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POLISH VALIDATION OF TWO MEASURES OF SOLDIERS' STRESSFUL EXPERIENCES: THE COMBAT EXPOSURE SCALE AND THE DIFFICULT LIVING AND WORKING ENVIRONMENT

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This study aimed to validate two questionnaires, the Combat Exposure Scale (CES) and the Difficult Living and Working Environment (DLWE), for Polish soldiers deployed during the Resolute Support Mission (RSM) in Afghanistan. A prospective cross-sectional study was conducted twice during the final peacekeeping mission in Afghanistan, at the beginning and the end of the 2021 deployment. The Polish Military Contingent consisted of 71 soldiers, ranging in age from 26 to 50 (M = 38.75, SD = 6.45). Construct validity was examined using confirmatory factor analysis (CFA), while criterion validity was assessed using Pearson's correlations with symptoms of post-traumatic stress disorder, depression and anxiety symptoms, self-rated physical health, and life satisfaction, and also using the repeated measures of Student's t-test. The structure of both scales presented an adequate fit to the data for a one-factor model, strong internal consistency, test-retest stability, appropriate psychometric properties, and criterion validity. The CES and DLWE correlated positively with symptoms of PTSD, depression and anxiety, and negatively with physical health and life satisfaction. Both the CES and the DLWE can be used as reliable and valid tools to monitor risk factors for soldiers' adverse physical and mental health during military missions.

Keywords: combat exposure; difficult living environment; peacekeeping mission in Afghanistan; Polish Military Contingent; post-traumatic stress disorder (PTSD)

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Environmental Condition and Combat Stressors During Military Employment

The impact of environmental conditions on military personnel is a critical area of concern, affecting both physical and mental health, psychological well-being, and operational effectiveness. Military service exposes personnel to various environmental challenges, such as extreme temperatures, pollutants, and physical demands (Bradburne & Lewis, 2018; Geretto et al., 2021; Nindl et al., 2013; Van De Graaff & Poole, 2022). Physiological responses to these environmental stressors can impact military personnel's function and fitness components (Shamsi et al., 2020). Deployment stressors also include various categories, such as exposure to the dead and injured, dangerous environments, active combat, personal suffering, and perceived responsibility (Carvalho et al., 2014, 2015; Sudom et al., 2016). These stressors showed direct exposure to warfare and its mental health consequences among individuals who have served in both combat and non-combat roles (Bovin et al., 2023). The severity of combat exposure in war veterans demonstrates adverse mental health outcomes associated with combat experiences (Carvalho et al., 2014; Sudom et al., 2019). In particular, emotional distress results from exposure to military combat scenarios (Carvalho et al., 2015).

The relationship between occupational and environmental exposures and incident post-deployment mental health conditions has been previously examined, with demographic factors and unique exposures in the deployed environment being associated with mental health conditions (Maupin et al., 2018). The severity and duration of exposure to environmental stressors can affect cognitive performance, with strategies such as acclimatization and habituation being suggested to improve cognitive performance in extreme environmental conditions (Maupin et al., 2018). Furthermore, extreme environmental conditions during deployment and exposure to hazards like burn pits and chemicals may lead to physiological responses such as nutritional and sleep disorders or increased mental stress (Nindl et al., 2013; Shamsi et al., 2020; Van De Graaff & Poole, 2022).

Impact of Combat Exposure on Physical and Mental Health and Well-Being

Combat exposure is associated with adverse health outcomes, including chronic disease diagnoses, sleep disturbances, and poorer physical health functioning (Carvalho et al., 2014; Howard et al., 2020; Maia & Morgado, 2022; Osgood et al., 2019; Porter et al., 2018; Reger et al., 2019; Schnittker, 2018). Also, several risky health behaviors are determined by combat experiences, including cigarette consumption, binge drinking, and drug use (Cesur et al., 2016; Osgood et al., 2019; Porter et al., 2018). Overall, combat exposure may negatively affect subjective well-being (Blackburn & Owens, 2015; Carr et al., 2019; Lee et al., 2022).

Furthermore, combat experiences are linked to increased mental health problems among military personnel, including increased symptoms of post-traumatic stress disorder (PTSD), depression, and anxiety (Armstrong et al., 2014; Bryan et al., 2013; Campbell et al., 2021; Kelber et al., 2019; Sudom et al., 2016, 2019; Tracie Shea et al., 2017). Studies have shown that especially such combat exposures as fighting, killing, threat to oneself, death/injury of others, and killing noncombatants are associated with adverse health outcomes (Carvalho et al., 2014, 2015; Guyker et al., 2013; Kelber et al., 2019; Porter et al., 2018; Ranes et al., 2017; Rivera et al., 2022; Schnittker, 2018; Sudom et al., 2016, 2019).

Research has identified distinct classes of combat experiences, such as limited exposure, medical exposure, unit exposure, and personal exposure, each associated with different mental health profiles (Kelber et al., 2019). Different types of combat exposure can impact the development of various symptoms of distress (Tracie Shea et al., 2017). Exposure to personal life threats predicts symptoms of hyperarousal, while exposure to death or severe injury of others predicts symptoms of depression (Tracie Shea et al., 2017). In addition, greater exposure to violent combat was predictive of re-experiencing and numbing symptoms, while proximity to wounding or death experiences were predictive of re-experiencing and anxious-arousal symptoms (Osório et al., 2018). Various types of combat trauma, such as personal life threats and exposure to death or severe injury of others, are associated with specific PTSD symptom clusters (Tracie Shea et al., 2017). However, active combat experiences, such as shooting or directing fire at the enemy, were associated with lower PTSD symptoms

(Britt et al., 2017). Therefore, for clinical purposes, it is crucial to measure different combat experiences during military deployment.

Tools for Assessing Soldiers' Stressful Experiences

The Combat Exposure Scale (CES), developed during the war in Vietnam (Keane et al., 1989; Lund et al., 1984), is one of the most frequently used tools to assess combat-related stressors (Baker et al., 2009; Sternke, 2011). The scale assesses such stereotypical war-zone stressors and events as going on special missions or patrols, firing weapons and receiving enemy fire, seeing atrocities or abusive violence, injured or dead soldiers (Fontana & Rosenheck, 1999; King et al., 1998; King et al., 1999). The 5-point response scale describes experience severity, frequency, and duration. The CES demonstrates a one-factor structure by using principal component analysis (PCA), which accounted for 57.6% of the common variance among the seven items (Keane et al., 1989). The CES also showed good psychometric properties, including internal stability (Cronbach's $\alpha = 0.85$, average correlation $r = 0.75$) and test-retest reliability with a one-week interval ($r = 0.97$, $p < 0.001$; Keane et al., 1989).

The CES has been translated and validated for Korean (Kim et al., 2013) and Spanish-speaking samples (Rivera-Rivera et al., 2022). In both studies (Kim et al., 2013; Rivera-Rivera et al., 2022), a one-factor structure was confirmed, as well as high internal consistency (Cronbach's $\alpha = 0.85$ in Korean and $\alpha = 0.84$ in Spanish samples), and a test-retest reliability ($r_{tr} = 0.94$ in both studies). Furthermore, veterans with a diagnosis of post-traumatic stress disorder (PTSD) scored significantly higher than their counterparts without PTSD in combat exposure (Groer et al., 2014; Keane et al., 1989; Kim et al., 2013; Lund et al., 1984). In addition, positive correlations were found between CES and PTSD symptoms in Ukrainian military personnel who participated in the armed conflict in eastern Ukraine (Kokun et al., 2020). Also, self-reported combat trauma exposure was positively related to injury during combat (Baker et al., 2009). The scale is unrelated to a specific war conflict, which can be regarded as a limitation of this tool (Sternke, 2011).

The Difficult Living and Working Environment (DLWE) is another crucial tool for measuring exposure to malevolent environments, such as daily discomforts resulting from the heat and poor living facilities, experienced by military personnel as particularly bothersome, annoying, or

uncomfortable (King et al., 1998; King et al., 1999). The DLWE is one of several scales of the revised second version of the Deployment Risk and Resilience Inventory (DRRI-2), developed to assess various factors that affected the mental health of soldiers and veterans during deployment (Vogt et al., 2013). The DRRI scales were validated in several studies (Vogt et al., 2008; Vogt et al., 2013), showing good parametric properties and internal consistency. In a more recent study performed in Israel, Cronbach's α (ranging from 0.90 to 0.91) and high test-retest reliability were also adequate (Maoz et al., 2016). However, difficult living conditions were unrelated to physical and mental health, as well as to symptoms of depression, anxiety, and PTSD among Israeli war veterans (Maoz et al., 2016). The DLWE was also translated into Portuguese and validated in the sample of colonial war veterans (Carvalho et al., 2011). A single-factor solution was confirmed using PCA, with Cronbach's $\alpha = 0.91$, item-total correlations ranging between 0.35–0.71, and high test-retest reliability. Furthermore, significant and positive correlations were found between the DLWE and symptoms of PTSD, depression, anxiety, and stress (Carvalho et al., 2011). Also, in the French-Canadian version of the DRRI, the DLWE showed appropriate parametric properties among a sample of Canadian veterans, with Cronbach's α ranging between 0.87 and 0.88 and a high test-retest correlation (Fikretoglu et al., 2006). The DLWE correlated positively with symptoms of depression, anxiety, and PTSD in the Canadian study (Fikretoglu et al., 2006). Furthermore, negative correlations were also found between DLWE and all dimensions of somatic health, including physical functioning, role limitations due to physical functioning, bodily pain, general health perception, vitality, social functioning, role limitations due to emotional problems, and general mental health (Fikretoglu et al., 2006).

The Present Study

Previous research has shown that exposure to combat and difficult living conditions during deployment are significant risk factors for the physical and mental health and well-being of soldiers and veterans, which is of paramount importance to clinical psychology. However, there are few tools for measuring combat exposure and environmental factors on military missions. In particular, there is a lack of proven tools for measuring combat exposure and environmental risk factors in the Polish cultural

context. However, Poland is a member of NATO, and Polish soldiers are deployed with troops from other countries, including the US Army, in various war zones, including Iraq and Afghanistan. Furthermore, across the Polish border, in neighboring Ukraine, there is currently a war being waged, sparked by the Russian invasion. There is a real threat that this war will spread to other countries, and Poland is in the direct danger zone. The present study aims to fill this research gap through the validation and adaptation of the self-reported questionnaires, measuring combat and environmental exposure in a sample of Polish soldiers participating in the military mission in Afghanistan.

Available tools for measuring combat exposure were developed and validated in English and are usually used by the US military. In the present study, two scales, CES and DLWE, will be adapted and validated in this study among Polish soldiers during the final Resolute Support Mission (RSM) in Afghanistan. The following hypotheses will be verified in this study based on previous studies:

H1. The Combat Exposure Scale (CES) has good fit indices for the one-factor model and good parametric properties in Polish adaptation.
H2. The Difficult Living and Working Environment (DLWE) questionnaire demonstrates appropriate fit indices for one-factor structure and good parametric properties in Polish adaptation.
H3. Higher scores in both scales, CES and DLWE, are related to the following variables among Polish soldiers during the deployment to the final peacekeeping mission in Afghanistan:
- H3.1 Higher symptoms of mental disorders, including PTSD, depression, and anxiety
- H3.2 Poorer self-reported physical health
- H3.3 Lower levels of life satisfaction.

METHOD

Study Design and Procedure

A prospective cross-sectional study was conducted twice during the final peacekeeping mission in Afghanistan. The first assessment (T1) took place in February 2021, one month after soldiers arrived at the base in

Ghazni, Afghanistan. The second assessment was in June 2021, before their return to Poland. The Polish Military Contingent includes members from various units, such as the 10th Opole Logistics Brigade. The mission commander and deputy informed soldiers about the study's purpose and distributed paper-and-pencil questionnaires. Soldiers were briefed on anonymity and provided informed consent. They were instructed to complete the questionnaire within a day, at their convenience, and submit it in a sealed envelope to a designated box the next day. Participants used a code (birthday, birth month, first letters of mother's and father's names) to maintain anonymity and link their T1 and T2 surveys. The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (No 05/2021, January 10, 2021). Informed consent was obtained from all subjects involved in the study.

Before data collection began, a power analysis was performed using G*Power ver. 3.1.9.7 software to determine the minimum sample size needed to obtain sufficient power to detect an effect (Faul et al., 2007). A power analysis indicated that the minimum sample size to yield a statistical power of at least 0.80 with an alpha of 0.05 and a medium effect size (d = 0.5) is 27 people for a one-tailed paired-sample t-test and 67 participants for a one-tailed correlation analysis, assuming a statistical power of at least 0.80 with an alpha of 0.05 and a medium effect size (r = 0.3). A ratio of 5:1 (cases for each estimated parameter) was used to determine the sample size for confirmatory factor analysis (CFA) (Bentler & Chou, 1987; Bollen, 1989; Tanaka, 1987). Considering that the CES is consistent with 7 items and the DLWE includes 14 items, a minimum number of 70 subjects is required for the present study.

Translation Process

The Combat Exposure Scale (CES) and the Difficult Living and Working Environment (DLWE) were translated following standard guidelines (Beaton et al., 2000). Initially, both a psychologist and an English philologist independently translated the questionnaires from English to Polish. These translations were compared to identify and correct discrepancies. In the second stage, any linguistic misunderstandings were resolved, and a consistent Polish version was developed. Another English philologist performed a back-translation from Polish to English in the third stage. Subsequently, all experts (the psychologist and two English specialists)

reviewed the translations and back-translations, comparing them with the original to resolve discrepancies and finalize the version. Finally, a pilot study was conducted with twenty fifth-year psychology students who completed the CES and DLWE in Polish, noting any issues with comprehensibility and linguistic accuracy. Minor language errors identified were corrected in the final version used in the current study (see Supplemental Materials).

Measures

Combat Exposure

The Combat Exposure Scale (CES) was developed to assess wartime stressors experienced by combatants and veterans (Keane et al., 1989a, 1989b). The CES is a 7-item self-report measure (e.g., "Did you ever go on combat patrols or have other dangerous duty?"), with responses rated on a 5-point Likert scale, indicating the frequency of given experiences during the lifespan (from 1 = *No* or *Never* to 5 = *More than 50 times*) and its duration (from 1 = *Never* to 5 = *More than 6 months*). Respondents describe their exposure to various combat situations, such as firing rounds at the enemy and being on dangerous duty with a risk of attack, injury, or death. The total CES score (ranging from 0 to 35) is calculated by using a sum of weighted scores. The result indicates the extent to which the subject was exposed to combat. The result indicates the extent to which the subject was exposed to combat. In this study, Cronbach's α for the CES was 0.84 at T1 and 0.87 at T2.

Deployment Environment

The Difficult Living and Working Environment (DLWE) was developed by staff at the VA's National Center for PTSD (Vogt et al., 2012a, 2012b, 2013). The DLWE is one of a set of questionnaires included in the Deployment Risk and Resilience Inventory-2 (DRRI-2), in section C, which belongs to the risk factors during a military mission (Vogt et al., 2013). The DLWE contains 14 statements describing individuals' exposure to day-to-day irritations and pressures that arise from military deployment, such as the absence of desirable food, inadequate privacy, substandard living conditions, uncomfortable climate, cultural obstacles, and

limitations on fulfilling soldiers duty (e.g., "During deployment… I didn't have access to bathrooms or showers when I needed them"). Respondents use a 5-point Likert response scale to assess the frequency of a given difficulty experienced during the deployment (from 1 = *Almost none of the time* to 5 = *Almost all of the time*). The scores are summarized (ranging from 14 to 70), and higher scores indicate more difficult living conditions for the soldier and a burdensome work environment. The scores are summarized (ranging from 14 to 70), and higher scores indicate more difficult living conditions for the soldier and a burdensome work environment. In this study, Cronbach's α for the DLWE was 0.84 at T1 and 0.88 at T2.

Post-Traumatic Stress Disorder

The PTSD Checklist (PCL) is a self-reported questionnaire developed to assess PTSD symptoms based on the Diagnostic and Statistical Manual of Mental Disorders (Ogińska-Bulik & Juczyński, 2023; Weathers et al., 1999). The abbreviated 6-item PTSD Checklist (PCL-6), used in the present study, consists of items 1, 4, 7, 10, 14, and 15 of the PCL and can be used in primary care or other healthcare settings, including military environments (Lang et al., 2012; Lang & Stein, 2005). The respondent rated on a five-point Likert scale (from 1 = *Not at all* to 5 = *Extremely*) the frequency of experienced PTSD symptoms during the past month (e.g., "Repeated, disturbing memories, thoughts, or images of a stressful experience from the past?"). The Polish version of the PCL was validated and shows strong test-retest reliability and high internal consistency, with Cronbach's α of 0.95 (Ogińska-Bulik & Juczyński, 2023). The Cronbach's α for the PCL-6 in this study was 0.88 at T1 and 0.85 at T2.

Depression

The 9-item Patient Health Questionnaire (PHQ-9) was developed (Kroenke et al., 2001, 2010; Ślusarska et al., 2019) to assess depression symptoms (e.g., "Feeling down, depressed, or hopeless"). Respondents rate, on a 4-point Likert scale (from 0 = *Not at all* to 3 = *Nearly every day*), how frequently a given problem bothered them during the last two weeks. A Polish validation study (Ślusarska et al., 2019) showed that the PHQ-9 is characterized by a one-dimensional structure, good construct

validity and high internal consistency, with Cronbach's alpha coefficients of 0.77. The internal consistency in the present study was Cronbach's α = 0.75 at T1 and 0.76 at T2.

Anxiety

The 7-item Generalized Anxiety Disorder (GAD-7) scale was developed (Basińska & Kwissa-Gajewska, 2023; Spitzer et al., 2006) to assess anxiety symptoms (e.g., "Not being able to stop or control worrying"). Respondents rate on a 4-point scale (from 0 = *Not at all* to 3 = *Nearly every day*) how often they experienced anxiety symptoms during the last two weeks. The higher the score, the more severe the anxiety symptoms (ranging from 0 to 21). A study to validate the Polish version of the GAD-7 among a non-clinical sample of employees during the COVID-19 pandemic demonstrated strong psychometric properties, including high internal consistency (Cronbach's α = 0.83), good construct validity, and measurement invariance across gender and age groups. The Cronbach's α for the GAD-7 in this research was 0.83 at T1 and 0.98 at T2.

Health

The General Self-Rated Health (GSRH) was measured using two single-item questions (DeSalvo et al., 2005, 2006; Piłat et al., 2019). The first question, GSRH-1, relates to an overall assessment of physical health ("In general, would you say your health is…?"), while the second GSRH-2 assesses physical health compared to other people of the same age ("Compared to others your age, would you say your health is…?). Both GSRH items are rated on a 5-point Likert scale (from 1 = *Excellent* to 5 = *Poor*). Therefore, higher scores denote worse health status. The GSRH has demonstrated good psychometric properties in the Polish population and is a reliable and valid tool that covers a wide range of health-related factors, making it useful in public health research and interventions (Piłat et al., 2019). The Cronbach's α coefficient for the GSRH in this study was 0.82 at T1 and 0.88 at T2.

Life Satisfaction

The 5-item Satisfaction With Life Scale (SWLS) was developed (Diener & Diener, 1995; Diener et al., 1985; Jankowski, 2015) to assess the global cognitive aspect of subjective well-being (e.g., "The conditions of my life are excellent"). Respondents rate on a 7-point response scale (from 1 = *Strongly disagree* to 5 = *Strongly agree*) how much a given sentence is consistent with their life. The total scores (ranging from 5 to 35) are a sum of all items, and higher scores suggest higher levels of life satisfaction. The Polish version of the SWLS is a reliable and valid tool for assessing life satisfaction in the Polish population, characterized by high internal consistency (Cronbach's alpha = 0.86) and test-retest reliability (in the range of 0.85–0.93 at 3-week intervals; 0.87–0.88 at 6-week intervals and 0.86 at 9-week intervals). The reliability of SWLS in this study was Cronbach's $\alpha = 0.87$ at T1 and 0.87 at T2.

Demographic Survey

The demographic characteristic of the sample was assessed using several questions, including code (day of birth, month of birth, first letter of mother's and father's name), gender (female, male), age, education (secondary, vocational, bachelor's, master's or higher), place of residence (village, town up to 5,000 inhabitants, city of 6,000–20,000, city of 21,000–50,000, city of 51,000–100,000, or city of over 100 thousand inhabitants), relationship status (single, in an informal relationship, in a registered union), religious identification (religiously unaffiliated, Roman Catholic, Eastern Orthodox, Protestant, other religion), number of children, experience in military service (total number of all years in military service), military rank (private, senior private, corporal, senior corporal, sergeant, sergeant major, junior warrant officer, warrant officer, senior warrant officer, senior staff warrant officer, second lieutenant, first lieutenant, captain, major, lieutenant colonel, colonel, brigadier general, division general, lieutenant general, army general), number of military missions completed (Iraq, Afghanistan, other missions), and the total number of months spent on all military missions.

Participants' Characteristics

The study involved 71 soldiers, including 67 men and 4 women (Table 1). The average age of participants was 38 years old (ranging from 26 to 50, $M = 38.75$, $SD = 6.45$). The vast majority of the respondents were married, and they had one child on average (ranging from 0 to 3 children, $M = 1.18$, $SD = 0.95$). Secondary education and living in the village prevailed among soldiers. Most participants identified with the Roman Catholic religion. The average length of military service was 16 years, and soldiers completed two previous military missions on average, spending 14 months on average.

Table 1
Participant Characteristics (N = 71)

Variable	Categories	*n*	%
Age	26–50 (*M, SD*)	38.75	6.45
Gender	Men	67	94.4
	Women	4	5.6
Education	Secondary education	43	60.6
	Bachelor's degree	3	4.2
	Master's degree or higher	25	35.2
Place of residence	Village	21	29.6
	Town: < 5,000	5	7.0
	City: 6,000–20,000	8	11.3
	City: 21,000–50,000	15	21.1
	City: 51,000–100,000	8	11.3
	City: > 100,000	14	19.7
Relationship status	Single	11	15.5
	In relationship	9	12.7
	Married	51	71.8
Identification with religion	Religiously unaffiliated	8	11.3
	Roman Catholic	62	87.3
	Protestant	1	1.4
No. of children	0–3 (*M, SD*)	1.18	0.95
Military service (years)	3–28 (*M, SD*)	16.32	6.88
Soldier ranks	private soldier	2	2.8
	senior private	13	18.3

	corporal	3	4.2
	senior corporal	2	2.8
	platoon sergeant	5	7.0
	sergeant	8	11.3
	senior sergeant	5	7.0
	junior warrant officer	3	4.2
	warrant officer	1	1.4
	senior warrant officer	2	2.8
	senior staff warrant officer	8	11.3
	second lieutenant	3	4.2
	lieutenant	5	7.0
	captain	5	7.0
	senior captain	1	1.4
	major	2	2.8
	lieutenant colonel	3	4.2
Previous military missions	0–8 (*M, SD*)	2.49	1.87
Time spent on military missions (months)	0–51 (*M, SD*)	13.57	12.59

Statistical Analysis

Descriptive statistics were calculated, including a range of scores, range of scores (Min., Max.), mean (*M*), standard deviation (*SD*), skewness, and kurtosis, to assess the parametric properties of the data (Tables S1 and S2 in the Supplemental Materials). Construct validity of the CES and DLWE was examined preliminarily using the Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity. The KMO > 0.5 and the *p*-value for Bartlett's test < 0.05 suggest there is a substantial correlation in the data. The confirmatory factor analysis (CFA) was performed to verify one-factor structure in both CES and DLWE questionnaires. The Lavaan package was used for the CFA, with the maximum likelihood (ML) estimation method and Bootstrap 95% confidence interval (CI) determined in 1000 resamples. Fit indices for the model were assessed using several goodness-of-fit criteria, including ML χ^2, *df* and *p*-value (the ratio χ^2/df < 2 is considered a very good fit, between 2 and 3 is good, and < 5

is acceptable), standardized root mean squared residual (SRMR ≤ 0.08 is acceptable), root mean square error of approximation (RMSEA; acceptable fit if ≤ 0.08, adequate fit if < 0.06, and good if 0.04), comparative fit index (CFI and TLI are acceptable if ≥ 0.90, and good if > 0.95) (Hu & Bentler, 1999). The Pearson's *r* correlations were calculated to examine associations between particular items within the CES and DLWE, as well as four-month test-retest stability (between T1 and T2). The two-way mixed effect intraclass correlation ICC(3,1) was also performed to examine the test-retest reliability for CES and DLWE. The ICC coefficient can be interpreted as poor if it is less than 0.40, fair if ranging between 0.40 and 0.59, good from 0.60 to 0.74, and excellent if between 0.75 and 1.00 (Cicchetti, 1994).

The criterion validity was assessed using Pearson's correlations between composite scores of various variables, including combat exposure (CES), difficult environmental conditions (DLWE), symptoms of posttraumatic stress disorder (PCL-6), depression (PHQ-9), and anxiety (GAD-7), self-rated physical health status (GSRH) and life satisfaction (SWLS). In addition, paired samples Student's *t*-test was conducted to examine significant differences between first (T1) and second (T2) measurements of combat exposure, difficult living conditions, symptoms of PTSD, depression, and anxiety, self-reported physical health status, and life satisfaction, during the deployment in Afghanistan. Cohen's *d* was calculated for effect size estimation. All statistical analyses were performed using JASP ver. 0.18.3.0 for Windows.

RESULTS

Construct Validity of the CES and DLWE

The KMO was 0.83 and 0.81 for CES and DLWE, respectively, indicating the sampling is adequate for factor analysis. Bartlett's test of sphericity was also significant for CES and DLWE, with $\chi^2(21) = 286.67$, $p < 0.001$, and $\chi^2(91) = 447.48$, $p < 0.001$, respectively, which means if the responses given with the sample are adequate. The CFA was performed for the one-factor model in the CES and DLWE. Fit indices suggested adequate fit for one-factor structure in both CES and DLWE (Table 2). Reliability was excellent (between 0.80 and 0.90) for both the CES and

the DLWE scale, using McDonald ω and Cronbach's α (Table 2). Also, test-retest reliability was good for CES, with Pearson's correlation r = 0.89 (95% CI = 0.80, 0.95, $p < 0.001$), and acceptable for the DLWE question-naire, with r = 0.69 (95% CI = 0.52, 0.82, $p < 0.001$). In addition, the intraclass correlation was performed for the same fixed set of raters and tests (N = 71, test-retest), which showed excellent coefficient for CES (ICC = 0.89, 95% CI = 0.83, 0.93), and good coefficient for DLWE (ICC = 0.69, 95% CI = 0.54, 0.79).

The parameter estimates showed appropriate properties (Tables S1 and S2), with standardized factor loadings ranging between 0.52 and 0.83 in the CES and from 0.38 to 0.81 on the DLWE scale. Although factor loadings below 0.40 are generally considered weak, we did not remove it because it was statistically significant for the model (p = 0.002), and the correlation between the item and the remainder was above 0.30, indicating that item 13 is significant to the total DLWE score, and contributes to the general factor. The mean score was M = 5.99 (SD = 6.10) for the CES and M = 21.49 (SD = 6.98) for the DLWE. Item-rest correlations ranged from 0.51 to 0.79 for the CES and from 0.38 to 0.73 for the DLWE. The average inter-item correlation was 0.54 (95% CI = 0.43, 0.63) for the CES and 0.38 (95% CI = 0.26, 0.50) for the DLWE.

Table 2

Fit Indices for One-Factor Models in the Combat Exposure Scale (CES) and Difficult Living and Working Environment (DLWE)

	χ^2	*df*	*p*	χ^2/df	RMSEA (95 *CI*)	SRMR	CFI	TLI	ω	α
CES	14.02	11	0.232	1.27	0.062 (0.00, 0.147)	0.042	0.99	0.98	0.89	0.87
DLWE	98.35	72	0.021	1.37	0.072 (0.029, 0.105)	0.063	0.93	0.92	0.86	0.88

Criterion Validity of the CES and DLWE

Pearson's correlation was used to examine the associations between the CES and DLWE and other variables, including post-traumatic stress disorder, depression, anxiety, physical health, and life satisfaction (Table 3). Combat exposure was positively related to challenging environmental conditions during deployment in Afghanistan. Both combat exposure and demanding environmental conditions were positively associated with symptoms of PTSD among soldiers. Challenging environmental condi-

tions assessed during the end of military mission (at T2) correlated positively with depression and anxiety symptoms. However, combat exposure was unrelated to symptoms of depression and anxiety during deployment. Poorer physical health at T1 was related to higher combat exposure at T1, and also worse physical health at T2 was related to higher combat exposure at T2. More difficult environmental experiences during the end of deployment at T2 were related to poorer self-rated physical health status. Also, higher scores on combat exposure and difficult living conditions were negatively related to life satisfaction, but only at the second measurement T2 (Table 3). The paired samples Student's *t*-test showed that the differences between T1 and T2 measurements were insignificant for all variables, including combat exposure, difficult living conditions, symptoms of PTSD, depression, and anxiety, self-reported physical health status, and life satisfaction (Table 4).

Table 3

Pearson's Correlations of Combat Experiences and Environmental Conditions During Deployment at the First (T1) and Second (T2) Measurement With Symptoms of Post-Traumatic Stress Disorder, Depression, Anxiety, Physical Health, and Life Satisfaction (N = 71)

Variable	CES T1		DLWE-2 T1		CES T2		DLWE-2 T2	
	T1	T2	T1	T2	T1	T2	T1	T2
Combat exposure (CES)			0.47***	0.47***			0.41***	0.41***
Posttraumatic stress (PCL-6)	0.37**	0.24*	0.46***	0.31**	0.33**	0.30*	0.39***	0.46***
Depression (PHQ-9)	–0.11	–0.03	0.02	0.13	–0.07	0.11	0.10	0.27*
Anxiety (GAD-7)	0.06	0.07	0.08	0.13	0.10	0.17	0.23	0.29*
Physical health (GSRH)	0.28*	0.20	0.23	0.23	0.23	0.25*	0.24*	0.30*
Life satisfaction (SWLS)	–0.23	–0.22	–0.08	–0.11	–0.22	–0.25*	–0.15	–0.30*

Note. CES = Combat Exposure Scale, DLWE = Difficult Living and Working Environment, PCL = PTSD Checklist, PHQ = Patient Health Questionnaire, GAD = General Anxiety Disorder, GSRH = General Self-Rated Health, SWLS = Satisfaction With Life Scale.

Table 4

The Paired Samples Student's t-test for Test (T1) and Retest (T2) Measurement During the Deployment of Polish Soldiers in Afghanistan

Variable	Test (T1)		Re-test (T2)		*t*(70)	*p*	*d*
	M	*SD*	*M*	*SD*			
Combat exposure (CES)	6.32	5.87	5.99	6.10	1.02	0.313	0.12
Difficult living conditions (DLWE)	22.24	6.40	21.49	6.98	1.19	0.238	0.14
Posttraumatic stress (PCL-6)	7.89	3.00	7.78	2.52	0.35	0.731	0.04
Depression (PHQ-9)	2.03	2.37	2.09	2.52	–0.18	0.861	–0.02
Anxiety (GAD-7)	1.61	2.16	1.85	2.73	–0.78	0.436	–0.09
Physical health (GSRH)	4.14	1.20	4.03	1.30	0.93	0.356	0.11
Life satisfaction (SWLS)	26.11	4.94	26.89	4.76	–1.92	0.059	–0.23

Note. CES = Combat Exposure Scale, DLWE = Difficult Living and Working Environment, PCL = PTSD Checklist, PHQ = Patient Health Questionnaire, GAD = General Anxiety Disorder, GSRH = General Self-Rated Health, SWLS = Satisfaction With Life Scale.

DISCUSSION

The purpose of this study was to adapt to the Polish context and validate two scales that measured the experiences of soldiers during the Resolute Support Mission (RSM) in Afghanistan, namely the CES and DLWE scales. Hypothesis H1 and H2 were fully supported, as both scales CES and DLWE demonstrated appropriate fit indices for the one-factor model and good parametric properties in Polish adaptation. Therefore, we can consider positive verification of construct validity of the CES and DLWE in this study. Also, criterion validity was partially supported for CES and DLWE since some correlations were found, as expected in hypothesis H3. However, the results will be discussed and interpreted below in detail.

Construct Validity

The study showed that responses obtained from the sample of Polish soldiers are adequate for both questionnaires, the CES and DLWE, as shown in the KMO and Bartlett's test of sphericity. Also, CFA performed for the CES and DLWE by using several fit indices (i.e., χ^2 test, SRMR, RMSEA, CFI, and TLI) showed that the one-factor model fits the data well, and one-factor structure is appropriate for both sales. Both CES and DLWE showed excellent reliability by using McDonald ω and Cronbach's α coefficients. The test-retest reliability was good for the CES and acceptable for DLWE, assessed by both Pearson's and intraclass correlations. These findings are in line with previous studies (Carvalho et al., 2011; Fikretoglu et al., 2006; Kim et al., 2013; Maoz et al., 2016; Rivera-Rivera et al., 2022; Vogt et al., 2013). The one-factor model and high reliability were also found previously in Korean and Spanish validation of the CES (Kim et al., 2013; Rivera-Rivera et al., 2022) and in a Portuguese validation of the DLWE (Carvalho et al., 2011). Furthermore, high internal consistency of the DLWE was also reported in other studies (Fikretoglu et al., 2006; Maoz et al., 2016; Vogt et al., 2013). Parametric properties of factor loadings and item-rest correlations were also appropriate for both CES and DLWE scales in this study. Therefore, both CES and DLWE can be considered reliable and valid measures of combat exposure and environmental life difficulties in the sample of Polish soldiers during peacekeeping missions.

Criterion Validity

The study found significant correlations between CES and DLWE scores and PTSD symptoms in Polish soldiers deployed in the final peacekeeping mission in Afghanistan, which is in line with previous studies (Carvalho et al., 2011; Fikretoglu et al., 2006; Groer et al., 2014; Keane et al., 1989; Kim et al., 2013; Kokun et al., 2020; Lund et al., 1984; Vogt et al., 2013). Furthermore, the present study indicated that combat exposure was unrelated to depression and anxiety symptoms during deployment, aligning with previous findings (Groer et al., 2014). However, a positive correlation emerged between challenging environmental conditions at T2 and both depression and anxiety symptoms, which is in line with some previous studies (Carvalho et al., 2011; Fikretoglu et

al., 2006). These findings align with various previous studies that found numerous adverse health outcomes following military deployment due to combat exposure and environmental life difficulties (Armstrong et al., 2014; Bryan et al., 2013; Campbell et al., 2021; Kelber et al., 2019; Sudom et al., 2016, 2019; Tracie Shea et al., 2017). In particular, the link between combat exposure and PTSD is well-documented, and combat experience is frequently used to assess PTSD severity in veterans and military personnel (Campbell et al., 2021; Kelber et al., 2019; Osório et al., 2013, 2018; Sudom et al., 2019; Tracie Shea et al., 2017).

Research also showed higher combat exposure among troops deployed to Iraq compared to Afghanistan in four US combat infantry units (Hoge et al., 2004). Research showed that the mental health of Afghanistan and Iraq veterans varies over time, reflecting the changes and intensity of military operations (Morgan et al., 2017). These findings may explain why depression and anxiety in Polish soldiers were not related to combat exposure. The population living in the area of Ghaznia was aware that this was the last stay of the soldiers and that they were gradually withdrawing from these areas, so they did not undertake combat actions. The last peacekeeping mission went smoothly, without any large military operations and traumatic events. Therefore, combat exposure did not increase significantly during the deployment in the Resolute Support Mission (RSM) in Afghanistan. It is also important to note that Polish soldiers were screened for mental health before deployment, and those with symptoms were excluded. Therefore, it can be assumed that the Polish team deployed in Afghanistan presented overall good mental health. Research indicates that combat exposure contributes to the development of mental disorders many years post-deployment. Longitudinal studies show that depressive symptoms follow a varied course, with some individuals experiencing a significant increase in symptoms years after deployment (Karstoft et al., 2020; Plas et al., 2024). Future studies should monitor the adverse effects of combat exposure and difficult living conditions on mental health many years after deployment.

This study revealed that soldiers with higher combat exposure at T1 had poorer physical health at T1, and those with worse physical health at T2 had higher combat exposure at T2. Additionally, consistently with previous research (Fikretoglu et al., 2006), participants facing difficult living conditions at T2 reported poorer self-rated physical health. These findings align with various previous studies, which found numerous ad-

verse health outcomes following military deployment due to combat exposure and environmental life difficulties (Carvalho et al., 2014; Howard et al., 2020; Maia & Morgado, 2022; Osgood et al., 2019; Porter et al., 2018; Reger et al., 2019; Schnittker, 2018). The present study identified a negative correlation between life satisfaction and both combat exposure and difficult living conditions at T2, suggesting that deployment-related stressors decreased life satisfaction among Polish soldiers after six months in Afghanistan. This result is consistent with previous studies, indicating that combat exposure negatively affects subjective well-being (Blackburn & Owens, 2015; Carr et al., 2019; Lee et al., 2022).

Practical Applications of the CES and DLWE

Both the CES and DLWE questionnaires are valuable tools for assessing military personnel and veterans' exposure to combat and challenging living or working environments. As the CES measures the frequency and intensity of combat-related experiences, it can help quantify a soldier's or veteran's exposure to direct combat situations, such as being under fire or witnessing injuries and deaths. Possible applications in clinical assessment include identifying soldiers at higher risk for developing post-traumatic stress disorder (PTSD) and other mental health disorders due to combat exposure, as well as assisting in targeted individual treatment planning. Monitoring changes in psychological health outcomes over time in relation to combat exposure can early identify individuals needing psychological support during deployment or post-deployment. Assessing the effectiveness of mental health interventions in groups with varying degrees of combat exposure may also be helpful in clinical trials. The CES measurement can contribute to research on the long-term psychological impact of combat experiences on the mental health of soldiers and veterans. Changes to CES scoring of military personnel can help military commanders make decisions about troop rotation, length of deployment, or post-operations decompression strategies.

The DLWE assesses stressors associated with non-combat challenges during military deployment, including poor living conditions, social isolation, adverse weather, lack of privacy, or interpersonal conflicts. The tool is helpful in evaluating stressors that may contribute to mental health conditions, even in the absence of direct combat. Understanding the environmental factors that contribute to psychological distress can help better

tailor treatment approaches. In addition, DLWE results can assist military commanders in identifying the most harmful daily life issues in order to mitigate non-combat stressors by improving the living and working conditions of military personnel during deployment. Identification of units or locations with high levels of environmental stress is also essential to implementing targeted support measures. This information is critical to developing military policy to improve living conditions and support systems and to design training programs for service members to better cope with challenging deployment environments.

To summarize, as the CES measures combat exposure intensity, it can be helpful mainly in clinical assessment, research, and screening for PTSD risk. The DLWE, however, can assess non-combat stressors, which seems primarily supportive of operational planning, living condition improvements, and general stress research. Together, the CES and DLWE provide a comprehensive understanding of the stressors faced by military personnel, both in combat and deployment environments, supporting better mental health outcomes and operational readiness.

Limitations of the Study

Research indicates that both the CES and DLWE scales are reliable tools for evaluating soldiers' experiences during missions, but some limitations hinder generalization to the entire military. The study involved 71 participants from various divisions and levels of military experience. Although we have shown that the sample size is adequate for the number of parameters analyzed in CFA, future studies should replicate our research in a more extensive research group of more than 100 participants. Future research should compare the mental health and well-being of soldiers on international missions with those stationed in Poland across different divisions and specializations. Additionally, only four women participated, limiting the generalizability to female soldiers. Repeating the measurements months or years post-deployment could provide valuable insights into the long-term associations between well-being, health symptoms, combat exposure, and living conditions. Long-term monitoring may be crucial for identifying soldiers at risk of adverse health outcomes following their deployment. Each military mission has its specifics due to the season, the intensity of combat, or the general level of threat in the region. This study was conducted at the end of the COVID-19 period,

which could also have influenced the results of these studies. Therefore, replication of studies in different military groups staying in a war zone and comparison of peacekeeping missions should help better understand the impact of stressors on mental health. Constant and repeated monitoring of the mental health of soldiers on a military mission is needed, especially when the mission is prolonged.

CONCLUSIONS

The CES and DLWE are essential tools for evaluating combat exposure and challenging living conditions among Polish soldiers deployed in Afghanistan. The validation study confirmed the reliability and validity of the tools within the Polish context. Both CES and DLWE demonstrated a good fit to the data, excellent internal consistency, adequate temporal stability, and suitable convergent validity with a one-factor solution. These tools effectively assess combat exposure and challenging living experiences during military deployment. High CES and DLWE scores correlate with an increased risk of PTSD symptoms. Moreover, soldiers with high DLWE levels exhibited significant depression and anxiety symptoms at the end of their deployment. Both CES and DLWE are sensitive indicators of physical health complaints. Addressing the complex impact of combat exposure on mental health requires treatment options that focus on combat exposure, living conditions, physical health, and symptoms of PTSD, depression, and anxiety. These CES and DLWE tools can be used during joint NATO military exercises, as well as in military missions.

CRediT statement

AMELIA FUDALI (60%): conceptualization, methodology, data collection, resources, writing (original draft), writing (review and editing).

ALEKSANDRA M. ROGOWSKA (40%): conceptualization, methodology, software, validation, formal analysis, resources, writing (original draft), supervision, writing (review and editing).

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