2012; Denhof & Spinaris, 2013; Denhof et al., 2014) as opposed to PTSD, depression, or anxiety in isolation (Denhof & Spinaris, 2013).

The current study supports previous research that has found comorbid PTSD symptomology patterns, (Brady et al., 2000; Ginzburg et al., 2010; Galatzer-Levy et al., 2013) and studies that demonstrate these effects rarely occur in isolation in individuals exposed to trauma (Kozaric-Kovacic et al., 2001; Orsillo et al., 2002). In addition evidence for the presence of subthreshold PTSD is demonstrated in the current sample, which supports previous findings (Helzer et al., 1987; Stein et al., 1997; McLaughlin et al., 2015) suggesting its possible clinical relevance and associations with impairment (Marshall et al., 2001; Cukor et al., 2010) and its potential larger prevalence amongst trauma exposed occupations than PTSD alone (Maia et al., 2007; Marmar et al., 2006). Higher mean levels of PTSD symptomology were also

found in the current study supporting research suggesting higher levels are more prevalent amongst occupations whose roles entail a higher risk of trauma exposure, (Perrin et al., 2007; Fulton et al., 2015). PTSD comorbidity is also demonstrated in the current study amongst prison personnel in line with similar occupations that have found high levels of comorbidity, (Jones et al., 2018; Petrie et al., 2018). More specifically, evidence is presented that supports and elucidates the occurrence of PTSD comorbidity findings amongst prison personnel (Spinaris et al., 2012; Denhof & Spinaris, 2013; Denhof et al., 2014).

The current study also demonstrates disparity in associations between male and female personnel. Previous findings have suggested higher prevalence rates in male personnel as opposed to female personnel (Denhof & Spinaris, 2013). However the current study found the reverse with higher comorbid symptomology rates in females than males consistent with previous PTSD literature (Chapman et al., 2012; Nemeroff et al., 2006), despite exposure to similar levels of potentially traumatic experiences (Tolin & Foa, 2006). Further to this, the findings support the general literature that typology of trauma, particularly that involving interpersonal violence, is more problematic for female personnel (Breslau et al., 1997). Future studies should seek to further explore and / or clarify these assumptions within other trauma exposed occupations as well as prison personnel. The disparity in associations between male and female personnel may indicate that certain personnel may be more resilient and / or develop better coping mechanisms to certain adverse outcomes than others. However, because of a significant lack of previous research within the prison literature surrounding these considerations only a speculative assumption to these variabilities and potential causes can be made.

Given the current findings that demonstrate high prevalence rates of comorbid symptomology rates in prison personnel in relation to trauma, and that these are consistent with findings in other countries (Konda et al., 2013; Spinaris et al., 2012; Denhof & Spinaris, 2016) there is substantial evidence to propose taking active and ongoing steps through policy recommendations, to counter its effects as a necessity in prison organisations, as addressing individual symptoms alone is ineffective in bringing about lasting positive and collective change. Trauma informed approaches are one such recommendation (SAMHSA, 2012; Harris & Fallot, 2001) and have been implemented in various prison establishments but not always collectively in organisations. When implementing such an approach, all components of the organisation receive ongoing education regarding the prevalence of trauma and the nature of its impact, and the ways in which trauma can affect operation, and the various complex ways

in which people recover from trauma. Organisations that address the effects of trauma also provide those at risk with strategies and resources for countering its effects, through mediums such as resilience building programmes (Cornum et al., 2011).

The strengths of the current study lie in the utilization of a large sample of prison personnel, an often under accessed and under researched trauma exposed population, as well as utilizing a person-centered approach through latent profile analysis. The division of PTSD symptomology clusters is arguably a further strength providing elucidation on which symptom clusters are more prevalent in conjunction with trauma typology and patterns of comorbidity. It is also proposed that the current study provides support for the use of the PPTM amongst prison personnel populations alongside the use of clinical or established self-report measures for PTSD, anxiety, and depression to identify individuals or sub-sets of personnel who may be at risk for the development of psychological illnesses in association to typologies of trauma exposure.

Despite the strength of the present findings, there are several potential limitations to the current study. Namely the use of self-report measures and potential reporting bias as well as the inability to define distinct clinical diagnosis assumptions between the classes. However, it does help to provide a distinction between groups to contextualise this assumption and provide a basis for future research. The current study was based purely on data from prison personnel in the UK only and as such there is a need to generalise findings in other countries' samples. Future studies harnessing a longitudinal nature should be undertaken to ascertain a causal link between the variables in this study and the development of, rather than presence of trauma exposure and its development with PTSD comorbidity. The current study utilised the PCL-C (Weathers et al., 1994) which maps directly onto DSM-IV diagnostic criteria for PTSD however, future studies should utilise the PCL-5 (Weathers et al., 2013) which maps directly onto DSM-V diagnostic criteria. The PCL-5 can be used similarly to the PCL-C in the current study to elucidate further sub categorisation classification of the disorder, namely the negative alterations of cognition and mood symptom cluster as well as the intrusion, avoidance, and hyper-arousal clusters. Previously this concept was incorporated into the overall PCL-C question clusters so all areas of the requirements for DSM-5, PTSD diagnosis were still utilised, but the use of the PCL-5 would provide further clarification. Furthermore, at the time of data collection it was felt that the PCL-C still provided greater quality measurement characteristics (Blanchard et al., 1996; Orsillo, 2002; Ruggiero et al., 2003) and diagnostic utility (Bertelson et al., 2011; Gardner et al., 2012; Keen et al., 2008; McDonald & Calhoun, 2010).

Despite the limitations listed above, the current study provides a significant contribution to the area of trauma exposure and PTSD comorbidity, particularly in prison context specific populations and further elucidates findings in previous research for disparity in PTSD comorbidity. The findings overall indicate important distinctions between patterns of PTSD, anxiety, and depression comorbidity in trauma exposed occupational groups, as well as important differences in the relationship of trauma exposure typology and comorbidity symptomology between male and female prison personnel. Despite previous research identifying comorbidity of PTSD, anxiety, and depression amongst prison personnel, the current study is the first of its kind to profile prison personnel and differences between male and females by symptomology and assess associations of typologies of trauma unique to working in a prison environment.

Conflict of interest

Authors declare that they have no conflict of interest.

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