Exposure to potentially morally injurious events and long-term psychological outcomes among Dutch military service members deployed to Afghanistan: a latent class approach

Gerrmann, J.; Nijdam, M.J.; Boeschoten, M.; Heide, F.J.J. ter; Geuze, E.; Vermetten, E.

Citation

Exposure to potentially morally injurious events and long-term psychological outcomes among Dutch military service members deployed to Afghanistan: A latent class approach

Jorinde Gerrmann [a,b,*], Mirjam J. Nijdam [a,c], Manon Boeschoten [a], F. Jackie June ter Heide [a], Elbert Geuze [d,e], Eric Vermetten [b]

[a] ARQ Centrum'45, ARQ Nationaal Psychotrauma Centrum, Oegstgeest, Diemen, the Netherlands
[b] Department of Psychiatry, Leiden University Medical Center, Leiden, the Netherlands
[c] Department of Psychiatry, Amsterdam University Medical Centers, University of Amsterdam, Amsterdam Public Health Research Institute and Amsterdam Neuroscience Research Institute, Amsterdam, the Netherlands
[d] Department of Psychiatry, University Medical Center Utrecht Brain Center, Utrecht, the Netherlands
[e] Brain Research & Innovation Center, Ministry of Defence, Utrecht, the Netherlands

ARTICLE INFO

ABSTRACT

Exposure to potentially morally injurious events (PMIEs) during military deployment is common and may lead to long-lasting negative psychological consequences, referred to as moral injury. Few studies investigated long-term outcomes following exposure to PMIEs. This study investigated patterns of exposure to PMIEs during deployment and associations with long-term psychological outcomes in a cohort ($N = 471$) of Dutch Afghanistan veterans 10 years post-deployment. Latent class analysis was used to identify classes characterized by patterns of exposure to PMIEs. We investigated differences between classes in posttraumatic stress disorder symptoms, depressive symptoms, anger, interpersonal sensitivity, guilt, and meaning-making. Three groups were identified: *high exposure* to betrayal, acts of commission, and omission (13.6 %, $n = 64$), *moderate exposure to death* involving witnessing deaths, particularly of innocents (44.9 %, $n = 212$), and *minimal exposure* to all PMIEs (41.5 %, $n = 195$). The *high exposure* class had the most prominent negative psychological outcomes, including posttraumatic stress disorder symptoms, depression, interpersonal sensitivity, guilt, and suppressed anger, as compared to the other classes. Higher levels of expressed anger were present in the *moderate* and *high exposure* classes as compared to the *minimal exposure* class. Meaning in terms of personal growth or added value from deployment experiences was similar for the three classes. Our findings point to long-term negative psychological outcomes among veterans after exposure to deployment-related PMIEs with higher exposure especially being linked to more negative psychological outcomes. This highlights the need for early screening of PMIEs and targeted moral injury interventions to prevent adverse outcomes.

1. Introduction

During war-zone deployment, military service members are often exposed to events that violate deeply held moral beliefs, known as potentially morally injurious events (PMIEs; Litz et al., 2009). These experiences can lead to various outcomes, ranging from short-term distress to long-lasting psychological, social, and existential suffering, collectively called moral injury (Vermetten et al., 2023). While meta-analytic studies have mostly linked higher exposure to PMIEs to

posttraumatic stress disorder (PTSD) and depression, outcomes extend beyond psychological to biological and social and spiritual/existential dimensions (Hall et al., 2022; Williamson et al., 2018). Since PMIE exposure does not invariably lead to moral injury, a deeper understanding of the relationship between PMIEs and long-term mental health outcomes is crucial to inform prevention and treatment of moral injury.

Initial studies primarily focused on developing a theoretical framework for moral injury (Litz and Kerig, 2019). More recent empirical research has investigated whether exposure to PMIEs and associated

outcomes reflect moral injury's latent structure—an underlying construct that cannot be directly observed but can be inferred through measurable variables. Categorical latent variable approaches, such as latent class analysis (LCA), has been used to investigate whether unobserved subgroups (classes) exist that share similar degrees and types of exposure, as well as psychological symptoms. According to the working model of Litz et al. (2009), moral injury occurs when PMIEs go against one's moral beliefs, leading to long-lasting changes in fundamental beliefs about the self and others. Attributing the event to internal, stable, and global causes may result in condemnation of the self and others, the proliferation of moral emotions (e.g., guilt, anger, and shame), and maladaptive behavior (e.g., withdrawal and self-destructive tendencies). In support of the moral injury model, LCA studies in clinical samples found that beliefs about the self and others, moral emotions, mental health symptoms, and existential and spiritual beliefs clustered among subgroups of veterans (Currier et al., 2019; Mensink et al., 2022; Smigelsky et al., 2019). Given these multifaceted and profound consequences for subgroups of veterans, investigating PMIE exposure patterns may help identify which veterans are at risk of moral injury.

A growing body of research suggests morally injurious outcomes depend on the type and degree of PMIE exposure. Litz and Kerig (2019) mention that moral injury can manifest in two distinct forms which can co-occur depending on the type of exposure. Veterans who hold themselves responsible for committing or not preventing PMIEs may internalize feelings of anger, shame, and guilt, leading to self-condemnation and social isolation. Secondly, if veterans have been victimized or experienced betrayal by others, they may externalize symptoms, resulting in anger, mistrust, hostility, and aggression. Along these dimensions, most LCA studies on PMIE exposure distinguished between acts of commission (e.g., harming others), omission (e.g., failing to save someone), and betrayal by self or others using the Moral Injury Events Scale (Nash et al., 2013) or the Moral Injury Questionnaire – Military version (Currier et al., 2015a). Litz and Walker (2025) expanded on dimensional aspects of the moral injury model, posing that experiencing a high frequency of PMIEs, more severe PMIEs, and feeling responsible for PMIEs, increase the risk of moral injury.

Previous LCA studies among veterans have identified three to four classes based on PMIE exposure, which were differentially associated with psychological outcomes at several months to years (Saba et al., 2022; Zerach et al., 2021, 2023) until up to 25 years post-deployment (De Goede et al., 2024). Most studies identified *high exposure, moderate exposure,* and *minimal* or *single-PMIE-type exposure* classes. In Israeli veterans (Zerach et al., 2021, 2023), the *high exposure* class reported higher feelings of guilt and shame compared to the *betrayal-only* class. Zerach et al. (2021) found that the *betrayal-only* class reported higher PTSD and depression symptoms than the *high exposure* class, while in a later study (Zerach et al., 2023) they found no significant difference in PTSD symptoms between these two classes. In both studies, the *high exposure* and *betrayal-only* class had higher symptoms of PTSD, depression, shame, and anger compared to the *minimal exposure* class. In American veterans, Saba et al. (2022) found that *high* and *moderate* classes did not significantly differ regarding elevated symptoms of PTSD, depression, and anger, though both classes reported more symptoms than the *single-PMIE-type* classes. In Dutch veterans (De Goede et al., 2024), the *high exposure* class had higher symptoms of PTSD compared to the compared to the lower PMIE exposure classes. Generally, classes with poorer psychological outcomes were more likely to be characterized by types of PMIEs involving acts of commission, omission, and betrayal (De Goede et al., 2024; Saba et al., 2022; Zerach et al., 2021, 2023). While some studies found a distinct betrayal class, often betrayal was present in the higher PMIE exposure classes. Overall, these studies have associated higher exposure to PMIEs— and to certain types of PMIEs— with higher symptoms of PTSD and depression, as well as with higher levels of moral emotions, several months to years post-deployment. Few studies have investigated whether these outcomes persist in the long-term and extend to a broader range of morally

injurious outcomes.

The current study aimed to identify patterns of exposure to PMIEs during deployment and examine associations with an extensive range of long-term psychological outcomes in a cohort of Dutch military 10 years after deployment to Afghanistan as part of the International Security Assistance Force of NATO (ISAF; van der Wal et al., 2019). From 2005 to 2008 Dutch armed forces participated with either the Provincial Reconstructions Teams or with the Task Force Uruzgan to bring stability, rebuild, and provide safety to the region. Military personnel were exposed to enemy fire, witnessed suffering or injury, and colleagues were injured or killed (Reijnen et al., 2015). Previous studies in the current cohort have found a higher prevalence of PTSD, depression, and anxiety symptoms at 10-year follow-up compared to all earlier assessments (van der Wal et al., 2020, 2023), indicating potential progression of moral injury after PMIE exposure (Nijdam et al., 2023; Vermetten and Jetly, 2018a).

Based on the studies of exposure to PMIEs among veterans, we hypothesized distinct classes determined by the degree and type of exposure to PMIEs. Based on the model by Litz et al. (2009) and previous literature, we hypothesized that veterans with higher exposure to PMIEs would report higher levels of mental health symptoms (PTSD and depression; e.g, Saba et al., 2022; Zerach et al., 2021), moral emotions (guilt, suppressed and expressed anger; Saba et al., 2022; Smigelsky et al., 2019; Zerach et al., 2021), negative beliefs about the self and others (interpersonal sensitivity; Mensink et al., 2022), and problems with meaning making (meaning of war; Currier et al., 2019; Currier et al., 2015b) than veterans who experienced minimal exposure.

2. Methods

2.1. Study design and participants

Participants took part in the Prospective Research in Stress-related Military Operations (PRISMO) study, a cohort study of Dutch veterans who were longitudinally assessed up to 10 years after deployment to Afghanistan. For more information on the characteristics of this cohort, we refer to the cohort profile (van der Wal et al., 2019). A total of 1007 Dutch military personnel were included, who were deployed for a period of four months between 2005 and 2008. The current study used data from the 10-year follow-up assessment in which a total of 598 veterans participated.

2.2. Measures

Demographic characteristics were assessed pre-deployment. All psychological outcomes were assessed at 10 years post-deployment. Exposure to PMIEs during deployment(s) to Afghanistan from 2005 to 2008 was assessed retrospectively using the 20-item Moral Injury Questionnaire-Military 10 years post-deployment (MIQ-M; Currier, Holland, Drescher, et al., 2015). Items represent two categories: 14 items that assess PMIEs and 6 items that measure both PMIES and responses to PMIEs. Items were rated on a 4-point scale from 1 (*never*) to 4 (*often*). Initial psychometric studies found support for a unidimensional factor structure (Currier et al., 2015a). To enhance interpretability for the LCA, we merged item responses into two categories to reflect whether veterans endorsed the event (*seldom, sometimes,* and *often*) or not (*never*). Cronbach's alpha in the current sample was α = .87.

2.2.1. Psychological outcomes

PTSD symptoms in the past four weeks was assessed with the 22-item Self-Rating Inventory for PTSD (SRIP; Hovens et al., 2002). The SRIP measures the three PTSD symptom clusters in DSM-IV: intrusions, avoidance, and hyperarousal. Items were combined into a sum score. Higher scores indicate more symptoms of PTSD (range 22–88). Psychometric research supported internal consistency and construct validity of the SRIP (Hovens et al., 2002). Cronbach's alpha in the current

sample was .92.

Depression symptoms in the past week was measured with the 20-item Center for Epidemiologic Studies-Depression Scale (CES-D; Radloff, 1977). Items were summed to obtain a total score. Higher scores indicate a higher number of depressive symptoms (range 0–60). Supporting evidence for internal consistency and construct validity has been found (Radloff, 1977). Cronbach's alpha in the current study was .88.

Interpersonal sensitivity was measured with the 18-item subscale of the revised Symptom Checklist (SCL-90-R; Derogatis, 1994). Items were summed for a total score. Higher scores indicate more feelings of inadequacy and inferiority and negative expectations of rejection and criticism by others (range 18–90). Cronbach's alpha in the current sample was .92. A single item of the SCL-90-R was used to assess feelings of guilt: *"For the past week, how much were you bothered by feelings of guilt?".* Previous studies supported internal consistency, discriminant validity, and factor structure of the SCL-90-R (Carrozzino et al., 2016; Schmitz et al., 2000).

Anger expression was measured with the 8-item anger-out subscale and anger suppression was assessed with the 8-item anger-in subscale of the 57-item State-Trait Anger Expression Inventory-2 (STAXI-2; Spielberger, 1999). Items of each subscale were summed to obtain total scores. Higher scores on the anger-out subscale reflect more physical or verbal aggressive behavior, while higher scores on the anger-in scale indicate how often angry feelings are experienced but not expressed (range 0–32). Internal consistency and construct validity were supported in previous studies (Lievaart et al., 2016; Spielberger, 1999). Cronbach's alpha for the anger-out and anger-in subscales were .74 and .75, respectively.

Meaning-making of war-zone exposure was assessed with 8 items of the 34-item Meaning of War Scale (MoWS; Mooren et al., 2009). In the present study, participants were instructed to indicate meaning-making of events during their war-zone deployment(s) to Afghanistan from 2005 to 2008. Items were summed to obtain a total score. Higher scores indicate meaning in terms of more personal growth or added value attributed to deployment experiences (range 8–40). Examples of items include: *"My deployment to Afghanistan has made me a stronger person"* and *"My deployment to Afghanistan gave my life meaning".* Initial studies have supported internal consistency and construct validity of this subscale (Mooren et al., 2009; Schok et al., 2011). Cronbach's alpha of the subscale was .66 in the current sample.

2.3. Data analysis

We conducted LCA in Mplus (Version 8.4) to identify subgroups of participants with similar patterns of exposure to PMIEs. Two out of the 20 MIQ-M items (sexual assault and mistakes that led to injury or death) were excluded from the LCA due to low endorsement (<3 %). We addressed missing data on the MIQ-M using full information maximum likelihood estimation. To identify the optimal number of latent classes, we evaluated models from one to six classes based on a number of criteria. Models with a lower value on the Bayesian Information Criteria (BIC) and sample-size adjusted Bayesian Information Criteria (aBIC) indicated better fit (Schwarz, 1978). We used the bootstrapped likelihood ratio test (BLRT) and Lo-Mendell-Rubin likelihood ratio test (LMR LRT) for significance on whether adding a class led to a relative improvement in fit. As fit indices often do not point to one optimal solution (Nylund-Gibson and Choi, 2018), we looked at the size and interpretation of classes for the most optimal latent class solution. We used entropy values and average latent class probabilities to assess classification accuracy. Entropy values and values of the smallest average latent class probability larger than .80 were considered as acceptable, though no definitive cutoff criterion exists (Weller et al., 2020). We labeled latent classes based on conditional probabilities for endorsing PMIEs.

The three-step procedure in Mplus by Asparouhov and Muthén (2014) was used to compare mean differences in psychological

outcomes across classes. We entered psychological outcomes into the model as auxiliary variables using the DU3STEP command to account for unequal means and variances. The three-step procedure handles missing data on the auxiliary variables with listwise deletion. To solve convergence problems for the guilt item due to near-zero variance within classes, we used the DE3STEP command to accommodate unequal means and equal variances. First, this method estimates latent classes based on PMIEs. Then participants were assigned to the most likely class and measurement error was estimated. Third, this method estimated the model and psychological outcomes while accounting for measurement error in class membership. We compared mean differences by class for PTSD symptoms, depressive symptoms, interpersonal sensitivity, feelings of guilt, anger expression and suppression, and meaning of war, using an overall chi square test, followed by class-by-class Wald tests when appropriate. Cohen's *d* (1988) was used as the measure of effect size for all comparisons, with values of 0.20, 0.50, and 0.80 or higher interpreted as small, medium, and large effects, respectively.

3. Results

A total of 471 of the 598 (78.76 %) veterans who took part in the 10-year follow-up were included in the current analysis based on the availability of the MIQ-M. A comparison of demographic and psychological characteristics between the included and excluded samples is displayed in Table 1. Compared to the included sample, participants without data on the MIQ-M showed significantly lower levels of PTSD, depression, interpersonal sensitivity, guilt, and anger expression, and a higher number of previous deployments; more frequently deployed in 2005/2006 than in 2007/2008, and more often had a role outside the military base, see Table 1. In the included sample, missing data for the MIQ-M and seven psychological outcomes were minimal (<3.5 %). Item endorsements are displayed in S1. The most highly endorsed PMIEs were tragic war-zone events (56.6 %), changed by witnessing so much death (41.9 %), and deaths of an innocent (39.1 %).

Table 2 displays the fit indices for models 1 to 6. As is common in LCA studies (Nylund-Gibson and Choi, 2018), fit indices did not point to a single model. The 3-class model showed the best fit as indicated by the lowest BIC, whereas the lowest aBIC supported the 6-class solution. However, beyond the 3-class model, the decrease in aBIC values became smaller and showed reduced improvement in fit. The BLRT improved with each additional class, while the LRT did not support a better fit beyond the 3-class model. Inspection of the plotted conditional probabilities by class and the number of participants assigned to each class revealed that the 3-class solution contained classes characterized by distinct PMIE response patterns among substantial portions of the total sample. The 4-class solution consisted of the three primary classes, and an additional class consisting of a small number of individuals only (8.1 %). Taken together, we determined the 3-class model to be optimal, based on fit indices, parsimony, and showing meaningful and distinctive patterns. Relative entropy for the 3-class model indicated that separation between the classes was acceptable (>.80). The lowest value of the average latent class posterior probability was acceptable (>.80) indicating a high certainty of class assignment.

Conditional probabilities of endorsing each PMIE exposure item for the 3-class solution are displayed in Fig. 1. We labeled the three classes *minimal, moderate exposure to death,* and *high exposure.* Veterans in the *minimal exposure* class (41.5 %; *n* = 195) showed low probability of endorsing all PMIEs (range 0−.21). Veterans in the *moderate exposure to death* class (44.9 %; *n* = 212) had moderate probability of exposure to deaths of an innocent (.57), changed by witnessing so much death (.54) and low probability to the remaining PMIEs (range .05–.41). The *high exposure* class (13.6 %; *n* = 64) had high probability of endorsing betrayal by leaders, civilians, and personal values, engaging in revenge, disproportionate violence, deaths of an innocent, changed by witnessing so much death, difficult decisions and deaths of children (range

Table 1

Demographics and psychological characteristics based on the availability of the MIQ-M.

	Participants with a MIQ-M measurement at 10-year follow-up (n = 471)	n	Participants without a MIQ-M measurement at 10-year follow-up (n = 536)	n	p value
Age during deployment	28.9 (9) range 18–60	471	27.9 (8.7) range18–57	536	.093
Male	424 (90 %)	471	497 (92.7 %)	536	.126
Previous deployments		445		251	<.001
Yes	231 (54.2 %)		109 (60.6 %)		
No	195 (45.8 %)		71 (39.4 %)		
Year of deployment		471		536	<.001
2005 or 2006:	12 (2.5 %)		249 (46.5 %)		
2007 or 2008	459 (97.5 %)		287 (53.5 %)		
Role during deployment		445		525	<.001
Outside the military base	229 (51.5 %)		254 (70.8 %)		
Inside the military base	170 (38.2 %)		78 (21.7 %)		
Both inside and outside the military base	46 (10.3 %)		27 (7.5 %)		
New deployments		367		213	<.001
Yes	103 (21.9 %)		76 (14.2 %)		
No	264 (56.1 %)		137 (25.6 %)		
Combat exposure	4.5 (3.1)	420	4.7 (3.3)	361	.426
PTSD symptoms	27.8 (7.8)	459	25.9 (4.7)	139	<.001
Depressive symptoms	5.9 (7)	459	3.7 (4.3)	142	<.001
Interpersonal sensitivity	23 (6.3)	456	21.5 (4.3)	141	<.001
Guilt feelings	1.2 (.6)	463	1.1 (.4)	141	.038
Anger expression	13.8 (3.5)	465	12.9 (2.9)	139	.010
Anger suppression	15.4 (4.2)	465	15.1 (3.8)	140	.445
Meaning of war	28 (4.9)	468	28 (4.8)	16	.974

Data are N (%) or M (SD). Differences in descriptive characteristics between participants with a MIQ-M measurement and participants without the MIQ-M were tested with a t-test (continuous) or $\chi2$-test (categorical).

.69–.96). Furthermore, veterans in the *high exposure* class had moderate probability of endorsing the PMIEs treating civilians harshly, feeling guilt over not saving a life, enjoying violence, and violations of rules of engagement (range .47–.61). Friendly-fire, survival guilt and destroying civilian property had low probabilities in all three classes (range 0–.31). As is displayed in Table 2, endorsement for these PMIEs were low in the total sample (<15 %). Tragic war-zone events were the highest endorsed PMIEs in the total sample (56.6 %) and had high probability in the *moderate exposure to death* (.81) and *high exposure* class (.98).

3.1. Mean difference comparisons by class

Mean scores of psychological outcomes were compared between classes, see Table 3. Raw scores and effect sizes for mean differences are depicted in Table 3 and Fig. 2 contains standardized scores. Overall Wald tests indicated differences in PTSD symptoms, depressive symptoms, interpersonal sensitivity, expression and suppression of anger, and feelings of guilt between classes. Meaning-making of war was similar for the three classes. Class-by-class comparisons revealed the following significant differences in psychological outcomes across classes. For symptoms of PTSD, depression, and interpersonal sensitivity, veterans assigned to the *high exposure* class had higher mean scores than those in the *moderate exposure to death* ($d \geq 0.50$) and *minimal exposure* classes ($d \geq 0.80$). Veterans assigned to the *moderate exposure to death* class reported more symptoms than those in the *minimal exposure* class ($d \geq 0.20$).

Veterans assigned to the *high exposure* class reported higher feelings of guilt and more suppression of anger than those in the *moderate exposure to death* ($d \geq 0.20$) and *minimal exposure* classes ($d \geq 0.50$). Findings indicate that feelings of guilt and suppression of anger did not differ between *moderate exposure* and *minimal exposure* classes. For expression of anger, veterans in the *moderate exposure to death* and *high exposure* classes reported higher mean scores than those in the *minimal exposure* class ($d \geq 0.20$). Findings indicate that expression of anger did not differ between *high exposure* and *moderate exposure to death* classes.

4. Discussion

The present study aimed to investigate patterns of exposure to PMIEs in an LCA approach and their association with psychological outcomes among veterans 10 years after deployment to Afghanistan. In a cohort of 471 veterans, we identified three classes based on their exposure to PMIEs: *high exposure* (13.6 %, $n = 64$), *moderate exposure to death* (44.9 %, $n = 212$), and *minimal exposure* (41.5 %, $n = 195$). The *high exposure* class was characterized by betrayal by military and political leaders, civilians, and self, as well as acts of commission and omission. The *moderate exposure to death* class was characterized by witnessing deaths, particularly of innocents. The *minimal exposure* class had low exposure to all PMIEs. In addition, we found significant differences in long-term psychological outcomes between the classes. Veterans in the *high exposure* class had more symptoms of PTSD, depression, and interpersonal sensitivity compared to those in the *moderate exposure to death* and *minimal* exposure classes. Pronounced feelings of guilt and suppression of anger were unique to the *high exposure* class. Higher levels of expressed anger were present in the *moderate exposure to death* and *high exposure* classes compared to the *minimal exposure* class. The *moderate exposure to death* class had more symptoms of PTSD, depression, and interpersonal sensitivity compared to the *minimal exposure* class, which showed low levels across all psychological outcomes. Meaning of war in terms of personal growth or added value from deployment experiences did not differentiate between classes.

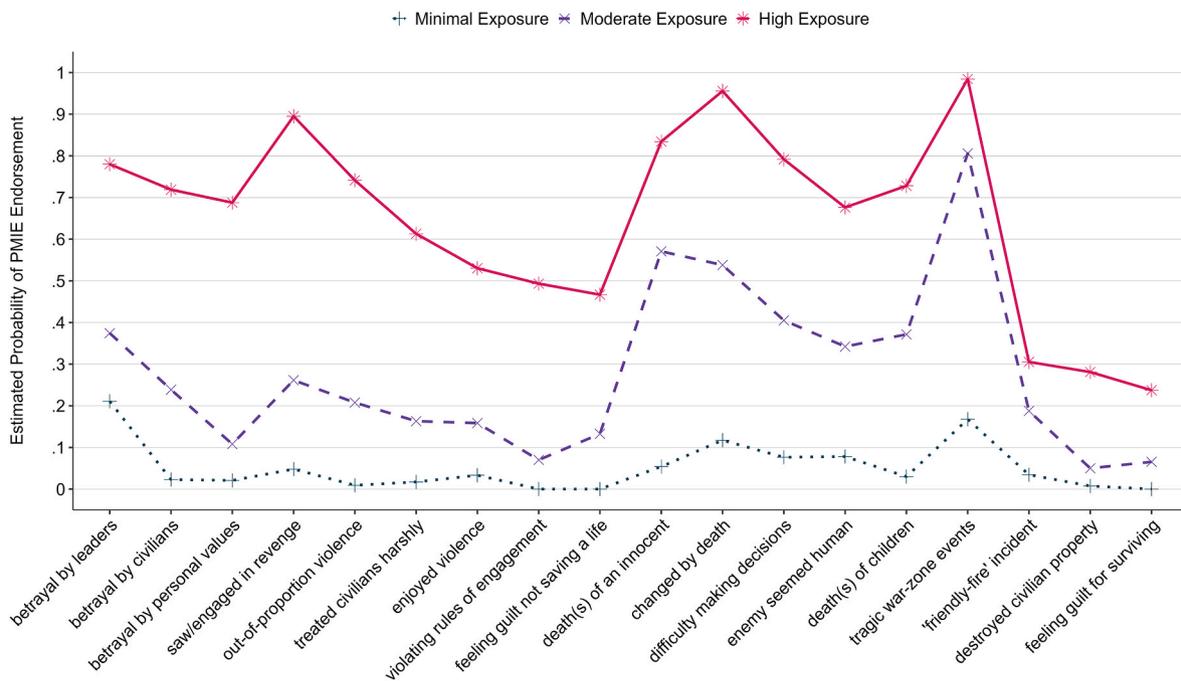Our findings can be interpreted in the context of the mission.

Table 2

Fit indices for one to six latent class models.

	Model fit criteria					Diagnostic criteria		
	Parameters	BIC	aBIC	LRT	BLRT	Smallest class, n (%)	Entropy	ALCPP
1-class	18	8,534.991	8,477.862			471 (100 %)		
2-class	37	7,471.712	7,354.28	<.001	<.001	179 (38 %)	0.865	.955
3-class*	56	7,316.642	7,138.909	<.001	<.001	64 (13.6 %)	0.833	.914
4-class	75	7,350.391	7,112.355	.409	<.001	38 (8.1 %)	0.813	.848
5-class	94	7,401.742	7,103.404	.153	<.001	36 (7.5 %)	0.792	.801
6-class	113	7,461.755	7,103.114	.227	.002	34 (7.3 %)	0.791	.817

Note. *Best fitting model. Abbreviations include BIC = Bayesian Information Criterion, aBIC = Sample Size Adjusted Bayesian Information Criterion, LRT = Lo-Mendel-Rubin Likelihood Ratio Test; BLRT = Bootstrapped Likelihood Ratio Test, ALCPP = Average Latent Class Posterior Probability.

Fig. 1. Estimated probabilities of PMIE endorsement by class.

Table 3
Mean difference comparisons by class.

Dependent variable	Overall X^2	Class	M	Standard Error	Cohen's d	Pairwise comparison	N
PTSD symptoms	112.45***	1	23.86	0.28	0.33[s] (1 vs. 2)	1 < 2 < 3	459
		2	28.62	0.49	1.22[l] (1 vs. 3)		
		3	36.76	1.84	0.85[l] (2 vs. 3)		
Depressive symptoms	36.05***	1	3.05	0.68	0.23[s] (1 vs. 2)	1 < 2 < 3	459
		2	6.02	0.59	0.96[l] (1 vs. 3)		
		3	13.42	1.64	0.74[m] (2 vs. 3)		
Interpersonal sensitivity	103.58***	1	19.88	0.25	0.35[s] (1 vs. 2)	1 < 2 < 3	456
		2	23.60	0.54	1.14[l] (1 vs. 3)		
		3	30.32	1.48	0.73[m] (2 vs. 3)		
Feelings of guilt	11.53***	1	1.10	0.03	.17 (1 vs. 2)	1,2 < 3	463
		2	1.13	0.04	0.77[m] (1 vs. 3)		
		3	1.81	0.24	0.58[m] (2 vs. 3)		
Expression of anger	38.13***	1	12.52	0.22	0.31[s] (1 vs. 2)	1 < 2,3	465
		2	14.50	0.29	0.58[m] (1 vs. 3)		
		3	14.99	0.55	0.26[s] (2 vs. 3)		
Suppression of anger	12.10***	1	14.98	0.37	0.05 (1 vs. 2)	1,2 < 3	465
		2	15.21	0.38	0.51[m] (1 vs. 3)		
		3	17.20	0.57	0.45[s] (2 vs. 3)		
Meaning of war	3.00	1	27.60	0.37	0.15 (1 vs. 2)	1,2,3	468
		2	28.48	0.38	-0.04 (1 vs. 3)		
		3	27.33	0.74	-0.19 (2 vs. 3)		

Note. ***$p \leq$ .001 Abbreviations include 1 = Minimal exposure, 2 = Moderate exposure to death, 3 = High exposure. Cohen's d values of 0.20, 0.50, and 0.80 or higher can be interpreted as s = small, m = medium, and l = large effects, respectively.

Between 2005 and 2008, the ISAF mission progressed towards a counterinsurgency against the Taliban with a sharp increase in the number of deaths among civilians and army personnel (Dimitriu and de Graaf, 2010). The Taliban's asymmetric tactics, such as improvised explosive devices and suicide bombers, became increasingly common and accounted for most casualties (Hoencamp et al., 2014). Molendijk (2019) noted that unclear mission objectives and political restrictions limited its capacity to have a significant and lasting impact on safety and stability. Our results align with these previous reports by showing that most veterans were part of the *moderate exposure to death* group, which involved exposure to deaths, especially deaths of innocents. Furthermore, the increased number and unpredictability of attacks may have led to potential moral dilemmas in ensuring security and stability while targeting combatants who operate within a civilian population (Currier

et al., 2015c; Vermetten and Jetly, 2018b). This may explain the subgroup of veterans likely to report high exposure to multiple categories of PMIEs rather than to a particular type. In line with Molendijk's (2019) observation that Dutch ISAF veterans faced ambiguous mission objectives based on political considerations, which created logistical challenges and compromised their safety, we found that veterans with high exposure were likely to report betrayal by military and political leaders, as well as betrayal of their personal values. In support of the moral injury model (Litz and Kerig, 2019; Litz et al., 2009), present findings indicate that higher exposure to certain types of PMIEs during deployment, involving betrayal by self and others, acts of commission and omission, were particularly linked to hallmark symptoms of moral injury in the long term. Veterans with high exposure reported pronounced feelings of inadequacy and inferiority and negative expectations about others,
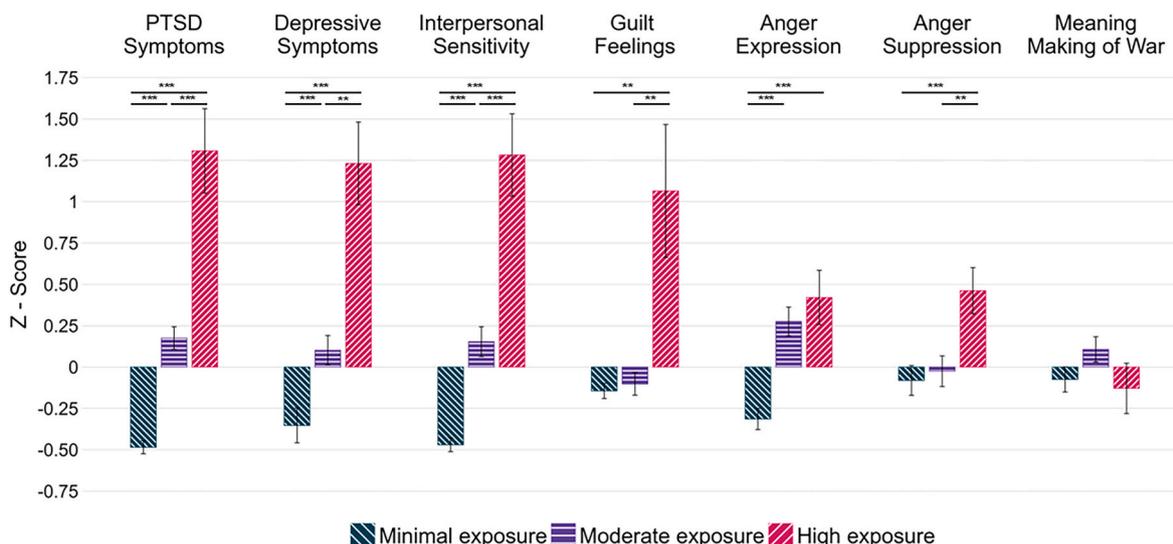
Fig. 2. Standardized scores for psychological outcomes by known class Note: **p ≤ .01, ***p ≤ .001.

guilt, and suppressed anger. These poor psychological outcomes may result from experiencing betrayal as well as acts of commission and omission, as these PMIEs were generally not endorsed by the other classes. This aligns with previous LCA studies (De Goede et al., 2024; Saba et al., 2022; Zerach et al., 2021, 2023), as the classes with the poorer psychological outcomes were more likely to endorse PMIEs involving acts of commission, omission, and betrayal. However, the degree of exposure may also explain these outcomes. Higher exposure to multiple types of PMIEs and a higher number of deaths were linked to more negative psychological outcomes. These findings align with cumulative stress models, which suggest that exposure to a higher number of stressors increases the risk of mental health symptoms. This supports a dimensional model of moral injury (Litz and Walker, 2025), in which a higher frequency of PMIEs increases the risk of potentially morally injurious outcomes. In agreement with meta-analyses (Hall et al., 2022; Williamson et al., 2018) and most recent LCA studies (De Goede et al., 2024; Saba et al., 2022; Smigelsky et al., 2019), higher PMIE exposure was associated with more symptoms of PTSD and depression. Similar to Zerach et al. (2021, 2023), and Smigelsky et al. (2019), the *high exposure* class reported the highest levels of guilt, compared to subgroups with lower exposure to PMIEs. The pattern of expressed anger resembled the findings of Saba et al. (2022), who found *moderate* and *high* classes to be characterized by similar levels of elevated anger compared to the single-type PMIE exposure classes.

In the present study, meaning in terms of personal growth or added value from deployment experiences was not related to PMIE exposure. This finding contrasts with Currier et al., 2015b who found that less meaning attributed to the index trauma mediated the relation between greater exposure to PMIEs and more adverse mental health outcomes. Our finding corresponds with De Goede et al. (2024) reporting that an aspect of meaning-making, posttraumatic growth, was not associated with PMIE exposure. As noted in reviews (Fischer et al., 2020; Schok et al., 2008), mixed findings across studies could be due to the wide range of operational definitions of meaning-making. Alternatively, meaning-making may not solely be determined by PMIE exposure, but depend on multiple aspects of life, such as the transition to civilian life, returning to relationships, parenthood, and work (Kopacz et al., 2019).

4.1. Strengths and limitations

The current study has multiple strengths. To our knowledge, this is the first study that assessed patterns of exposure to PMIEs and long-term associations with psychological outcomes in a large cohort of veterans.

Earlier LCA studies on PMIEs mostly investigated associations with mental health symptoms and moral emotions several months to years post-deployment. Moreover, we contributed to the literature by assessing a broad range of psychological outcomes, including mental health symptoms, moral emotions, interpersonal sensitivity, and meaning-making. Present findings should be viewed in the light of potential limitations. First, PMIE exposure during deployment was assessed in retrospect at 10-year follow-up and may have been susceptible to recall bias (Mattsson et al., 2021; van Giezen et al., 2005). Also, data remain cross-sectional, so we cannot determine whether PMIEs played a causal role in determining psychological outcomes. Second, as noted in psychometric reviews (Frankfurt and Frazier, 2016; Koenig et al., 2019), the MIQ-M contains six items that assess exposure to PMIEs and responses related to these events, thereby confounding exposure with associated psychological outcomes. Hence, in the current study PMIE exposure may not have been fully independent of outcomes. Third, veterans without data on the MIQ-M had a higher number of previous deployments, often served outside the military base, and exhibited less negative psychological outcomes, than those with MIQ-M data. Therefore, the results of this research may not generalize to the overall Dutch veteran population deployed to Afghanistan.

Overall, this study provides insight into the long-term outcomes following deployment, highlighting the profound impact PMIEs may have on mental health and well-being. Ten years after deployment, veterans with high exposure to PMIEs had the most prominent mental health problems, including symptoms of PTSD, depression, interpersonal problems, guilt, and anger. Our findings have significant implications for research and clinical practice. Early identification of veterans with high exposure to PMIEs may assist in the timely detection of morally injurious outcomes and provision of interventions. More longitudinal research is needed to examine how moral injury evolves over time, whether it remains stable or fluctuates, and potential delayed symptoms as veterans transition to civilian life. In addition, moral emotions and interpersonal functioning may hold valuable insights for effective PTSD treatment. Posttraumatic guilt and anger symptoms have emerged as predictors of PTSD treatment outcome in veterans (Dewar et al., 2020). Studies found that more guilt related to the index trauma and heightened anger predicted more PTSD symptoms during (Rameckers et al., 2024) and after treatment (Cowlishaw et al., 2022), underscoring the need to address moral emotions. Targeted interventions for moral injury, including Adaptive Disclosure (Litz et al., 2021, 2024) and Trauma-Informed Guilt Reduction Therapy (Norman et al., 2022), have shown promising results in improving outcomes for

veterans with pronounced moral emotions and interpersonal problems. Emerging therapies may offer new pathways for recovery toward reconciliation with oneself and others by addressing existential and spiritual issues through the practice of acceptance and forgiveness (Brémault-Phillips et al., 2022). In conclusion, clinicians and researchers must continue to pay attention to internalizing and externalizing manifestations of moral injury, particularly in veterans with high PMIE exposure in the long-term after deployment. Understanding how veterans manage guilt, suppressed and expressed anger and relate to others, may offer new ways to prevent and treat moral injury.

CRediT authorship contribution statement

Jorinde Gerrmann: Writing – original draft, Formal analysis, Conceptualization. **Mirjam J. Nijdam:** Writing – review & editing, Conceptualization. **Manon Boeschoten:** Writing – review & editing, Conceptualization. **F. Jackie June ter Heide:** Writing – review & editing, Conceptualization. **Elbert Geuze:** Writing – review & editing, Investigation, Conceptualization. **Eric Vermetten:** Writing – review & editing, Investigation, Conceptualization.

Ethics Approval and Consent to Participate

The Institutional Review Board of the University Medical Center Utrecht approved the study, approval number 01/333-0. Written informed consent was obtained from all participants at the start of the study.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used AI Chat (DeepAI, 2024) to improve readability and language. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Declaration of competing interest

The authors declare that they have no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychires.2025.05.077.

References

Asparouhov, T., Muthén, B., 2014. Auxiliary variables in mixture modeling: three-step approaches using Mplus. Struct. Equ. Model.: A Multidiscip. J. 21 (3), 329–341. https://doi.org/10.1080/10705511.2014.915181.
Brémault-Phillips, S., Cherwick, T., Smith-MacDonald, L.A., Huh, J., Vermetten, E., 2022. Forgiveness: a key component of healing from moral injury? Front. Psychiatr. 13, 906945. https://doi.org/10.3389/fpsyt.2022.906945.
Carrozzino, D., Vassend, O., Bjorndal, F., Pignolo, C., Olsen, L.R., Bech, P., 2016. A clinimetric analysis of the Hopkins Symptom Checklist (SCL-90-R) in general population studies (Denmark, Norway, and Italy). Nord. J. Psychiatr. 70 (5), 374–379. https://doi.org/10.3109/08039488.2016.1155235.
Cohen, J., 1988. Statistical Power Analysis for the Behavioral Sciences. Routledge.
Cowlishaw, S., Metcalf, O., Little, J., Hinton, M., Forbes, D., Varker, T., Agathos, J., Bryant, R.A., McFarlane, A.C., Hopwood, M., Phelps, A.J., Howard, A., Cooper, J., Dell, L., O'Donnell, M.L., 2022. Cross-lagged analyses of anger and PTSD symptoms among veterans in treatment. Psychol Trauma 14 (2), 336–345. https://doi.org/10.1037/tra0001084.
Currier, J.M., Foster, J.D., Isaak, S.L., 2019. Moral injury and spiritual struggles in military veterans: a latent profile analysis. J. Trauma Stress 32 (3), 393–404. https://doi.org/10.1002/jts.22378.
Currier, J.M., Holland, J.M., Drescher, K., Foy, D., 2015a. Initial psychometric evaluation of the moral injury questionnaire–military version. Clin. Psychol. Psychother. 22 (1), 54–63. https://doi.org/10.1002/cpp.1866.
Currier, J.M., Holland, J.M., Malott, J., 2015b. Moral injury, meaning making, and mental health in returning veterans. J. Clin. Psychol. 71 (3), 229–240. https://doi.org/10.1002/jclp.22134.
Currier, J.M., McCormick, W., Drescher, K.D., 2015c. How do morally injurious events occur? A qualitative analysis of perspectives of veterans with PTSD. Traumatology (Tallahass., Fla.) 21 (2), 106–116. https://doi.org/10.1037/trm0000027.
de Goede, M.L., van der Aa, N., Mooren, T.M., Olff, M., Ter Heide, F.J.J., 2024. Potentially morally injurious experiences and associated factors among Dutch UN peacekeepers: a latent class analysis. Eur. J. Psychotraumatol. 15 (1), 2332105. https://doi.org/10.1080/20008066.2024.2332105.
Derogatis, L.R., 1994. SCL-90-R: Symptom Checklist-90-R: Administration, Scoring, and Procedures Manual. NCS Pearson.
Dewar, M., Paradis, A., Fortin, C.A., 2020. Identifying trajectories and predictors of response to psychotherapy for post-traumatic stress disorder in adults: a systematic review of literature. Can. J. Psychiatr. 65 (2), 71–86. https://doi.org/10.1177/0706743719875602.
Dimitriu, G., de Graaf, B., 2010. The Dutch COIN approach: three years in Uruzgan, 2006–2009. Small Wars Insur. 21 (3), 429–458. https://doi.org/10.1080/09592318.2010.505471.
Fischer, I.C., Shanahan, M.L., Hirsh, A.T., Stewart, J.C., Rand, K.L., 2020. The relationship between meaning in life and post-traumatic stress symptoms in US military personnel: a meta-analysis. J. Affect. Disord. 277, 658–670. https://doi.org/10.1016/j.jad.2020.08.063.
Frankfurt, S., Frazier, P., 2016. A review of research on moral injury in combat veterans. Mil. Psychol. 28 (5), 318–330.
Hall, N.A., Everson, A.T., Billingsley, M.R., Miller, M.B., 2022. Moral injury, mental health and behavioural health outcomes: a systematic review of the literature. Clin. Psychol. Psychother. 29 (1), 92–110. https://doi.org/10.1002/cpp.2607.
Hoencamp, R., Huizinga, E.P., van Dongen, T.T., Idenburg, F.J., Ramasamy, A., Leenen, L.P., Hamming, J.F., 2014. Impact of explosive devices in modern armed conflicts: in-depth analysis of Dutch battle casualties in southern Afghanistan. World J. Surg. 38 (10), 2551–2557. https://doi.org/10.1007/s00268-014-2645-5.
Hovens, J.E., Bramsen, I., van der Ploeg, H.M., 2002. Self-rating inventory for posttraumatic stress disorder: review of the psychometric properties of a new brief Dutch screening instrument. Percept. Mot. Skills 94 (3 Pt 1), 996–1008. https://doi.org/10.2466/pms.2002.94.3.996.
Koenig, H.G., Youssef, N.A., Pearce, M., 2019. Assessment of moral injury in veterans and active duty military personnel with PTSD: a review. Front. Psychiatr. 10 (443), 443. https://doi.org/10.3389/fpsyt.2019.00443 [Review].
Kopacz, M.S., Lockman, J., Lusk, J., Bryan, C.J., Park, C.L., Sheu, S.C., Gibson, W.C., 2019. How meaningful is meaning-making? New Ideas Psychol. 54, 76–81. https://doi.org/10.1016/j.newideapsych.2019.02.001.
Lievaart, M., Franken, I.H., Hovens, J.E., 2016. Anger assessment in clinical and nonclinical populations: further validation of the state-trait anger expression inventory-2. J. Clin. Psychol. 72 (3), 263–278. https://doi.org/10.1002/jclp.22253 [Article].
Litz, B.T., Kerig, P.K., 2019. Introduction to the special issue on moral injury: conceptual challenges, methodological issues, and clinical applications. J. Trauma Stress 32 (3), 341–349. https://doi.org/10.1002/jts.22405.
Litz, B.T., Rusowicz-Orazem, L., Doros, G., Grunthal, B., Gray, M., Nash, W., Lang, A.J., 2021. Adaptive disclosure, a combat-specific PTSD treatment, versus cognitive-processing therapy, in deployed marines and sailors: a randomized controlled non-inferiority trial. Psychiatry Res. 297, 113761. https://doi.org/10.1016/j.psychres.2021.113761.
Litz, B.T., Stein, N., Delaney, E., Lebowitz, L., Nash, W.P., Silva, C., Maguen, S., 2009. Moral injury and moral repair in war veterans: a preliminary model and intervention strategy. Clin. Psychol. Rev. 29 (8), 695–706. https://doi.org/10.1016/j.cpr.2009.07.003.
Litz, B.T., Walker, H.E., 2025. Moral injury: an overview of conceptual, definitional, assessment, and treatment issues. Annu. Rev. Clin. Psychol. https://doi.org/10.1146/annurev-clinpsy-081423-022604.
Litz, B.T., Yeterian, J., Berke, D., Lang, A.J., Gray, M.J., Nienow, T., Frankfurt, S., Harris, J.I., Maguen, S., Rusowicz-Orazem, L., 2024. A controlled trial of adaptive disclosure-enhanced to improve functioning and treat posttraumatic stress disorder. J. Consult. Clin. Psychol. 92 (3), 150–164. https://doi.org/10.1037/ccp0000873.
Mattsson, A.M., Sonne, C., Carlsson, J., 2021. The accuracy of traumatic memories in posttraumatic stress disorder: a review. J. Nerv. Ment. Dis. 209 (3). https://journals.lww.com/jonmd/fulltext/2021/03000/the_accuracy_of_traumatic_memories_in.13.aspx.
Mensink, B., van Schagen, A., van der Aa, N., Ter Heide, F.J.J., 2022. Moral injury in trauma-exposed, treatment-seeking police officers and military veterans: latent class analysis. Front. Psychiatr. 13, 904659. https://doi.org/10.3389/fpsyt.2022.904659.

Molendijk, T., 2019. The role of political practices in moral injury: a study of Afghanistan veterans. Polit. Psychol. 40 (2), 261–275. https://doi.org/10.1111/pops.12503.

Mooren, T., Schok, M., Kleber, R.J., 2009. De zin van ingrijpende gebeurtenissen: een vragenlijst over betekenisgeving na oorlogs-en geweldservaringen. Psychologie en Gezondheid 37 (2), 101–110.

Nash, W.P., Marino Carper, T.L., Mills, M.A., Au, T., Goldsmith, A., Litz, B.T., 2013. Psychometric evaluation of the moral injury events scale. Mil. Med. 178 (6), 646–652. https://doi.org/10.7205/MILMED-D-13-00017.

Nijdam, M.J., Vermetten, E., McFarlane, A.C., 2023. Toward staging differentiation for posttraumatic stress disorder treatment. Acta Psychiatr. Scand. 147 (1), 65–80. https://doi.org/10.1111/acps.13520.

Norman, S.B., Capone, C., Panza, K.E., Haller, M., Davis, B.C., Schnurr, P.P., Shea, M.T., Browne, K., Norman, G.J., Lang, A.J., Kline, A.C., Golshan, S., Allard, C.B., Angkaw, A., 2022. A clinical trial comparing trauma-informed guilt reduction therapy (TrIGR), a brief intervention for trauma-related guilt, to supportive care therapy. Depress. Anxiety 39 (4), 262–273. https://doi.org/10.1002/da.23244.

Nylund-Gibson, K., Choi, A.Y., 2018. Ten frequently asked questions about latent class analysis. Translational Issues in Psychological Science 4 (4), 440–461. https://doi.org/10.1037/tps0000176.

Radloff, L.S., 1977. The CES-D scale: a self-report depression scale for research in the general population. Appl. Psychol. Meas. 1 (3), 385–401.

Rameckers, S.A., van Emmerik, A.A.P., Grasman, R.P.P.P., Arntz, A., 2024. Non-fear emotions in changes in posttraumatic stress disorder symptoms during treatment. J. Behav. Ther. Exp. Psychiatry. 84, 101954. https://doi.org/10.1016/j.jbtep.2024.101954.

Reijnen, A., Rademaker, A.R., Vermetten, E., Geuze, E., 2015. Prevalence of mental health symptoms in Dutch military personnel returning from deployment to Afghanistan: a 2-year longitudinal analysis. Eur. Psychiatry 30 (2), 341–346. https://doi.org/10.1016/j.eurpsy.2014.05.003.

Saba, S.K., Davis, J.P., Lee, D.S., Castro, C.A., Pedersen, E.R., 2022. Moral injury events and behavioral health outcomes among American veterans. J. Anxiety Disord. 90, 102605. https://doi.org/10.1016/j.janxdis.2022.102605.

Schmitz, N., Hartkamp, N., Kiuse, J., Franke, G.H., Reister, G., Tress, W., 2000. The Symptom Check-List-90-R (SCL-90-R): a German validation study. Qual. Life Res. 9 (2), 185–193. https://doi.org/10.1023/a:1008931926181.

Schok, M.L., Kleber, R.J., Elands, M., Weerts, J.M.P., 2008. Meaning as a mission: a review of empirical studies on appraisals of war and peacekeeping experiences. Clin. Psychol. Rev. 28 (3), 357–365. https://doi.org/10.1016/j.cpr.2007.04.005.

Schok, M.L., Kleber, R.J., Lensvelt-Mulders, G.J.L.M., Elands, M., Weerts, J., 2011. Suspicious minds at risk? The role of meaning in processing war and peacekeeping experiences. J. Appl. Soc. Psychol. 41 (1), 61–81. https://doi.org/10.1111/j.1559-1816.2010.00702.x.

Schwarz, G., 1978. Estimating the dimension of a model. Ann. Stat. 6 (2), 461–464. http://www.jstor.org/stable/2958889.

Smigelsky, M.A., Malott, J.D., Veazey Morris, K., Berlin, K.S., Neimeyer, R.A., 2019. Latent profile analysis exploring potential moral injury and posttraumatic stress disorder among military veterans. J. Clin. Psychol. 75 (3), 499–519. https://doi.org/10.1002/jclp.22714.

Spielberger, C.D., 1999. STAXI-2 : State-Trait Anger Expression Inventory-2 : Professional Manual. Psychological Assessment Resources.

van der Wal, S.J., Geuze, E., Vermetten, E., 2023. Long-term risk for mental health symptoms in Dutch ISAF veterans: the role of perceived social support. Psychol. Med. 53 (8), 3355–3365. https://doi.org/10.1017/S0033291721005389.

van der Wal, S.J., Gorter, R., Reijnen, A., Geuze, E., Vermetten, E., 2019. Cohort profile: the prospective research in stress-related military operations (PRISMO) study in the Dutch armed forces. BMJ Open 9 (3), e026670. https://doi.org/10.1136/bmjopen-2018-026670.

van der Wal, S.J., Vermetten, E., Elbert, G., 2020. Long-term development of post-traumatic stress symptoms and associated risk factors in military service members deployed to Afghanistan: results from the PRISMO 10-year follow-up. Eur. Psychiatry 64 (1), e10. https://doi.org/10.1192/j.eurpsy.2020.113.

van Giezen, A.E., Arensman, E., Spinhoven, P., Wolters, G., 2005. Consistency of memory for emotionally arousing events: a review of prospective and experimental studies. Clin. Psychol. Rev. 25 (7), 935–953. https://doi.org/10.1016/j.cpr.2005.04.011.

Vermetten, E., Jetly, R., 2018a. A critical outlook on combat-related PTSD: review and case reports of guilt and shame as drivers for moral injury. Military Behavioral Health 6 (2), 156–164. https://doi.org/10.1080/21635781.2018.1459973.

Vermetten, E., Jetly, R., 2018b. Moral decisions in military operations and its relevance for mental health practice and outcomes. Moral Decis Mil Ment Health 1–6.

Vermetten, E., Jetly, R., Smith-MacDonald, L., Jones, C., Bremault-Phillip, S., 2023. Moral injury in a military context. In: Veteran and Military Mental Health. Springer, Nature Switzerland AG, pp. 231–261. https://doi.org/10.1007/978-3-031-18009-5_14.

Weller, B.E., Bowen, N.K., Faubert, S.J., 2020. Latent class analysis: a guide to best practice. J. Black Psychol. 46 (4), 287–311. https://doi.org/10.1177/0095798420930932.

Williamson, V., Stevelink, S.A.M., Greenberg, N., 2018. Occupational moral injury and mental health: systematic review and meta-analysis. Br. J. Psychiatr. 212 (6), 339–346. https://doi.org/10.1192/bjp.2018.55.

Zerach, G., Ben-Yehuda, A., Levi-Belz, Y., 2023. A prospective investigation of protective factors for moral injury and psychiatric symptomatology among Israeli combatants: a Latent Class Analysis approach. Int. J. Soc. Psychiatr. 69 (5), 1134–1144. https://doi.org/10.1177/00207640231152211.

Zerach, G., Levi-Belz, Y., Griffin, B.J., Maguen, S., 2021. Patterns of exposure to potentially morally injurious events among Israeli combat veterans: a latent class analysis approach. J. Anxiety Disord. 79, 102378. https://doi.org/10.1016/j.janxdis.2021.102378.