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RESEARCH

The contribution of exposure to potentially morally injurious events to trajectories of posttraumatic stress symptoms among discharged veterans – a five-year study

Yoav Levinstein[1,4] · Gadi Zerach[2] · Yossi Levi-Belz[3] · Rachel Dekel[4]

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Abstract

Purpose Combatants and veterans are at risk of developing post traumatic stress symptoms (PTSS). The long-term responses to traumatic events are variable and can be classified into distinct PTSS trajectories. In this prospective study, we evaluated PTSS trajectories among combat veterans during the initial year after discharge from military service. Subsequently, we analyzed how combat exposure and PMIEs contributed to these trajectories.

Methods Our study encompassed 374 combat veterans who participated in a five-year prospective study, with four waves of measurements, T1 - one year before enlistment, T2 - one month prior to discharge from military service (July 2021), and then again at six months (T3 - February 2022) and twelve months after discharge (T4, July-August 2022) .

Results The utilization of Latent Profile Analysis (LPA) revealed a diverse array of PTSS trajectories. Predominantly, a resilient trajectory emerged as the most frequently observed (69.3%), with 'delayed onset'(13.6%), 'improving'(9.9%) and 'chronic'(6.1%) trajectories following in order. Importantly, multinominal regression analysis indicated that combat exposure and PMIE-betrayal contributed to alignment with symptomatic trajectories.

Conclusions This study represents the first of its kind to establish longitudinal, time-dependent associations between PMIEs and PTSS trajectories. These results emphasize the critical importance of ongoing screening and the development of tailored interventions for combat veterans.

Keywords PTSD · PTSS trajectories · Moral injury · Veterans · Combatants

Introduction

Posttraumatic stress disorder symptoms (PTSS) pose a significant mental health challenge for combatants and veterans [1]. The long-term responses to traumatic events are variable and can be classified into distinct PTSS trajectories [2]. However, knowledge of the military-related factors contributing to these patterns is limited despite their substantial clinical and theoretical significance. In this prospective study, we investigate how exposure to transgressive incidents during military service contributes to PTSS trajectories in the initial post-discharge year.

Veterans and soldiers are high-risk populations for developing mental distress, with Post traumatic stress disorder (PTSD) being the most common and severe psychiatric consequence of combat exposure [3]. PTSD is characterized by four symptom clusters: intrusion, persistent reexperiencing of the traumatic event, persistent avoidance of trauma-related stimuli, negative alterations in cognitions and mood, and marked alterations in arousal and reactivity associated with the traumatic event(s) [4]. Research has indicated high rates of PTSD among military populations, ranging from 9.5 to 30% among U.S. veterans [1].

Several studies in the past two decades have shown general heterogeneity in reactions to potentially traumatic

✉ Yoav Levinstein
Yoav.levinstein@biu.ac.il

1 Department of Health and Well-Being Medical Corps, IDF, Tel HaShomer, Israel

2 Department of Psychology, Ariel University, Ariel, Israel

3 The Lior Tsfaty Center for Suicide and Mental Pain Studies, Ruppin Academic Center, Emek Hefer, Israel

4 School of Social Work, Bar-Ilan University, Ramat-Gan, Israel

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events [5]. However, the PTSS literature has detailed homogenous trajectories after exposure [6]. Bonanno's [7] seminal findings showed *resilience*—a stable trajectory of healthy functioning—to be the dominant reaction (65.7%) to adverse events, followed by recovery (20.8%), chronicity (10.6%), and delayed onset (8.9%) [2]. In military populations, resilience is even more dominant (73-85%), followed by recovery (4-6%), delayed onset (3-10%), and chronicity (2-9%) [8–10].

However, research on PTSS trajectories among active-duty combatants is relatively sparse compared to the extensive literature on PTSD among veterans. The existing studies, predominantly conducted among U.S. forces, exhibit disparities in their approaches and methodologies, particularly in terms of the length and number of measurements. Additionally, only a few variables have been investigated as potential predictors of PTSS trajectories [11]. Our study marks a significant step forward, exploring the impact of specific military experiences, particularly exposure to transgressive events during military service, on PTSS trajectories during the initial year post-discharge, beyond the impact of combat exposure.

Combatants experience various stressors, including events posing threats to life, witnessing injuries and deaths, and exposure to combat [12]. Combat exposure is considered the leading stressor in war and has been significantly associated with PTSD [3]. Furthermore, stressful or traumatic experiences during deployment have consistently emerged as significant predictors of symptomatic trajectories, such as delayed onset, chronic, and recovery trajectories, when compared with resilient trajectories [11].

Nevertheless, combatants are not only passive bystanders but also individuals who commit acts of aggression causing death, injury, and destruction, thereby violating ethical standards and commonly held values during peacetime [13, 14]. These experiences, whether as victims or aggressors, might challenge their core values and beliefs. Potentially morally injurious events (PMIEs) are those that violate deeply held beliefs [15]. PMIEs comprise one's own actions (PMIE-self), the actions of others (PMIE-other), or perceptions of betrayal (PMIE-betrayal) [16]. The prevalence of PMIE exposure varies, with rates ranging from 10.8 to 30% among U.S. combat veterans [17] and among Israel Defense Forces (IDF) combatants [18, 19] and veterans [20].

In the aftermath of having engaged in morally conflicting actions or witnessing trusted individuals commit moral transgressions, service members and veterans may experience profound moral distress and various psychiatric symptoms [21]. *Moral injury* (MI), a term coined by Jonathan Shay [22, 23], refers to the harmful psychological and functional consequences observed among Vietnam veterans as a result of authority figures betraying ethical principles. Although MI and PTSD have some similarities in symptomology and etiology, most scholars agree that the two are distinct. Specifically, PTSD is considered a danger- or fear-based disorder, whereas MI is more commonly attributed to shame or guilt [15, 24]. However, beyond the established connection between PMIEs and MI ([25], [26] , [27]), our study aims to identify the distinctive contribution of PMIEs to PTSS trajectories.

Existing studies have reported a significant correlation between PMIEs and mental and behavioural health outcomes among combatants and veterans [21]. Our research specifically targets the transitional period when combatants transition to civilian life, a phase associated with an elevated risk of developing mental health disorders, specifically PTSD [28]. This transition phase, often most challenging during the initial year following discharge, represents a crucial juncture for intervention and support [29, 30]. Surprisingly, limited studies have focused on distress during the first year post-discharge, and no research has investigated the longitudinal relationship between exposure to PMIEs during military service and the development of PTSS during this critical transitional phase.

The present study

This study seeks to fill the noted gaps in knowledge by expanding the inquiry of the long-term relationship between PMIEs and PTSS, specifically focusing on their contribution to distinctive PTSS trajectories. Thus, we designed a study model following a cohort of IDF veterans as part of comprehensive MI research among IDF veterans [31]. This approach facilitated a longitudinal perspective regarding the temporal connections between combat veterans' military combat service experiences and their mental well-being. Our focus was on the distinct phase of adapting to civilian life.

We collected data on the participants' PMIEs, combat exposure, PTSS, and control variables in the final month of their military service (T2). To analyze the trajectories of PTSS, we evaluated our group of discharged veterans at two distinct time points during the first year after their discharge: six months (T3) and 12 months (T4).

We posited the following hypotheses:

H1 - All known trajectories (resilient, recovery, chronic, delayed onset) among combat service veterans in the first year after military discharge will be identified. We presumed that resilience would be the most prevalent trajectory, with an anticipated prevalence of 65-80%.

H2- PMIE facet scores (self, other, and betrayal) at T2 will contribute to veterans' PTSS trajectories beyond the control variables (i.e., pre-enlistment screening data and pre-military potentially traumatic events) and combat exposure.

Method

Participants and procedure

Male combatants from seven active IDF brigades participated in this study ($N = 374$). Mandatory military service in Israel comprises 32 months. Upon completion of mandatory service, soldiers have the option of enlisting for various positions in the professional army. Most, however, are discharged, with most combat soldiers continuing to serve in the reserve forces for 2–3 weeks annually. These individuals comprise a relevant study population, as IDF troops spend substantial periods of their service in the West Bank performing peace-keeping missions among civilian populations [32]. These missions might include actual combat against armed militias or individuals, apprehending those suspected of terrorist activity, operating check posts, patrolling, and other policing missions [20, 32]. Participants met inclusion criteria such as completing at least 30 months of their required combat military service and being discharged 3–4 weeks after T2.

Approximately fifteen hundred combatants were approached and invited to participate in this study. Of these, 1,230 agreed to participate at T2, resulting in 959 (77%) complete and valid questionnaires. These 959 participants were then approached again at T3 and T4. At T3, 335 (34.9%) were unreachable, refused, or avoided participation, and 95 (10%) had invalid questionnaires, resulting in 529 (55%) complete and valid questionnaires. At T4, 335 (34.9%) were unreachable or refused, and 61 (6.3%) had invalid questionnaires, yielding 451 (47%) complete and valid questionnaires. Overall, 374 participants completed all three measurements.

These groups differed in their mean pre-enlistment Cognitive Index scores, $F_{(2, 767)} = 12.01$, $p < .001$): Participants who completed all three measurements scored higher on the Cognitive Index ($M = 60.18$, $SD = 15.51$) than those who completed two measurements ($M = 55.47$, $SD = 15.92$) and a single measurement ($M = 53.86$, $SD = 16.73$). Significant differences in religiosity were found between those who completed all measurements and those who did not, $\chi^2(10) = 35.59$, $p < .001$: More secular participants completed all measurements (56.9%) than those completing one (32.8%) or two measurements (38.5%). No additional significant differences were found between the groups on other sociodemographic and pre-enlistment variables.

All participants in the study were in the same age cohort and had enlisted in mandatory IDF service. All participants were male; their mean age at T2 (at discharge) was 21.14 (*S.D.* = 0.80); on average, participants had completed 12.01 (*S.D.* = 0.10) years of education; most were Israeli-born ($n = 325$, 92.1%) and unmarried ($n = 348$, 98.3%). As frequently observed in the Israeli population [33], religious beliefs emerged as a distinguishing sociodemographic factor, displaying notable disparities among the cohort. Among the respondents, 170 (45%) identified as secular, 50 (13%) as religiously observant, and 78 (20%) as religiously traditional, with the remaining 76 (20%) not disclosing their religious orientation. Therefore, religiosity was controlled in the statistical analysis. Most participants ($n = 259$, 72.3%) served as combatants in infantry brigades.

Measures

Pre-enlistment personal data (T1) were collected for all participants after receiving consent. Subsequent data were collected at three time points: June 2021 (T2), February 2022 (T3), and July-August 2022 (T4).

Moral injury event scale (MIES) [34]

The 9-item MIES is a self-report scale assessing moral injury related to combat experiences. The MIES comprises three subscales: exposure to perceived transgressions committed by the respondent (MIES-self), by others (MIES-other), and perceived betrayals by other military and non-military individuals (MIES-betrayal). Items were presented on a 6-point Likert-type scale, ranging from 1 (*strongly disagree*) to 6 (*strongly agree*), yielding a score for each of the three subscales. The MIES was administered only at T2. The questionnaire has shown good internal reliability (Cronbach's $\alpha = 0.90$) [34]. Similar reliabilities were yielded in the Hebrew version ($\alpha = 0.83 - 0.90$) [32] and for the current sample, $\alpha = 0.86$ (Total). Cronbach's alpha coefficients for the three subscales in the current sample were $\alpha = 0.81$ (Other), $\alpha = 0.86$ (Self), and $\alpha = 0.78$ (betrayal).

Combat experiences scale (CES) [12]

Combat experiences were measured with the 18-item CES, tapping a range of conventional modern combat-related experiences to which a combat soldier may have been exposed. Respondents were asked to indicate which of the listed events they had experienced at any time during their combat service, resulting in a total number of combat experiences, with scores ranging from 0 to 18. The CES was administered only at T2. This scale has been used widely with Israeli populations and found highly valid and reliable (Cronbach's $\alpha = 0.84$) [36]. The Cronbach's alpha coefficient for the current sample was $\alpha = 0.73$.

PTSD checklist for DSM-5 (PCL-5) [35]

This checklist is a 20-item self-report measure assessing the presence and severity of PTSD symptoms. PCL-5 items tap respondents' symptoms in the past month, corresponding to DSM-5 criteria for PTSD: Respondents are asked to rate how much they have been bothered by each of the 20 items in the past month on a 5-point Likert-type scale, ranging from 0 (*not at all*) to 4 (*extremely*). The PCL-5 is a psychometrically sound measure of DSM-5 PTSD. It is valid, reliable, and appropriate for assessing PTSD diagnostic status and symptom severity in veterans and active service members. Cut-off scores to indicate further assessment are typically 31–33 [36]. PCL-5 scores have exhibited strong internal consistency ($\alpha = 0.94$; $\alpha = 0.96$) [35, 36]. This scale has been used widely with Israeli populations and found highly valid and reliable [e.g. [37]]. This measure was administered at three time points. Cronbach's alpha coefficients for the current sample were $\alpha = 0.93$ (T2), $\alpha = 0.92$ (T3), and $\alpha = 0.93$ (T4).

Life events checklist (LEC-5) [38]

The participants' potentially traumatic and negative life events were assessed by the LEC-5 self-report questionnaire comprising 17 events over the participant's life that could lead to PTSD or psychological distress. For each item, respondents are asked to indicate whether the event happened to them personally. The LEC-5 was administered only at T2. The Hebrew version of the LEC-5 has shown good reliability ($\alpha = 0.81$) in previous studies [39]. The Cronbach's alpha coefficient for the current sample was $\alpha = 0.87$.

Pre-enlistment screening data (one year prior to enlistment; T1)

Data were collected regarding participants' *Cognitive Index* score and *Performance Prediction* of combatants, derived from a standard IDF semi-structured interview conducted by trained IDF psychology technicians and designed to predict soldiers' military performance [40, 41].

Cognitive index (CI)

An intelligence evaluation score considered to be a valid measure of general intelligence and highly correlated with the Wechsler Adult Intelligence Scale [40]. Standard CI scores range from 10 to 90 in a normal distribution, with a mean of 50 and 10-point increments [42].

Performance prediction score (PPS)

The PPS is a combined score drawn from the interview score and the empirically weighted scores on several indexes such as the Cognitive Index, combat service suitability, years of schooling, and command of the Hebrew language. PPS scores range from 42 to 56, with higher scores indicating better fitness and greater potential for combat service [40].

Sociodemographic information

The following demographic characteristics were obtained at T2: age, gender, family status, religiosity, educational level, and military service characteristics. On T4, participants were asked how many reserve duty days they served between T2 and T4.

Procedure

Four measurements were collected: T1 provided pre-enlistment data, which were collected approximately one year before enlisting as part of standard military enlistment. T2 was administered during the final month of the participants' active military duty. Recruitment comprised two phases: (a) the P.I. explained the research and its importance in a group setting without the presence of the unit's officers or other commanders. It was emphasized that participation was voluntary and confidential; (b) a second explanation was given individually during the signing of the consent form, assuring that consent to participate would not affect the participant's future reserve military service in any way. For participants completing the T2 measures, we obtained additional pre-enlistment personal data through the Military Induction Center's (MIC) computerized records (T1), which included the Cognitive Index and performance prediction scores.

Data at T2 were collected using hard-copy questionnaires distributed individually by research assistants. T3 and T4 measurements occurred 6 and 12 months after discharge, respectively. Data for T3 and T4 were collected using the Qualtrics survey application (https://www.qualtrics.com). Inclusion criteria at T3 and T4 included all participants who completed a full questionnaire at T2. Participants at T3 and T4 were compensated with a gift card (50 NIS, approximately U.S. $13). Specific measures on all three measurements were monitored so that those yielding scores reflecting probable PTSD were individually and discreetly approached by the P.I., a clinical social worker experienced in PTSD. These individuals were offered personal consultation or referral to optional clinics specializing in PTSD treatment.

All procedures associated with this study comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved by the IDF Medical Corps Institutional Helsinki Committee, approval number 2139-2020.

Statistical analysis

First, we calculated descriptive statistics, PTSS score sums, probable PTSD cases, PMIEs, combat exposure, and control variables (T2), followed by computing PTSS score sums and probable PTSD cases at T3 and T4. Second, the associations between the study variables were examined in a series of Pearson correlation analyses. Third, in order to categorize longitudinal trajectories of PTSS, we ran a latent profile analysis (LPA) using Mplus 7 [43].

LPA is a statistical modeling approach for estimating distinct profiles of variables. LPA was chosen since it is a person-centered statistical method for identifying related cases from multivariate continuous data [44]. Furthermore, LPA is a categorical latent variable approach that focuses on identifying latent subpopulations within a population based on a certain set of variables. LPA treats profile membership as an unobserved categorical variable, where its value indicates to which profile an individual belongs with a certain degree of probability [45].

According to simulation studies [46–48], a sample size ranging from 300 to 500 is recommended as a minimum requirement for conducting LPA. Moreover, we conducted a Monte Carlo simulation [47] with 1000 replications in MPLUS which showed a power of 1.0, indicating that the current sample possesses suitable power for LPA.

Commonly, decisions regarding model retention in LPA use the Bayesian information criterion (BIC), adjusted BIC (ABIC), and Akaike's information criterion (AIC) [48]. BIC is used for model selection decisions, with a lower BIC value representing the preferred model [4849]. Like BIC, lower values of AIC indicate better model fit. Finally, *entropy* is a measure of how well each LPA model partitions the data into profiles [50]. Entropy can range from 0 to 1, with higher values representing a better fit of the profiles to the data [48]. Additionally, all trajectory profiles were required to include a minimum of 5% of the total study cohort to avoid unstable trajectory classes.

In the fourth phase, a multinomial logistic regression was conducted with SPSS version 28.01.01(14) to assess the contribution of covariates and factors to affiliation with a particular trajectory group.

Results

Prevalence of PMIEs, combat exposure PTSS

Almost half of the participants (48.7%, $n=181$) endorsed at least one MIES item at T2, slightly agreeing or higher; 23.7% ($n=88$) endorsed at least one MIES-self item; 41.7% ($n=155$) at least one MIES-other item; and 33.9% ($n=126$) at least one MIES-betrayal item. Regarding PTSS at T2, 33 (8.8%) of participants scored 31 or higher on the PCL-5, representing the recognized cut-off for suspected PTSD [36]. This PTSS cut-off at T3 and T4 was reported among 32 (8.6%) and 29 (7.8%) of the participants, respectively.

Relationships between the study variables

The means, standard deviations, and correlations between the study variables are presented in Table 1, revealing no significant correlations between pre-military data (T1) and any of the study's variables. Furthermore, life events (T2) correlated positively and significantly with PMIE-betrayal (T2) and PTSS (T2, T3, T4). Life events, combat exposure, and PMIE scores (T2) correlated positively and significantly with PTSS on all three measurements. PMIE-self (T2) correlated significantly and positively with PTSS (T2, T3, T4). PMIE-other (T2) correlated significantly and positively with PTSS (T2) and PTSS (T4). PMIE-betrayal (T2) correlated significantly and positively with PTSS (T2, T3, T4).

Latent profile analysis

Table 2 shows fit statistics of 2–5 class solutions of PTSS trajectory profiles among veterans during three time measurements throughout the first year after discharge. Fit indices (i.e., BIC, AIC, ABIC, Entropy) suggested that a 5-class solution best described PTSS changes over time. Nevertheless, two of the clusters in this solution were notably small, comprising less than 5% of the sample, a criterion in LPA. Thus, as anticipated, a 4-class model best described our cohort's PTSS trajectories, aligning with prior theory [2, 7]. Similar to previous studies, resilience was found to be the most prevalent trajectory (70.1%), followed by delayed onset (13.4%) and chronicity (6.3%). An 'improving' pattern of PTSS severity characterized 10.1% of participants, whereby an initially reported near-threshold severity gradually weakened. Each participant was assigned to one of the four trajectory groups. Figure 1 presents mean PCL-5 scores in the four groups over the three measurement times, thus supporting H1.

Table 1 Descriptive statistics

	N	M	SD	1	2	3	4	5	6	7	8	9	10	11
1. PPS	339	52.69	2.23	--										
2. CI	339	60.18	15.52	0.856**	--									
3. Life events	374	2.68	3.44	-0.05	-0.07	--								
4. CE	374	3.47	2.71	0.00	-0.05	0.287**	--							
5. PMIE-total	372	18.26	8.81	-0.04	0.03	0.09	0.270**	--						
6. PMIE- self	372	7.17	4.44	-0.03	0.04	0.04	0.213**	0.874**	--					
7. PMIE-other	372	5.07	3.01	0.00	0.08	-0.02	0.223**	0.757**	0.581**	--				
8. PMIE-betrayal	372	6.02	3.66	-0.06	-0.04	0.196**	0.208**	0.724**	0.411**	0.295**	--			
9. PTSS T2	374	10.19	13.27	-0.10	-0.09	0.180**	0.424**	0.442**	0.369**	0.301**	0.367**	--		
10. PTSS T3	370	11.96	12.55	0.00	-0.03	0.213**	0.275**	0.182**	0.113*	0.10	0.218**	0.463**	--	
11. PTSS T4	374	10.82	11.72	-0.02	-0.02	0.122*	0.283**	0.293**	0.228**	0.220**	0.247**	0.544**	0.676**	--
12. Reserve duty	371	1.73	1.00	−0.016	0.037	0.011	−0.82	0.036	0.006	-1.09*	−0.010	−0.040	−0.061	−0.061

Table 2 Class comparison

Class	AIC	BIC	ABIC	Entropy
2	8441	8480	8448	0.903
3	8320	8375	8330	0.897
4	8253	8324	8267	0.901
5	8198	8284	8215	0.921

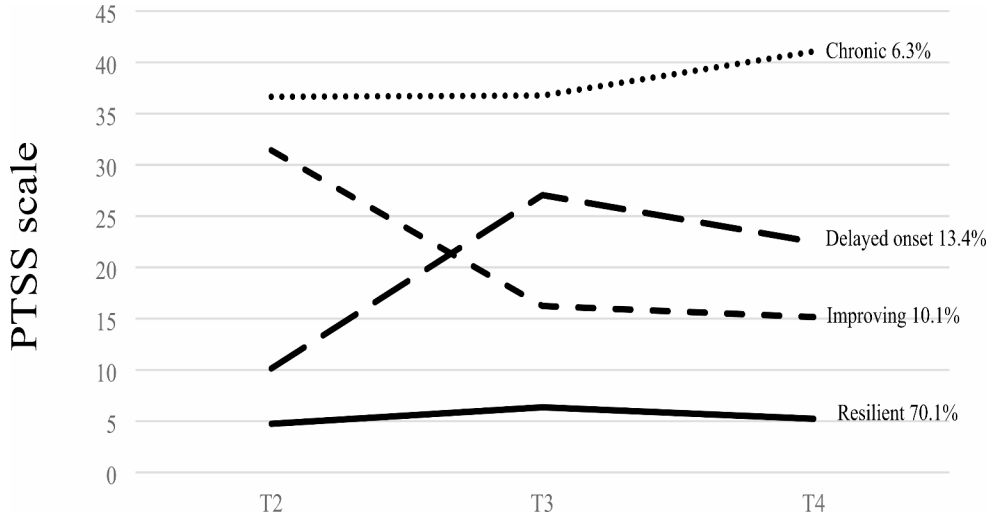
Multinomial logistic regression

Finally, to characterize predictors of longitudinal trajectories of PTSS trajectories, we conducted a multinomial logistic regression analysis. The PTSS trajectory membership group was entered as the dependent variable in this analysis, and the resilient membership group was entered as the reference group. The following predictors were entered into the model: pre-enlistment data (performance predictor and Cognitive Index scores), potentially traumatic life events score, combat exposure score, and PMIE facet scores. The single sociodemographic factor revealing significant differences within the cohort was religiosity; hence, religiosity was also entered into the model. Table 3 presents the likelihood ratio tests of covariates and factors in the model. The results of the multinomial logistic regression can be seen in Table 4. Whereas religiosity and the pre-military screening variables did not significantly predict membership of the symptomatic trajectory profiles, combat exposure comprised a significant predictor of membership to all symptomatic trajectories (O.R.s: chronic = 1.334, $p = .003$; delayed onset = 1.150, $p = .044$; improving = 1.356, $p < .0001$; for confidence intervals, see Table 4). PMIE-other did not significantly predict assignment to trajectory membership. PMIE-self predicted affiliation to chronic trajectory (O.$R = 1.128$, $p = .35$) and revealed contributions approaching significance in the improving group (O.$R = 1.096$, $p = .061$). PMIE-betrayal was a significant predictor of membership to the chronic (O.$R = 1.216$, $p = .002$) and improving (O.$R = 1.114$, $p = .049$) trajectories but not to the delayed onset trajectory. Therefore, PMIE-betrayal (and, to some extent, PMIE-self) contributed to PTSS trajectories beyond control factors and combat exposure, thus partially supporting H2.

Discussion

In this study, we investigated the impact of PMIEs experienced during combat military service on the trajectories of PTSS in the first year following discharge. The findings show that whereas we observed a higher prevalence of symptomatic trajectories than anticipated, most participants exhibited a resilient PTSS trajectory. Notably, betrayal-related PMIEs were found to contribute to symptomatic trajectories, surpassing the influence of combat exposure and

Fig. 1 PTSS trajectories



pre-deployment variables. To our understanding, this prospective study marks the initial endeavor to confirm a longitudinal association between PMIEs and PTSS trajectories.

Our findings regarding rates of exposure to PMIEs were markedly higher than those reported by other military forces [e.g., [51] ,[52]] and somewhat higher than Israeli samples of older combat veterans and active duty combatants [18, 19]. These high rates may be explained by the participants' protracted deployments in urban arenas, requiring them to carry out their duties among civilians. Urban military conflict has been associated with elevated exposure to PMIEs [32]. Moreover, the timing of our study, corresponded to the conclusion of the participants' service, with recollections of PMIE experiences still fresh and vivid.

Our findings concerning the PTSS trajectories align with previous research on the combatants' and veterans' responses to military service in that (a) four distinct trajectories were revealed, and (b) their subgroup prevalence resembled findings among Dutch [53] and U.S [5, 10]. combatants. The resilient trajectory was somewhat less prevalent in our sample (71%) than in prior studies [10, 53]. However, the resilient trajectory, yielding consistently low PTSS across the three measurements, was the most frequently observed in our cohort. High resilience among combat veterans could be explained and anticipated, considering the typically high level of preparedness and training among military personnel [8]. Furthermore, our sample of combatants had not participated in full-scale warfare, likely experiencing fewer combat incidents. This reduced exposure could contribute to the prevalence of the resilient trajectory observed.

Unexpectedly, more than 30% of our participants presented one of the three symptomatic trajectories, surpassing findings among combatants and veterans in earlier studies [11]. Notable was the 'delayed onset' trajectory, the second most prominent category. In this trajectory, individuals showed mild symptoms at their military discharge, followed by a significant increase in symptom severity during the subsequent year of transitioning to civilian life, signifying persistent and substantial distress. This trajectory pattern can be understood in light of the context of the current study, which was conducted during the participants' transition to civilian life. As combatants disengage from their military identity, values, and roles [54], and military camaraderie gradually weakens, resilience demonstrated at discharge may decline. This dynamic could potentially lead to a delayed stress response, as indicated in previous studies [55].

Our study model enabled us to assess the unique contribution of PMIEs, among various control and exposure variables, to PTSS trajectories. However, none of the control variables were revealed to contribute significantly to the development of PTSS symptomatic trajectories. As anticipated, combat exposure played a substantial role in all three symptomatic trajectories. This finding aligns with our expectations, as combat exposure has consistently emerged as one of the strongest predictors of PTSS trajectories [8].

Central to the focus of this study, PMIE-betrayal comprised the most robust predictor of symptomatic PTSS trajectories among the PMIE facets. PMIE-betrayal significantly predicted both chronic and improving trajectories, demonstrating its influence above and beyond sociodemographic factors, control variables, and combat exposure. These findings align with previous cross-sectional studies conducted among U.S. veterans [56] and IDF combatants and veterans [18, 57].

Litz et al.'s [15] operational framework highlights the *self* as the primary transgressor of moral codes. However, our findings support Shay's [23] conceptualization of moral injury as a character wound that stems from a betrayal of justice by a person of authority in a high-stakes situation (p. 183). Previous research has indicated that experiences of betrayal not only diminish but, in certain instances, may completely negate the protective impact of resilience

Table 3 Likelihood ratio tests

Effect	Model-fitting criteria	Likelihood ratio tests		
	-2 Log likelihood of reduced model	Chi-square	df	Sig.
Intercept	523.473[a]	0.000	0	
Religiosity	532.094	8.621	9	0.473
PPS	524.488	1.016	3	0.797
Cognitive Index	525.504	2.032	3	0.566
Life events	524.278	0.805	3	0.848
Combat exposure	547.342	23.870	3	0.000
PMIE-self	532.243	8.771	3	0.032
PMIE-other	523.725	0.253	3	0.969
PMIE-betrayal	536.267	12.794	3	0.005
Reserve Duty	526.969	3.497	3	0.321

Note The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis = all parameters of that effect are 0. [a]This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom

factors, such as perceived social support [58], unit cohesion [22], and trust [16], thus hampering recovery.

Shay's [22] conception of morally injured veterans as victims of others' wrongdoing mirrors views found elsewhere in the mental health and ethics literature on how breaches in social and moral contracts and damage to belief systems can facilitate trauma [59]. These perspectives explore the notion that posttraumatic stress can be viewed as a deficiency in one's "cognitive baggage," indicating that the beliefs and expectations individuals had about themselves and their environment may have suffered significant impairment and could now be deemed non-functional [60]. Hence, one can infer that individuals who undergo betrayal in addition to combat exposure are more prone to developing symptomatic trajectories in response to the deterioration of their perceptions of the world. The current findings align with our team's previously reported data, revealing that the disruption of one's assumptive world significantly contributes to psychological distress among female combat veterans [61].

From another perspective, *betrayal trauma theory* offers an approach to framing trauma that underscores the significance of social relationships in comprehending the consequences of posttraumatic experiences [62]. Thus, some veterans might have seen commanders or institutions on which they depended for survival substantially violating the veterans' trust. Processing and recalling these events, then, might result in perceiving the negative incidents as a betrayal.

The prospective model of this study, representing a timeline beginning in combat military service and continuing through the post-discharge transition to civilian life, allows us to suggest that PMIE-betrayal actively contributes to the development of PTSS and could be considered a risk factor in post-deployment assessments. Furthermore, the findings suggest that individuals exhibiting symptomatic trajectories may be undergoing betrayal trauma, impacting their capacity to process events encountered during their

Table 4 Odds ratios (OR) and confidence intervals (CI) for predictors of PTSD trajectories

Predictors	Chronic OR (95% CI)	Delayed onset OR (95% CI)	Improving OR (95% CI)
Non	1.640(0.379 – 7.100) $p = .508$	1.187(0.413-3.408) $p = .750$	1.387(0.442–4.356) $p = .575$
Secular	0.902(0.217-3.757) $p = .888$	1.348(0.544-3.251) $p = .495$	0.819(0.273–2.453) $p = .721$
Traditional	-	-	-
Religious	-	0.419(0.099-1.783) $p = .239$	0.644(0.135–3.068) $p = .580$
PPS	0.950(0.850–1.121) $p = .742$	1.033(0.942-1.132) $p = .493$	1.013(0.901-1.138) $p = .831$
Cognitive Index	1.002(0.971–1.034) $p = .890$	0.989(0.967-1.011) $p = .323$	0.986(0.961-1.012) $p = .292$
Life events	1.043(0.914–1.190) $p = .541$	1.029(0.938–1.129) $p = .545$	1.036(0.935-1.148) $p = .500$
Combat exposure	1.347(1.113–1.630) $p = .002$	1.158(1.012–1.326) $p = .033$	1.364(1.180–1.576) $p < .0001$
PMIE-self	1.134(1.011–1.273) $p = .032$	0.952(0.851-1.065) $p = .387$	1.097(0.996-1.209) $p = .061$
PMIE-other	1.024(0.837-1.254) $p = .815$	1.035(0.898-1.192) $p = .635$	1.012(0.860–1.191) $p = .883$
PMIE-betrayal	1.243(1.095–1.411) $p = .001$	1.059(0.946-1.174) $p = .271$	1.132(1.015–1.264) $p = .026$
Reserve duty	0.612(0.252–1.487) $p = .279$	1.124(0.862–1.740) $p = .259$	0.850(0.499–1.447) $p = .549$

Note Reference categories: Resilient. PPS= predicted performance score; Religiosity categories: Religious, Secular, Traditional, and Non

combat service and, consequently, influencing their ability to recover.

The present study has several methodological limitations. Firstly, we employed self-report questionnaires, potentially introducing biases, particularly in the assessment of probable PTSD. Thus, the lack of involvement of a trained clinician renders the self -assessment susceptible to estimation bias. Second, participant attrition should be acknowledged, particularly the observed disparity in religiosity between those completing all three measurements and those who did not. The potential influence of this attrition on the study's internal validity and the generalizability of findings should be considered. Thirdly, our sample comprises IDF Ground Forces veterans; however, it does not include personnel from other military branches such as the Air Force or Navy. Lastly, given that our study involves an Israeli veteran cohort, we must acknowledge potential cultural and military context disparities with other countries, including variations in types of exposure and the role of the mandatory nature of military service. Thus, caution is advised when generalizing the findings beyond our study, and future research should aim for a more representative sampling.

The findings of this study have significant clinical implications. The identification of four distinct PTSS trajectories among discharged combatants highlights the need for ongoing systematic screening as a crucial component of the discharge process for this population. While combat experiences were found to contribute to all symptomatic trajectories, our findings emphasize the persistent impact of PMIEs, particularly those involving betrayal and self-related issues, on two specific PTSS trajectories: chronic and improving.

These trajectories are characterized by elevated PTSS scores at the time of military discharge, suggesting that betrayal may contribute to the early onset of PTSS. Mental health professionals should recognize that elevated PTSS in the early stages following discharge may not only indicate exposure to CE but is more likely to reflect experiences of PMIEs. This understanding is vital for accurately assessing and addressing the mental health needs of recently discharged veterans.

Hence, individuals who express feelings of betrayal or exhibiting early PTSS should be considered for tailored, evidence-based interventions. Interventions such as *Adaptive Disclosure* [63] or *Cognitive Processing Therapy* (CPT) [64], which target the patient's thoughts, feelings, and beliefs concerning the traumatic events as well as their PTSD symptoms. These findings contribute to the growing body of knowledge in the field and provide actionable insights for clinicians working with veterans who have experienced PMIEs.

Author contributions Y.L served as administration project leader and contributed equally to investigation, conceptualization, formal analysis, data curation writing reviewing and editing. G.Z & Y.L.B contributed equally to investigation, conceptualization, formal analysis, data curation writing reviewing and editing. R.D contributed equally to, conceptualization, formal analysis, writing reviewing and editing.

Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

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