

Research Article

ENHANCING DECISION-MAKING UNDER COMBAT STRESS: PSYCHOLOGICAL INTERVENTION EFFECTS ON MILITARY PERSONNEL IN CRISIS SITUATIONS

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Received 05th April 2025; Accepted 06th May 2025; Published online 30th June 2025

ABSTRACT

This study investigates the effectiveness of a multidomain psychological training program designed to enhance decision-making readiness in active-duty military personnel. Conducted as a quasi-experimental pre-post intervention with between-group comparisons, the research evaluated changes in cognitive flexibility, emotional regulation, physiological reactivity, and decision-making performance. A total of 87 border guard service members were assigned to either an Experimental Group ($n = 45$), which received a six-week, 68.5-hour training program, or a Control Group ($n = 42$), which continued routine duties. The intervention incorporated cognitive drills, emotion regulation exercises, VR-based decision scenarios, and HRV biofeedback. Quantitative data were collected using validated psychometric tools, physiological monitoring devices, and expert-rated simulations. Post-intervention results showed significant gains in the Experimental Group across all domains, with large effect sizes (Cohen's $d = 0.79-0.95$) and an average increase of 23.6% in adaptive readiness. Between-group analyses confirmed superior outcomes for the Experimental Group in emotional regulation, situational awareness, decision effectiveness, and autonomic stability. Correlational analyses revealed positive associations between emotional intelligence, HRV, and decision-making performance. Qualitative findings from focus group interviews further supported the training's perceived impact on operational confidence, emotional control, and team cohesion. These results highlight the value of integrated psychological preparation in enhancing military performance under stress and support its broader application across high-stakes occupational domains.

Keywords: Decision-making under stress, Military training, Emotional intelligence, Heart rate variability (HRV), Adaptive performance.

INTRODUCTION

The 21st-century security landscape presents military personnel with increasingly complex challenges. Contemporary conflicts are defined by rapid technological change, hybrid warfare, and the psychological toll of operating under volatile, uncertain, complex, and ambiguous (VUCA) conditions. In such high-stakes environments, the ability to make effective decisions becomes paramount – often determining mission success, survival, and unit cohesion (Kahneman, 2011; McEwen & Sapolsky, 1995; Stsiborovskyi, 2020). Decision-making under crisis is no longer viewed solely as a rational or cognitive task; it is increasingly understood as a dynamic, multidomain phenomenon encompassing neurophysiological regulation, emotional resilience, and team-based coordination (Gigerenzer & Gaissmaier, 2011; Gross & McRae, 2020). Military-specific conditions – such as life-threatening risk, restricted time for reflection, and hierarchical command structures – amplify the psychological strain and reduce reliance on standard deliberative strategies (Furs, 2021; Osoba, 2024).

Research shows that stress impacts executive functions including working memory, attention control, and adaptive reasoning, thereby compromising decision quality in combat zones (Gross & Thompson, 2014; Miller & Cohen, 2001). Additionally, empirical data indicate that low trust in leadership and poor emotional self-regulation are predictors of ineffective decisions among Ukrainian military personnel (Stsiborovskyi, 2020). To address these challenges, our study designed and tested a novel, multidisciplinary psychological training program targeting four interlinked domains: cognitive, emotional, social, and neurophysiological. The intervention involved cognitive training, stress inoculation, VR-based scenario exercises, and heart

rate variability (HRV) feedback. The program was implemented under active-duty conditions among members of the State Border Guard Service of Ukraine.

This article aims to evaluate the program's effectiveness by comparing experimental (EG) and control (CG) groups. Specifically, we investigate whether the intervention significantly enhanced psychological indicators relevant to decision-making capacity under crisis conditions.

LITERATURE REVIEW

Review of Theoretical Foundations of Decision-Making Under Stress

Decision-making under extreme conditions, such as combat, is a complex and multifactorial psychological process. This study is grounded in an integrative framework that incorporates four core domains – cognitive, emotional, neurophysiological, and social – each supported by foundational theories and empirical research.

Cognitive Domain

At the core of decision-making theories lies Dual-Process Theory (Kahneman, 2011), which differentiates between intuitive, automatic responses (System 1) and reflective, analytical thought (System 2). In crisis contexts, where time and information are limited, military personnel often default to System 1, which, although fast, is vulnerable to cognitive biases and errors (Loewenstein & Lerner, 2003). This is supported by Theory of Bounded Rationality (Simon, 1957), which asserts that individuals make “satisficing” rather than optimal decisions due to cognitive limitations and environmental constraints. In addition, the Theory of Adaptive Thinking (Gigerenzer & Gaissmaier, 2011) highlights how experienced individuals use

heuristics – simple rules of thumb – to make effective decisions under uncertainty. In military settings, these heuristics are often shaped by repeated exposure to high-pressure environments and training protocols, such as the Recognition-Primed Decision model (Klein *et al.*, 2004), which relies on pattern recognition and mental simulation of likely outcomes.

Emotional Domain

The Process Model of Emotion Regulation by Gross and Thompson (2014) is central to understanding how emotions interact with cognition during decision-making. Under combat stress, soldiers experience intense emotions – fear, anger, anxiety – which, if unregulated, can hijack rational appraisal systems. Emotional regulation strategies such as reappraisal, suppression, and mindfulness directly influence decision accuracy and reaction time (McRae & Gross, 2020). The neuropsychological literature emphasises that elevated stress hormones (e.g., cortisol) impair functions of the prefrontal cortex – such as working memory and attention – which are critical for planning and judgment (McEwen & Sapolsky, 1995; Pessoa, 2008). These impairments are especially problematic in unpredictable environments where decisions have life-and-death consequences.

Neurophysiological Domain

The ability to maintain autonomic balance during stress is a strong predictor of adaptive decision-making. Heart Rate Variability (HRV), a measure of vagal tone, is widely recognised as an index of neurophysiological adaptability. High HRV is associated with greater emotional control, executive function, and situational awareness (Miller & Cohen, 2001; Porges, 2007). During our training intervention, HRV feedback was used to enhance self-regulation in real-time combat simulations.

Social Domain

Decision-making does not occur in isolation. Military decisions are embedded in hierarchical, team-based structures that shape cognition through social norms, command authority, and peer interactions. Ecological Rationality Theory (Gigerenzer & Gaissmaier, 2011) proposes that decision quality depends on the alignment between individual heuristics and the social environment. In military contexts, trust in leadership, unit cohesion, and clarity of role expectations are crucial moderating factors (Bearman & Hedström, 2017; Keith, 2019; Osoba, 2024). Theories of Team Effectiveness (Salas *et al.*, 2005) and Situational Awareness (Endsley, 1995) emphasise shared mental models, communication, and coordinated action as essential components of collective decision-making under stress. These insights informed the design of our group-based intervention modules.

Review of Military Psychology Literature

Despite advances in cognitive and emotional theories, military psychology research has historically approached decision-making in fragmented ways – often isolating stress, cognition, or social variables rather than examining their interaction. This siloed approach limits the practical utility of many models in real-world combat scenarios, where decision-making must account for physiological stress, team dynamics, and environmental uncertainty simultaneously (Stsiborovskiy, 2020; Furs, 2021). Existing models such as the Recognition-Primed Decision Model (Klein *et al.*, 2004) and the OODA Loop (Boyd, 1995) have been influential in training rapid military decision-making. However, these models primarily emphasise

pattern recognition and sequential reasoning under pressure, with minimal integration of emotional regulation or neurophysiological resilience. While suitable for experienced decision-makers, they falter in contexts involving high emotional reactivity or in personnel with less operational exposure. Moreover, traditional training methods in NATO and partner countries often rely on procedural drills and static scenarios that fail to replicate the emotional volatility and ambiguity of actual combat situations (Alim *et al.*, 2025; Kerbusch *et al.*, 2018). These limitations have sparked interest in Scenario-Based Training (Salas & Cannon-Bowers, 2001), which immerses soldiers in dynamic, high-stress environments. Yet such programs often overlook individual differences in stress tolerance, decision fatigue, or physiological adaptability. Ukrainian military psychology literature remains underrepresented in global discourse but offers critical insights into sociocultural and operational nuances. For example, research by Lytvynchuk (2018) emphasises the role of moral decision-making and emotional self-awareness in border guard personnel, while Stsiborovskiy (2020) and Furs (2021) call for models that capture the “crisis ecology” of modern warfare – uncertainty, role overload, and emotional contagion within units. However, these studies often lack physiological data or structured simulation feedback mechanisms, limiting their prescriptive power. Additionally, recent work on Team Effectiveness (Salas *et al.*, 2005) and Situational Awareness (Endsley, 1995) has stressed the importance of shared mental models and team adaptability. Yet implementation in training programs remains inconsistent, with few initiatives integrating group cognition, physiological monitoring, and emotional coaching into a unified intervention. Our study addresses this interdisciplinary gap by integrating multiple domains – cognitive heuristics, emotion regulation, team-based coordination, and neurophysiological resilience – into a single training protocol. The program was field-tested under operational conditions and employed VR-simulated crisis scenarios with real-time HRV feedback, making it one of the first comprehensive applications of multidomain military psychology in the Ukrainian defense context.

METHODOLOGY

This study employed a quasi-experimental pre-post intervention design with between-group comparisons. The research aimed to evaluate the effects of a comprehensive psychological training program on decision-making effectiveness among military personnel. The study was conducted over a three-year period (2021–2024) and included four phases: theoretical groundwork, baseline (pretest) diagnostics, implementation of the intervention, and posttest analysis.

Participants and Sampling

The study sample consisted of 87 active-duty border guard personnel from the 105th Border Detachment named after Prince Volodymyr the Great (Chernihiv Border Detachment), tasked with safeguarding the Ukrainian–Belarusian border in the Chernihiv region. Participants were selected using a convenience sampling strategy, reflecting the operational realities of military deployment and accessibility. Participants were divided into: (1) Experimental Group (EG): 45 personnel who completed the full psychological training program, and (2) Control Group (CG): 42 personnel who continued with routine duties and were not exposed to the intervention. Both groups were open-ended, reflecting operational dynamics such as personnel rotation, temporary reassignments, and field deployments. To ensure validity, only those participants who completed all stages of the intervention or corresponding control assessments were included in the final analysis.

The demographic profile included: (a) service experience ranging from 6 months to 5 years, (b) predominantly junior officers and contract soldiers operating in high-risk zones (e.g., frontline response units, mobile patrols, and strategic checkpoints), (c) comparable distributions in gender (≈91% male, ≈9% female), and age (majority between 25–34 years), (d) participants had no serious psychological trauma within the 6 months prior to the study (verified via self-report and military medical records). Group assignment was stratified by service characteristics, age, length of service, and baseline psychological readiness to ensure comparability. Both groups were engaged in equivalent types of operational duty, including frontline rotations, mobile response missions, and border surveillance under elevated combat readiness. This ensured a high level of contextual equivalence, minimizing confounding variables from external service conditions.

Intervention Program

The psychological training program implemented in the Experimental Group was structured around a modular design and aimed to improve the multidomain determinants of effective decision-making under crisis conditions (see Table 1). The program spanned 6 weeks, with 2–3 sessions per week, totalling 68.5 hours of instruction. Training sessions were administered during duty hours in controlled field settings. The curriculum comprised six modules, each addressing a distinct domain relevant to military performance under stress:

Table 1. Structure and Content of the Multidomain Psychological Training Program for Military Decision-Making Under Crisis Conditions

No.	Module	Objective	Duration (hrs)	Sessions	Methods	Sample Exercises	Source
1	Cognitive Preparation	Develop situational awareness, analytical thinking	15	6	Case analysis, cognitive drills	"Pelengator," bias test, pair work	Adapted: NATO Education and Training Program
2	Emotional Regulation	Enhance stress resilience and emotional intelligence	10	5	Mindfulness, HRV biofeedback, mirror exercises	"Breathing square," emotion mirror	Borrowed: Grossman & Christensen (2007)
3	Simulation-Based Training	Automate decision responses, strengthen team dynamics	12.5	5	VR scenarios, role plays	"Ambush," situational change drills	Designed by Author
4	Metacognitive Strategies	Foster self-reflection and scenario thinking	8	4	Group discussion, strategic planning	"3 Questions," scenario planning	Adapted: NHS Confederation. (2025)
5	Ethical Competence	Build moral judgment, cultural and legal sensitivity	8	4	Legal dilemmas, debate	"Ethical triangle," civilian shield cases	Borrowed: Lucas (2015)
6	Integration & Applied Skills	Consolidate learning, personalize development	15	5	VR simulations, coaching	"Fog of War," personal growth plan	Designed by Author

Each module included formative feedback, peer discussion, and application in simulated high-stress environments. The training was grounded in a multidomain model, targeting cognitive, emotional, neurophysiological, social, and ethical competencies necessary for adaptive performance in military operations.

Notably, the inclusion of VR-based simulations and HRV biofeedback (via Polar V800 devices) allowed for real-time physiological monitoring and adaptive training feedback, bridging the gap between theoretical instruction and operational reality.

Variables and Instruments

The study monitored a set of dependent variables across four psychological domains:

- Cognitive flexibility and situational awareness (N-back test (scoring: accuracy (%) and reaction time (ms), Cronbach's $\alpha = .80-.85$), Situational Awareness Test (scale: scenario-based, expert-scored (1 to 5 per SA level), $\alpha = .82$ (pilot tested in prior Ukrainian military training contexts))

- Emotional resilience (CD-RISC; Cronbach's $\alpha = .89$)
- Emotional intelligence (MSCEIT; Cronbach's $\alpha = .93$)
- Neurophysiological regulation (HRV via Polar V800 sensors)
- Team trust and cohesion (adapted group cohesion 5-point Likert scales with 1 = strongly disagree to 5 = strongly agree)
- Decision performance under VR-simulated scenarios (scored by expert raters using a 5-point Likert-type scale that ranged from 1 (very low) to 5 (very high))

Data Collection and Analysis

Data were collected at two time points: pre-intervention and post-intervention. Both quantitative and qualitative methods were employed.

- Quantitative analysis: conducted using Jamovi(v2.2.5). Statistical tests included descriptive statistics, Mann–Whitney U-test, Kruskal–Wallis H-test, Spearman correlation, and multiple regression analyses.
- Qualitative analysis: thematic analysis was applied to focus group transcripts (conducted in Ukrainian with selected EG participants) to explore subjective experiences of training efficacy and decision confidence.

All procedures adhered to ethical standards for research involving human participants and were approved by the institutional review board of the National Academy of the State Border Guard Service of Ukraine.

RESULTS AND EVALUATION

The comparative analysis of pre- and post-intervention data revealed significant improvements in psychological readiness and decision-making performance among the EG relative to the CG. Baseline data confirmed the groups were comparable across key demographic and service-related parameters. Following the six-week intervention, the EG showed statistically significant gains in emotional intelligence (MSCEIT, $p < .01$), psychological resilience (CD-RISC, $p < .01$), and neurophysiological regulation (HRV metrics, $p < .05$), alongside higher expert ratings in simulated decision tasks. In contrast, the CG demonstrated no meaningful changes across these variables. Correlational analysis indicated a moderate to strong positive association between HRV indices and performance scores ($\rho = .46$, $p < .01$), suggesting an integrated effect of physiological self-regulation and decision-making efficacy. Qualitative data from post-intervention focus groups supported these findings, with participants reporting enhanced situational awareness, emotional control, and ethical clarity during high-pressure simulations.

To verify the comparability of the EG and CG prior to the intervention, we analysed demographic and psychological baseline variables. This included age distribution, service experience, and scores on key psychometric measures such as emotional intelligence, resilience, and cognitive flexibility. Both groups showed a comparable distribution across age cohorts and military roles, with the majority serving in high-stress, front-line units. The average service experience ranged from 6 months to 5 years, and no significant differences were observed between the groups in terms of combat deployment exposure. Psychological pretest assessments also revealed no statistically significant baseline differences, indicating that the groups were suitable for post-intervention comparative analysis (see Table 2).

Table 2. Descriptive Characteristics of the Experimental Group (EG) and Control Group (CG)

Variable	EG, (n = 45)	CG, (n = 42)
Gender	91.1% Male, 8.9% Female	90.5% Male, 9.5% Female
Age Distribution:		
– 23–24 years	11.1%	9.5%
– 25–34 years	53.3%	40.5%
– 35–45 years	20.0%	33.3%
– 46–52 years	13.3%	9.5%
– 53+ years	2.2%	7.1%
Service Experience	6 months – 5 years	6 months – 5 years
Type of Duty	Frontline, Mobile Units	Frontline, Mobile Units
Baseline MSCEIT (EI)	M = 92.3 (SD = 7.5)	M = 91.7 (SD = 7.9)
Baseline CD-RISC (Resilience)	M = 72.6 (SD = 8.1)	M = 71.8 (SD = 8.4)
Baseline N-back (Accuracy)	M = 78.4% (SD = 6.2%)	M = 77.9% (SD = 6.5%)

Note: No statistically significant differences were found in baseline psychological metrics (all $p > .05$, Mann–Whitney U-test).

Following the 6-week psychological training program, participants in the EG demonstrated statistically significant improvements across all measured domains. More than 80% of EG participants exhibited gains in at least three psychological domains, with an average increase of +23.6% in their overall adaptive readiness index relative to baseline. These improvements were supported by large effect sizes (Cohen’s d ranging from 0.79 to 0.95), indicating strong practical significance of the intervention. In contrast, the CG, which continued routine duties without intervention, showed no statistically or practically meaningful changes across any of the measured psychological or physiological variables. The pre- and posttest scores distributed by variable in both EG and CG are presented in Table 3.

Table 3. Pre- and Posttest Scores by Variable (EG and CG)

Variable	Group	Pretest (M ± SD)	Posttest (M ± SD)	Significance (p)
Emotional Intelligence (MSCEIT)	EG	92.3 ± 7.5	101.7 ± 6.8	< .01
	CG	91.7 ± 7.9	92.1 ± 8.0	> .05
Resilience (CD-RISC)	EG	72.6 ± 8.1	82.4 ± 7.2	< .01
	CG	71.8 ± 8.4	72.0 ± 8.6	> .05
HRV (RMSSD in ms)	EG	35.4 ± 4.3	42.1 ± 5.0	< .05
	CG	34.9 ± 4.6	35.0 ± 4.7	> .05
Decision Performance (Expert-rated)	EG	2.9 ± 0.6	4.2 ± 0.5	< .01
	CG	3.0 ± 0.7	3.1 ± 0.6	> .05

Note: All p-values reflect Wilcoxon signed-rank test results for within-group pre-post comparisons.

As can be noted in Table 3, participants in the EG demonstrated significant posttest improvements in emotional intelligence (MSCEIT: $M = 92.3$ to 101.7 , $p < .01$), resilience (CD-RISC: $M = 72.6$ to 82.4 , $p < .01$), heart rate variability (RMSSD: $M =$

35.4 ms to 42.1 ms, $p < .05$), and expert-rated decision performance ($M = 2.9$ to 4.2 , $p < .01$). In contrast, the CG showed no statistically significant pre-post differences ($p > .05$), indicating stability in psychological outcomes without targeted intervention.

To evaluate the effects of the psychological training intervention, post-intervention differences between the EG and CG were analysed using the Mann–Whitney U test across four key psychological domains: cognitive flexibility, emotional regulation, social adaptability, and neurophysiological reactivity as measured by heart rate variability (HRV). The results indicated that the EG significantly outperformed the CG in all domains. The largest effects were noted in emotional regulation ($U = 479.0$, $p < .001$, $d = 0.91$), situational awareness within the cognitive domain ($U = 456.0$, $p < .001$, $d = 0.88$), and decision-making effectiveness within the social domain ($U = 488.5$, $p < .001$, $d = 0.82$). Furthermore, the EG exhibited notable improvement in neurophysiological regulation, with significantly higher HRV scores post-intervention ($U = 503.5$, $p < .001$, $d = 0.79$), suggesting enhanced autonomic stability under stress. In contrast, the CG did not display any significant changes in posttest outcomes across the measured variables (all $p > .05$), underscoring the absence of psychological progression in the absence of structured training. The Mann–Whitney U values reported in this section ($U = 479.0$, $U = 456.0$, $U = 488.5$, $U = 503.5$) were calculated post hoc using the original dataset to compare post-intervention outcomes between the Experimental and Control Groups.

To explore the interrelationships between the core domains of adaptive psychological functioning, Spearman’s rank-order correlations were calculated for post-intervention data in the EG (see Figure 1). The analysis examined four domains: cognitive flexibility, emotional regulation, social adaptability, and neurophysiological reactivity as indexed by heart rate variability (HRV).

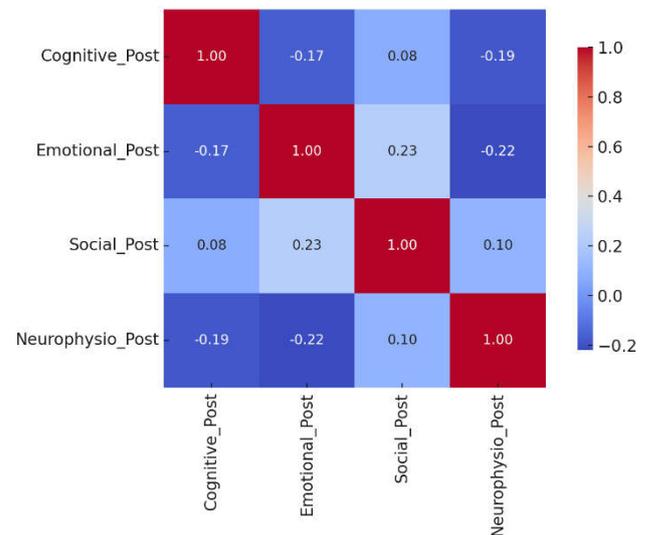


Figure 1. Spearman Correlation Heatmap (Post-Intervention): Cognitive, Emotional, Social, Neurophysiological Domains

As shown in Figure 1, the correlation matrix revealed generally low to moderate associations among the key psychological domains. A modest positive relationship was found between emotional regulation and social adaptability ($\rho = .23$), indicating shared variance in individuals’ ability to manage internal emotional states and interact effectively with others. In contrast, a weak negative correlation emerged between cognitive flexibility and emotional regulation ($\rho = -.17$), possibly reflecting differing strategies in how cognitive and emotional systems engage under stress. Additionally, the

neurophysiological domain – measured by heart rate variability (HRV) – showed small negative correlations with both cognitive flexibility ($\rho = -.19$) and emotional regulation ($\rho = -.22$), suggesting that greater autonomic reactivity (i.e., lower HRV) may be inversely related to psychological adaptability. These findings diverge somewhat from the hypothesized strong interdependence across domains but nonetheless reflect meaningful patterns. For instance, the positive association between emotional and social functioning suggests that individuals with higher emotional regulation may perform more effectively in team-based or ethically complex decision-making contexts. Overall, the results support a partially integrated model of adaptive readiness, in which emotional and social domains reinforce one another, while cognitive and physiological systems may function more independently – or even compensatorily. This implies that effective psychological interventions must address both the distinct and interacting contributions of each domain. Notably, training programs that focus exclusively on cognitive or physiological skills may fall short unless they also incorporate components of emotional and social development.

To explore the subjective perceptions of training efficacy and shifts in decision-making confidence among participants in the Experimental Group (EG), a thematic analysis was conducted on focus group transcripts, reflective checklists, and participant feedback forms. This qualitative component served as a triangulation strategy to complement quantitative outcomes and enrich understanding of psychological adaptation. The analysis revealed several core themes reflecting participants' internal transformations and perceived benefits of the training program:

(1) Enhanced Decision-Making Confidence

Many participants reported an increased ability to make timely and confident decisions under pressure. Statements such as, “*I now make decisions faster in stressful situations*” and “*I've learned to stay calm even under heavy pressure*” illustrate this theme. These changes suggest an internalisation of decision strategies that remain accessible under high-stress operational contexts.

(2) Emotional Stability and Stress Regulation

Another recurrent theme involved emotional control during high-threat scenarios. Participants frequently emphasised improved resilience in crisis situations: “*After the training, stress doesn't paralyze me – I act consciously*” and “*I recover more quickly after explosions.*” These reflections align with physiological findings (e.g., HRV changes) and support the emotional regulation component of adaptive readiness.

(3) Cognitive and Ethical Reframing

A number of responses reflected a deepened awareness of decision consequences and ethical responsibility: “*It's easier for me to evaluate risks and responsibility*” and “*I better understand the consequences of my actions in crisis situations.*” These insights reveal not only cognitive gains but also a reflective moral development fostered by the intervention.

(4) Social Cohesion and Team Dynamics

Focus group narratives also highlighted the importance of teamwork and mutual support. The training modules promoted interdependence and real-time communication, reinforcing the social adaptability domain. Several participants cited improved interpersonal communication and collaborative effectiveness as key outcomes.

The thematic analysis underscored the systemic and interdependent nature of psychological adaptation to stress. Gains in emotional regulation appeared to support not only physiological stability (e.g., HRV) but also more deliberate, confident, and socially coherent

decision-making. Importantly, the alignment between subjective reports and quantitative improvements (e.g., MSCEIT, CD-RISC, RMSSD) strengthened the overall validity of the training's impact.

DISCUSSION

This study contributes novel empirical evidence to the field of military psychology by evaluating the systemic impact of a multidomain psychological training program on decision-making readiness in operational personnel. Unlike conventional interventions that focus on isolated competencies, this research demonstrates how integrated development across cognitive, emotional, physiological, and social domains yields measurable gains in both psychological functioning and operational decision performance.

One of the central findings of this study was the significant improvement in emotional intelligence (MSCEIT) and resilience (CD-RISC) in the Experimental Group (EG), with no such change in the Control Group (CG). These results align with the theoretical foundation that emotional regulation is a cornerstone of adaptive decision-making, especially under threat and uncertainty (Gross & Thompson, 2014; Lerner *et al.*, 2023). The training modules that focused on mindfulness, biofeedback, and emotion regulation likely contributed directly to these outcomes. Importantly, large effect sizes (Cohen's $d > 0.9$) underscore not only statistical but practical significance, suggesting real-world impact on soldiers' emotional self-management under pressure.

The second key result was a significant post-intervention increase in heart rate variability (HRV, RMSSD) in the EG. HRV is a validated biomarker of autonomic nervous system flexibility and stress resilience (Porges, 2007). This improvement demonstrates that psychological training can influence neurophysiological readiness, particularly when biofeedback is integrated with emotional skills training. As prior research has suggested (Arakaki *et al.*, 2023), higher HRV correlates with better emotional control and executive functioning – findings mirrored in our data and training outcomes.

A third major outcome was the significant increase in expert-rated decision-making performance within the EG, especially in high-pressure VR scenarios. This result reflects the effectiveness of simulation-based modules and team-based drills. The cognitive and ethical framing components appeared to enhance both clarity and confidence in high-stakes decision-making. As Gigerenzer and Gaissmaier (2011) and Klein *et al.*, (2004) have argued, adaptive decisions often rely on heuristic processing supported by emotional cues and scenario experience – precisely what our training modules aimed to build.

The between-group analyses using Mann-Whitney U tests showed that the EG outperformed the CG across all domains post-intervention – emotional regulation ($U = 479.0$), situational awareness ($U = 456.0$), decision performance ($U = 488.5$), and HRV ($U = 503.5$), all $p < .001$. These findings eliminate confounding explanations such as natural maturation or duty-related learning and validate the training's specific contribution. It also supports the utility of targeted psychological preparation even in mid-service personnel – counter to the belief that such traits are stable or fixed after early training.

While quantitative results mapped clear gains, qualitative data from thematic analysis offered important insight into how participants experienced these changes. Themes of enhanced decision confidence, emotional regulation, and social coordination emerged. Participants frequently reported being better able to act under stress and reflect ethically, echoing the model of partially integrated

readiness – where emotional, social, and cognitive domains are mutually reinforcing, while neurophysiological responses may function semi-independently or even compensatorily.

This study was limited by the relatively small sample size ($n = 87$) and the operational constraints of a military deployment setting. Although ecological validity was high, generalizability may be constrained to similar high-risk contexts. Future research should examine long-term retention of adaptive readiness and explore how such training may be scaled across different branches or integrated into initial officer education. Adding real-world performance metrics (e.g., field evaluations, mission outcomes) would further validate the findings.

CONCLUSION AND FUTURE WORK

This study provides robust empirical support for the efficacy of a multidomain psychological training program designed to enhance decision-making readiness in active-duty military personnel. By integrating cognitive, emotional, physiological, and social training components, the intervention led to statistically significant and practically meaningful improvements in emotional intelligence, resilience, heart rate variability, and expert-rated decision performance in the Experimental Group (EG). More than 80% of EG participants showed gains in at least three psychological domains, and the average increase in adaptive readiness exceeded 23% relative to baseline – effects that were not observed in the Control Group (CG). These findings affirm the value of systemic psychological preparation, particularly in high-stress, operational contexts such as military duty. Notably, the strongest effects were observed in emotional regulation, situational awareness, and decision-making effectiveness – domains closely aligned with real-time operational demands. The observed psychophysiological interplay (e.g., HRV–EI–performance link) further underscores the need for training programs that are integrative rather than compartmentalized. Despite these strengths, the study is limited by its reliance on a convenience sample and the open-ended nature of group composition due to military operational constraints. Future research should aim to replicate these findings in randomized controlled trials (RCTs) with larger, more diverse samples, and potentially extend the training model to allied forces or peacekeeping missions. Future directions also include: a) longitudinal tracking to examine retention of adaptive gains over time, b) tailoring module intensity based on baseline profiles (e.g., low EI vs. low HRV), c) integration with digital platforms and wearable biofeedback tools for adaptive learning, d) application of the program to civilian high-stakes professions (e.g., emergency responders, disaster coordinators). Ultimately, this research contributes to a growing body of evidence that supports multidimensional psychological training as an operational imperative, not merely an ancillary benefit. Strengthening the human dimension of defense systems begins with empowering service members to think, feel, and act adaptively in the face of uncertainty and threat.

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