Table S1 Characteristics and key findings of the studies on computational approaches to PTSD in Middle Eastern or conflict-affected populations.

Reference	Population	Data Types	Analytical Methods	Study Objective	Key Findings	Practical Implications
Yamin et al. (2021) [1]	Male Iraqi refugees in the US (N = 53)	Self-reports (HTQ, PCL-C, HADS, acculturation scale); CRP	Hierarchical Multiple Regression; Pearson Correlations	Examine associations between acculturation, CRP, and 2-year post-migration PTSD/depression	Acculturation inversely related to depression ($\hat{I}^2$ = -0.28); CRP positively related to both PTSD ($\hat{I}^2$ = 0.32) and depression ($\hat{I}^2$ = 0.45) symptoms at 2-year follow-up	Interventions promoting host-country acculturation and reducing systemic inflammation may mitigate long-term psychological suffering
Siegel et al. (2021) [2]	Male Iraq/Afghanistan veterans	Multi-omic blood markers; 16 self-report/clinician scales	Random Forest (RF); Partitioning Around Medoids (PAM) clustering	Identify symptom severity subtypes and biological correlates	Identified two subtypes (S1/S2); Multi-omics (methylation, microRNA, lactate) yielded AUCs of 0.819 and 0.922	Facilitates objective laboratory-based screening and treatment targeted to severity
Papini et al. (2023) [3]	US Army soldiers (N = 4,771)	801 pre-deployment self-reported predictors	Gradient-Boosting Machine (GBM); Elastic Net	Predict post-deployment PTSD before trauma exposure	Optimal GBM model with 58 core predictors achieved AUC 0.74; top 1/3 of high-risk participants accounted for 62.4% of cases	Enables pre-deployment risk stratification to facilitate targeted resilience training

Naghavi et al. (2020) [4]	University students in the MENA region (N = 573)	Battery of 92 items (PCL-5, PHQ, PTG, social support)	Stability feature selection; Stacked ensemble decision trees	Diagnose suicide ideation/behavior using a robust ML approach	System achieved AUC 0.90; identified 23 critical items across trauma exposure and PTSD symptoms as primary predictors	Development of high-accuracy screening tools for at-risk young adults in educational settings
Schultebraucks et al. (2021) [5]	Active-duty Army personnel (N = 473)	Polygenic, epigenetic, metabolomic, inflammatory markers; neurocognitive tests	Latent Growth Mixture Modeling (LGMM); RF; SVM	Predict post-deployment PTSD symptom trajectories from pre-deployment data.	SVM predicted provisional diagnosis with AUC 0.88; sleep quality and cognitive flexibility were among the highest-ranked features	Informs deployment readiness and suggests modifiable pre-deployment intervention targets
Goel et al. (2023) [6]	Veterans with PTSD (N = 8)	Multisession functional MRI (fMRI) data	Deep Learning (DL); SVM; Support Vector Regression (SVR)	Individualized classification of self-reported stress states	Accurately classified 8-class stress responses with a mean RMSE of 0.6 across individualized models	Enables real-time fMRI neurofeedback to optimize virtual reality (VR) exposure therapy
Xu et al. (2023) [7]	Male warzone veterans (N = 475)	41 Routine CLIA clinical laboratory blood tests	Random Forest with stepwise forward variable selection	Create objective diagnostic screening tests using accessible lab markers	Model differentiated PTSD from healthy controls with AUC 0.730; markers of glucose metabolism and inflammation were most significant	Holds promise for low-cost, high-throughput screening in primary care settings

Mohammadi et al. (2025) [8]	Treatment-seeking patients in Iran (N = 463)	ITQ scores; trauma exposure checklist	Network Analysis (graphical LASSO algorithm)	Explore the symptom structure and identify central nodes of Complex PTSD	"Feelings of failure" and "worthlessness" were the most central nodes; "long-term upset" bridged PTSD and DSO symptoms	Central symptoms should be prioritized in clinical intervention models (e.g., compassion-focused therapy)
Tylee et al. (2015) [9]	US Marines (N = 50)	Blood-based gene-expression (mRNA) levels	SVM classifiers; ANCOVA	Develop a post-deployment diagnostic biomarker panel	2-gene transcript panel (GSTM1, GSTM2) achieved 80% accuracy; 20-exon panel achieved 90% accuracy in test subset	Proof-of-principle for using transcriptomic signatures as adjuncts to behavioral diagnosis
Glatt et al. (2013) [10]	US Marines (N = 50)	Pre-deployment blood-based gene-expression levels	SVM classifiers; ANCOVA	Identify pre-deployment predictors of PTSD risk and resilience	23-transcript model achieved 70% accuracy; 5-exon model attained 80% accuracy; immune genes were significantly enriched	Proposes pre-deployment screening to foster earlier intervention among high-risk individuals
Arnetz et al. (2020) [11]	Middle Eastern refugees (Iraq/Syria)	BDNF, NGF neurotrophins; heavy metal blood concentrations	Linear Regression; Neuroplasticity Index construction	Analyze association between war trauma, environmental exposures, and mental health	Neuroplasticity index associated with PTSD ($Î^2$ = 0.25); blood lead levels correlated with neuroplasticity scores	Expanded panel including environmental toxicants and neurotrophins may improve risk prediction

Nkiliza et al. (2023) [12]	Active-duty deployed soldiers (N = 120)	Plasma oxylipins; ethanolamides; APOE genotype	Mixed linear modeling (MLM); Hierarchical clustering	Characterize chronic lipid changes associated with mTBI and PTSD	AA-derived oxylipins (CYP pathway) and anandamide elevated in E4+ carriers with comorbid TBI/PTSD	Bioactive lipids could serve as minimally invasive markers for differential diagnosis of chronic TBI and PTSD
Gradus et al. (2017) [13]	US Veterans (Iraq/Afghanistan) (N = 2,244)	Pre-deployment and military factors; traumatic experiences; psychopathology	CART; Random Forest	Examine gender-specific associations between trauma and suicidal ideation	AUC 0.91 (men), 0.92 (women); sexual harassment interacted strongly with SI for women; depression/PTSD key for men	Support for gender-specific actuarial tools to improve suicide risk identification
Salmanipour et al. (2025) [14]	Epileptic patients with C-PTSD (N = 137)	PTGI-21; self-concept, experiential avoidance, ego strength scales	Structural Equation Modeling (SEM) (SmartPLS-4)	Examine predictors of post-traumatic growth (PTG)	Self-concept, avoidance, and ego strength combined explained 77% of PTG variance; ego strength is a significant mediator	Enhancing ego strength in clinical settings can promote greater PTG and diminish avoidance
Trousselard et al. (2023) [15]	French Army soldiers (N = 290)	Urinary/blood cortisol; BDNF; psychopathological scales	Hierarchical Cluster Analysis	Determine relationship between allostatic load and mental health	Identified 4 allostatic profiles; 10% reported high psychopathology despite being medically fit-for-duty	Recommendation for subthreshold screening to link infra-clinical “biological scars” with psychological suffering

Veeser et al. (2023) [16]	Refugee minors (outpatient care) (N = 417)	MINI-KID (Module K); social history predictors	Multiple Logistic Regression	Evaluate prevalence and association of risk factors with PTSD	Prevalence 61.6%; top predictor was number of interpersonal traumatic life events (20.8% variance)	Underscores the need for age-specific diagnostic instruments and specialized care structures
Barathie & Karam (2025) [17]	Lebanese adults (N = 1,000)	Arabic version of PCL-5	Exploratory Factor Analysis (EFA) (Promax rotation)	Construct validation of Arabic PCL-5 in high-trauma population	Two retained factors: trauma-specific (blast) vs. non-trauma-specific; high internal consistency (KR-20 = 0.918)	Suggests nuanced clinical interviews are superior to self-reports to avoid symptom "double counting"
Ibrahim et al. (2018) [18]	Displaced Kurdish and Arab adults (N = 206)	Kurdish/Arabic PCL-5; war exposure instrument	Receiver Operating Characteristic (ROC)	Determine a contextually valid PCL-5 cut-off score for displaced populations	Optimal cut-off of 23 found for a balanced sensitivity/specificity (lower than Western standards)	Provides a culturally calibrated screening foundation for local humanitarian health services
Ghafouri et al. (2024) [19]	Displaced Yazidi mothers (N = 283)	Harvard Trauma Questionnaire (HTQ); PTG Inventory	Wardâ€™s minimum variance cluster analysis	Analyze the balance between post-traumatic distress and growth	Identified 4 groups; 39% categorized as "Severe symptoms and low growth"; 13% as "Moderate symptoms/high growth"	Interventions should focus on recreating cultural security and pride alongside symptom reduction

Sönmez & Karaoğlu (2023) [20]	Psychology students in Turkey (N = 290)	Stereotype Content Model (SCM) scales	Hierarchical and K-means Cluster Analysis	Examine societal perceptions of mental illness warmth and competence	PTSD grouped in Cluster 2 (moderate competence/warmth); perceived as "warmer than competent"	Educating future clinicians on stereotypes can prevent preferential treatment or avoidance in practice
Bal & Jensen (2007) [21]	Turkish child/adolescent survivors (N = 293)	CPTSD Reaction Index for Children	Confirmatory Factor Analysis (CFA)	Test the validity of the DSM-IV-TR symptom structure in children	Results supported the three-symptom cluster model (intrusion, avoidance/numbing, arousal)	Validates the applicability of established diagnostic frameworks across cultural and age groups
Farhood et al. (2018) [22]	Lebanese civilians (N = 991)	Arabic Harvard Trauma Questionnaire (HTQ)	Multiple Logistic Regression	Assess gender differences in PTSD prevalence, trauma types, and risk factors	Females were twice as likely to score above threshold (24.3%); health problems were a specific risk for females	Maximum treatment effectiveness requires drawing unique trauma-vulnerability profiles for each gender

Table S2 The table below summarizes the predictive performance and key predictors, resulting from the computational studies.

Paper (Year)	Method/Model	Main Metric(s)	Population	Top Predictors/Biomarkers	Validation/Notes
Papini (2023) [3]	Gradient-Boosting Machine	AUC 0.74 (95% CI 0.71-0.77)	US Army pre-deployment	Stressful/unit experiences, childhood trauma, anxiety	Independent temporal/geographic cohort
Schultebraucks (2020) [5]	RF + SVM	AUC 0.78 (RF) - 0.88 (SVM)	US Army pre-deployment	Sleep quality, anxiety, depression, cognitive flexibility	75% and 25% internal split for training and testing groups
Xu (2023) [7]	Random Forest	AUC 0.73; Accuracy 0.71	Veterans	Glucose, CRP, HbA1c, WBC, Alkaline phosphatase	Internal out-of-bag (OOB) + external cohort (AUC 0.60)
Goel (2023) [6]	Deep Learning/SVM/SVR	RMSE 0.6 (±0.1)	Veterans with PTSD	Whole-brain cortical gray-matter fMRI features	Permutation testing, multi-session
Naghavi (2020) [4]	Stacked Ensemble Decision Trees	AUC 0.90 (95% CI 0.86-0.93)	Middle East and North Africa (MENA) university students	Post-Traumatic Stress Disorder Checklist (PCL-5) items, psychological illness, Post-Traumatic Growth (PTG)	3-fold cross-validation
Gradus (2017) [13]	Classification and regression trees analysis (CART) + Random Forest	AUC 0.91 (men)/ 0.92 (women)	Iraq/Afghanistan veterans	Depression, PTSD, somatic complaints, sexual harassment	OOB bootstrap
Siegel (2021) [2]	RF + PAM Clustering	Subtype AUC 0.82-0.92	Male veterans	Methylation, microRNA, lactate markers	Independent validation (N = 62)
Tylee (2014) [9]	Support Vector Machines (SVMs)	Accuracy 80-90%	US Marines	GSTM1, GSTM2 gene transcripts	Independent test subset
Glatt (2013) [10]	Support Vector Machines (SVMs)	Accuracy 70-80%	US Marines	Gene transcripts (23 full-length, 5 exons)	Independent test sample

Salmanipour (2025) [14]	Structural Equation Modeling	77% variance explained in PTG	Epilepsy + C-PTSD patients	Self-concept, experiential avoidance, ego strength	Fit indices (Root Mean Squared Error (RMSE), Standardized Root Mean Squared Error (SRMR), Normed Fit Index (NFI))

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