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Assessing psychometric of the perceived stress scale and identifying stress-associated factors in a sample of Ukrainian female refugees in the Czech Republic

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ABSTRACT

Introduction: The full-scale Russian war has caused refugees to experience many stressful events, which may have a long-term adverse impact on their physical and mental health. Understanding the factors associated with increasing/decreasing stress is essential for the psychosocial support services for refugees. The Perceived Stress Scale (PSS) is a popular tool for assessing life stress perception through self-reporting. The purposes of the study were: 1) to examine the psychometric qualities of the Ukrainian versions of the PSS-14 and PSS-10; 2) to determine the level of perceived stress; 3) to reveal factors associated with perceived stress in the sample of Ukrainian female refugees in the Czech Republic ($N = 919$).

Methods: Perceived stress was measured by the Ukrainian versions of the Perceived Stress Scale (PSS-14 and PSS-10) which were validated by applying exploratory and confirmatory factor analysis. Linear regressions were run to understand associations between self-reported physical health conditions, the barriers to adaptation in the host country, the determinants of social health and perceived stress.

Results: Both PSS-14 and PSS-10 scales had a high level of internal consistency. Two factors (involving positive and negative items) were extracted based on exploratory factor analysis. The external consistency was confirmed by analysing correlations of the PSS-14/PSS-10 and coping strategies as well as self-reported physical and mental health. Ukrainian female refugees in the Czech Republic experienced moderate to high levels of perceived stress. The study found that on the one hand, a decrease in self-reported physical and mental health statuses, worsening health due to the war, low housing quality, financial disadvantages, experience of cultural differences issues and discrimination, healthcare access inequalities, lack of Czech language skills, failure to integrate into social activities within Ukrainian community, lack of social support, and applying an avoidant coping strategy are factors associated with forced migration that could increase perceived stress in the sample of Ukrainian female refugees. On the contrary, the level of perceived stress of participants could decrease with increasing social support, including such factors as regular communication with relatives and friends who are staying in Ukraine, and having good relations with loved ones, friends, and locals.

Conclusions: The Ukrainian version of PSS-10 has good psychometric properties and can be relied upon to measure perceived stress. The study revealed factors associated with the perceived stress in the sample of Ukrainian female refugees in the Czech Republic and emphasised the necessity of psychosocial support services and developing interventions to help cope with stress among Ukrainian female refugees in the host country.

1. Introduction

Millions of Ukrainians were forced to flee their homes due to Russia's invasion of their country on February 24, 2022. The Czech government has provided "temporary protection" to 573,460 Ukrainian refugees as of November 12, 2023 (Operational Data Portal, 2023). In terms of rebuilding their homes, defending cultural norms and family values, and at the same time searching for work and adapting to a new language and culture, female refugees — particularly those with children — face pressure from stressful circumstances that could be harmful to their

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mental well-being.

1.1. Perceived stress scale (PSS) and it construct validation

Among instruments to measure self-reported life stress perception, the Perceived Stress Scale (PSS) is one of the most used. The PSS was invented by Cohen, Kamarck, and Mermelstein to measure how people assess the degree of control they have or do not have over unpredictable, unmanageable, and overburdened events in their lives (Cohen and Williamson, 1988). The three versions of the scale PSS-14, PSS-10 and PSS-4 have been tested in a variety of cultures and translated into many languages. Psychometric properties of the PSS validated in previous studies showed that the PSS-14/10 has a two-dimensional structure, composed of negatively stated items called "perceived stress"/ "perceived helplessness"/ "perceived distress" and positively stated called "perceived control"/ "perceived self-efficacy"/ "perceived coping" (Lazarus, 1966; Hewitt et al., 1992). Additionally, a systematic review of studies testing the internal structure of PSS-14/PSS-10 and a meta-analytic confirmatory factor analysis of these studies database conducted by Koğar and Koğar proved that the correlated two-factor model is the best to explain the factor structure of PSS-14/PSS-10 (Koğar and Koğar, 2023). These two dimensions correspond with Lazarus's psychological stress theory (Lazarus, 1966) and were revealed in numerous studies with different samples of the population, including migrant samples (Huang et al., 2020; Bastianon et al., 2020).

In multiple studies, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used to evaluate the construct validity of the PSS translated into other languages. Moreover, the two-factor model was reported to be a better fit for the PSS-14 and PSS-10 (Andreou et al., 2011; Leung and Tsang, 2010; Smith et al., 2014). According to the theory, there are two first-order factors in the PSS, so a bifactor model is also suitable. Thus, studies which employed it showed that a bifactor structure with a general factor (where all items are included) and two specific factors: "perceived helplessness" (only negative items) and "perceived self-efficacy" (only positive items) have been the best fit for both PSS-14 and PSS-10 scales (Juarez-Garcia, A. et al., 2023; Ruisoto et al., 2020; Jovanović, and Gavrilov-Jerković, 2015; Lee, and Jeong, 2019; Park, and Colvin, 2019; Reis et al., 2019; Wu, and Amtmann, 2013).

1.2. Perceived stress and coping strategies

Stress accompanies human life daily and could have negative effects on mental and physical health. Stressors are inherent in biological life, and having an evolved stress response is an adaptive feature contributing to the organism's survival via the mobilisation of its resources for fight or escape. Yet enduring chronic stress or facing a highly intense, traumatising stressor can lead to consequences that are long-lasting and detrimental to health. However, not all stressors are the same with respect to their potential to have outcomes for health. The last several decades of stress research have produced new data that changed our understanding of how psychosocial stress works to instigate pathology and presented new theoretical and methodological challenges. Recently, Slavich (2019) critiqued stress measurement as inadequate for the complexity of the concept and its importance for health outcomes.

One of the theoretical aspects that has been introduced is the distinction between stress exposure (i.e., facing an objectively measurable stressor) and perceived stress (i.e., a subjective experience of stress resulting from an individual's facing a stressor). The latter has shown a superior predictive ability in terms of negative health outcomes compared to the former, highlighting the cognitive dimension of the stress process. Medical sociologists have been emphasising the impracticality of exploration of the stress process without its interpretative aspect (Pearlin, 1989; Turner et al., 2020). Subjective stress can occur without being exposed to a stressor, and exposure to a stressor can occur without subjective experience of stress per se. Methodologically, subjective stress tends to yield more precise results, which makes it preferable as a stress-assessment tool (Shields et al., 2023).

Coping is an essential component of a person's adaptational process throughout stressful events and could predict their physiological and psychological well-being. According to psychologists Lazarus and Folkman, coping is the process of continuously modifying one's cognitive and behavioural strategies to deal with external and/or internal demands that are deemed to be too demanding or to exceed one's resources. Based on prior research outcomes, people employ the coping strategies they believe to be more successful for them during a particular stressful situation. As a result, different people may employ different strategies (Johnson, 1999).

The transactional theory of stress and coping suggests that when people consider environmental stressors to be potentially harmful, they use coping mechanisms to reduce or eliminate the stressors' negative consequences. According to the aforementioned theory, there are two forms of stress management. Emotion-focused coping refers to controlling the emotions brought on by managing the stressor, whereas problem-focused coping entails taking direct action to control the stressor (Lazarus and Folkman, 1984, 1987). So, coping strategies have a significant impact on how much stress individuals face (Cohen et al., 2000; Doron et al., 2014). Coping is a crucial part of how refugees adapt to stressful situations caused by pre-migration and post-migration factors and might indicate their physical and mental well-being.

Previous studies with student samples revealed an association between a high level of perceived stress and a higher preference for avoidance coping strategies (Doron et al., 2014; Thai et al., 2021). Previous studies demonstrated, for example, that patients who employ avoidant coping strategies report higher levels of perceived stress than those who employ active coping strategies (Najam and Aslam, 2010; Soderstrom et al., 2000). Additionally, the study with Bhutanese refugees identified that increased usage of problem-focused and emotion-focused coping strategies was associated with reduced perceived stress (Poudel-Tandukar et al., 2020).

Formerly, it was found that perceived stress is positively correlated with some health indicators, including anxiety, depression, psychological inflexibility, alcohol consumption, and negative resilience (Ruisoto et al., 2020). One study, applying the bivariate analysis, showed that mental health was negatively associated with stress and positively associated with social support (Bovier et al., 2004). Research with university students under the COVID-19 lockdown showed that family and friend support were protective factors against stress (Bourion-Bédès, 2021). Forces migration often include family separation and social isolation, and in the Ukrainian refugee case, females with children are moved apart from their male family members. The study with refugees also supported those with lower social support reported poorer mental well-being and higher levels of perceived stress (Jankovic-Rankovic et al., 2022). Therefore, social support may help reduce stress and the negative impacts of the stressful life experiences of refugees.

It is well-known that many refugees have limited access to secure housing, satisfactory quality food and other necessities due to financial hardships and material resource shortages in the host country, which elevate the stress. A meta-analysis conducted by Porter and Haslam found that refugees having access to safe, private housing have better mental health status than those living in institutions or temporary housing. The psychological well-being of refugees is influenced by socioeconomic determinants, including financial and housing security (Porter and Haslam, 2005). Other research also proved that employment and housing uncertainty and hazardousness were positively associated with perceived stress (Caroz-Armayones et al., 2022). The survey of Ukrainian refugees showed that their health status is related to their socioeconomic situation, more specifically, those in material deprivation and those in worse housing conditions reported their health as poorer (Hlas Ukrajinců: Zdraví a služby 2022).

Moreover, refugees may experience numerous barriers to employment, such as ignorance of the local language, lack of recognition of

their credentials in the host country, discrimination, a lack of demanding vocational skills, and psychological or physical obstacles (Krahn et al. 2000). Studies showed that refugees are often employed in positions below their qualification degree, expertise, or skills (Colic-Peisker, 2009; Krahn et al. 2000). Another study also reported that refugees with higher education have poorer mental health, more stress, and lower job satisfaction because their current employment is not appropriate to their skills and qualifications (Bridekirk et al. 2021). More than 50 % of Ukrainian refugees of both genders in the Czech Republic were economically active; however, 80 % of them were working in low-skilled jobs, and approximately 75 % of respondents declared they were in 'very unsatisfactory' or 'critical' financial conditions (Klimešová et al. 2022). According to numerous research, refugees with a university degree and higher socioeconomic status before forced migration have worse outcomes for their mental health after settling in host countries because of lowering and losing their socioeconomic status, which could contribute to settlement stress (Li et al., 2016; Porter and Haslam, 2005).

Additionally, for refugees and forced migrants, relocating and acclimating to a foreign physical and cultural environment, including an unknown language, presents notable social and interpersonal problems (Li et al., 2016). The survey conducted with refugees and migrants during the COVID-19 pandemic indicated that females are one of the groups that deal with increasing levels of discrimination and the increased stresses of daily life (Spiritus-Beerden et al., 2021).

There is a strong proven negative correlation between perceived stress and self-reported health. In the total population of Scandinavia and Greece, there was e.g. a positive correlation between PSS and experienced serious life events, self-reported poor health, anxiety, and depression (Koppner et al., 2020).

As well evidence from many European countries demonstrated that despite the introduction of equity policy, health and healthcare access inequalities between migrants and locals persist mainly because of the financial status of immigrants, lack of the language and cultural competency to understand and navigate the healthcare systems that may be subject to discrimination (Lebano, 2020).

Hence, the present study aims 1) to examine the psychometric qualities of the Ukrainian versions of the PSS-14/10; 2) to determine the level of perceived stress; 3) to reveal factors associated with perceived stress in the sample of Ukrainian female refugees in the Czech Republic.

2. Material and methods

2.1. Participants and data collection

This cross-sectional study was conducted among Ukrainian female refugees in the Czech Republic ($N = 919$). The inclusion requirements were an age of 18 and more, had been forced to move to the Czech Republic due to the full-scale Russian war in Ukraine. Data were collected via a Ukrainian-language online survey that included questions about self-reported health, coping strategies, adaptation barriers and demographic information. The survey was disseminated through social media platforms, including Facebook, Telegram, and Viber, as well as non-governmental organisations that assist refugees and Czech schools that accept Ukrainian children. All data were anonymised and processed under the General Data Protection Regulation. Participants in the study were required to sign online a consent form before completing the questions. They were also informed that participation was entirely optional and that they might stop at any time. The information was gathered between June 6 and September 6, 2022.

2.2. Measures

Jamovi statistic software version 2.2.5. was utilised to perform the exploratory and confirmatory factor analysis in the PSS-14/PSS-10 validation process and regression analysis (The jamovi project 2021; R Core Team 2021; Gallucci and Jentschke, 2021; Rosseel et al., 2018; Epskamp, 2017; Revelle, 2019; Rosseel 2019; Epskamp et al. 2019; Fox and Weisberg, 2020).

2.2.1. Online survey questionnaire

The online survey included: 1) a socio-demographic questionnaire with general questions including age, education, socio-economic status, marriage status, number of children under 18, and employment status; 2) questions related to self-reported physical health, health care access, health deterioration due to the war, chronic diseases, limitation on daily activity because of ill health; 3) questions related to barriers to adaptation such as lack of living space, living with strangers, financial difficulties, unemployment, language ignorance, cultural differences, discrimination; 4) questions related to social health such as communication with family, friends, locals, participation in events organised for refugees, religious communities, watching news from Ukraine.

2.2.2. The perceived stress scale

The Perceived Stress Scale (Cohen et al., 1983) is the most well-known and used tool for assessing self-reported psychological stress. The original PSS consists of 14 items (PSS-14). Each item is rated on a 5-point Likert-type scale, ranging from 0 = 'never' to 4 = 'very often'. The scale was grouped into two subscales: negative subscale (items 1, 2, 3, 8, 11, 12 and 14) and positive subscale (items 4, 5, 6, 7, 9, 10 and 13) with scores ranging from 0 to 56. The PSS questionnaire is designed to assess the level of perceived stress experienced over a month.

The original PSS-14 was translated from English into the Ukrainian language and subsequently back into English by two different translation agencies to ensure the accuracy of translation and checked by researcher and psychologist. The Ukrainian version of the original 14-item Perceived Stress Scale (Cohen et al., 1983) was completed by participants (Appendix A – Ukrainian version of the PSS-14). In the 10-item version before analysis, 4, 5, 12, and 13 items were removed.

2.2.3. Coping strategies measure

The study used the BRIEF-COPE, which includes 28 items, to measure different coping strategies grouped into 14 sub-scales of coping reactions: active coping, planning, instrumental support, positive reframing, acceptance, emotional support, humour, religion, venting, self-distraction, denial, behavioural disengagement, substance use, and self-blame. Each item was scored using a 4-point Likert scale (1 = *I* haven't been doing this at all to 4 = I've been doing this a lot). The midpoint of the scale was 2.5. This study applied the three-dimensional conceptual system, which includes problem-focused coping (dealing with sources of stress), emotion-focused coping (handling feelings and thoughts associated with the stressor), and avoidant coping (avoiding dealing with the stressor or associated emotions) (Carver et al. 1989; Huijts et al. 2012).

The Ukrainian version of BRIEF-COPE was reported as valid and reliable in the previous study. The general internal consistency measured by Cronbach's alpha was 0.81, and the internal consistency of each of the three sub-scales (problem-focused, emotional, and avoidant) was between 0.65 and 0.77 (Mazhak et al., 2023).

2.3. Demographic characteristics of the sample

In total, 919 responses to the survey came from female refugees from Ukraine. Over 70 % of those surveyed stated they were married or cohabiting, and 68.4 % said they had children under the age of 18. Thirty per cent of them work in the Czech Republic, seventy-six per cent reported a decline in material and financial conditions, and 75 % have a university degree. The two biggest obstacles to adapting to the host country are financial disadvantages (40 %) and lack of knowledge of the Czech language (81 %). Out of them, only 28 % signed up with family physicians. Based on their self-reported physical health, 43 % of females

thought their health was good, 46.8 % thought it was fair, and 10.2 % thought it was bad and very bad combined. Furthermore, 4.5 % of participants claimed that the war had injured and destroyed their health, and 27.9 % of participants said that their health had gotten worse over the previous month.

Moreover, female refugees from Ukraine reported their emotional and psychological conditions as fair (52.7 %), bad (26 %) and very bad (7.7 %). 75 % of participants check news from Ukraine several times per day, and 70 % communicate with their relatives and friends who are in Ukraine at least once per day. Most of them used effective coping strategies - 64.5 % used problem-focused and 29.5 % emotion-focused coping strategies. Additionally, respondents experienced moderate to high levels of perceived stress. The responses from female refugees were displayed using descriptive statistics of absolute and relative frequency (Appendix B - Socio-demographic, self-reported health statuses, coping strategies and perceived stress characteristics).

3. Results

3.1. PSS-14 and PSS-10 psychometric validation

Reliability (internal consistency) of the PSS-14 and PSS-10 was measured with Cronbach's α (acceptability criterion of which is ≥0.70) and McDonald's ω (acceptability criterion of which is ≥0.65). Validity evaluation included structural and construct validity. Structural validity was assessed by exploratory, confirmatory factor analysis and bifactor modelling. Model fit was checked by the comparative fit index (CFI), Tucker-Lewis index (TLI), standardised root mean square residual (SRMR), and root mean square error of approximation (RMSEA). The acceptable fit criteria applied were CFI ≥ 0.95, TLI ≥ 0.95, SRMR ≤ 0.06, and RMSEA ≤ 0.06. Convergent validity was assessed by correlating the total scores of the PSS-14, the PSS-10 and two factors: Self-efficacy and Helplessness, the BRIEF-COPE (three-factor structure: problem-focused, emotional-focused and avoidant strategies), Self-Reported Physical Health (SRPH) and Self-Reported Emotional and Psychological Status (SREPS). All statistical tests were two-tailed and employed a significance level of $p < .05$. To determine the degree of inter-correlation among the PSS-14 items and 10 items, the Kaiser-Myer-Oklin criterion and the Bartletts' test of sphericity were calculated.

The overall PSS score was computed by summing the negative subscale scores and the reverse of the positive subscale scores. The related items for PSS were averaged to provide the scores on the 'Self-efficacy' (positive) and 'Helplessness' (negative) subscales. Higher stress levels are indicated by higher overall scores.

The descriptive statistic (Table 1) shows that the respondents, on average, had moderate perceived stress level PSS-14 ($M = 31.60$; SD = 7.17) and PSS-10 ($M = 23.20$; SD = 5.83), more often applied problem-focused coping strategy ($M = 2.79$; SD = 0.54) than emotion-focused coping strategy ($M = 2.31$; SD = 0.46) and avoiding coping strategy ($M = 2.18$; SD = 0.50). In addition, the respondents, on average, estimated their mental health status as worse than physical.

3.1.1. Reliability (internal consistency)

The PSS-14 total scale had a high level of internal consistency, as determined by Cronbach's α and McDonald's ω of 0.80. The first factor – is the 'Helplessness' subscale (including negatively stated items: 1, 2, 3, 8, 11, 12, 14) providing Cronbach's α of 0.83 and McDonald's ω of 0.84, the second factor is the 'Self–efficacy' subscale (including positively stated items: 4, 5, 6, 7, 9, 10, 13) providing Cronbach's α of 0.81 and McDonald's ω of 0.82. Furthermore, a very good internal consistency was revealed for the PSS=10 scale, providing Cronbach's α of 0.78 and McDonald's ω of 0.79 for the overall sample, Cronbach's α and McDonald's ω of 'Helplessness' Factor and 'Self-Efficacy' Factor were the same 0.84 and 0.72 respectively.

Table 1
Means, standard deviations, Skewness and Kurtosis coefficients for PSS-14 and other variables.

PSS-14 Items:	Mean	SD	Skewness	Kurtosis
1. How often have you been upset because of something that happened unexpectedly?	2.64	0.86	−0.13	−0.15
2. How often have you felt that you were unable to control important things in your life?	2.42	1.10	−0.33	−0.46
3. How often have you felt nervous and "stressed"?	2.75	0.96	−0.48	−0.07
4. How often have you dealt successfully with irritating life hassles?	1.83	0.81	0.18	0.56
5. How often have you felt that you were effectively coping with important changes that were occurring in your life?	2.03	0.88	0.17	−0.02
6. How often have you felt confident about your ability to handle your personal problems?	2.00	0.92	0.07	−0.01
7. How often have you felt that things were going your way?	2.50	1.05	−0.29	−0.40
8. How often have you found that you could not cope with all the things that you had to do?	2.15	1.05	−0.07	−0.37
9. How often have you been able to control irritations in your life?	1.91	0.89	0.01	0.06
10. How often have you felt that you were on top of things?	2.23	0.93	0.05	−0.02
11. How often have you been angered because of things that happened that were outside of your control?	2.24	1.07	−0.21	−0.44
12. How often have you found yourself thinking about things that you have to accomplish?	2.79	1.02	−0.67	0.07
13. How often have you been able to control the way you spend your time?	1.75	0.93	0.16	−0.09
14. How often have you felt difficulties were piling up so high that you could not overcome them?	2.25	1.20	−0.18	−0.78
PSS-14 (from 0 to 56)	31.60	7.17	−0.06	0.51
PSS-10 (from 0 to 40)	23.20	5.83	−0.13	0.39
Problem Focused Coping	2.79	0.54	−0.02	−0.52
Emotion Focused Coping	2.31	0.46	0.22	−0.01
Avoidant Coping	2.18	0.50	0.34	−0.02
Self-Reported Physical Health (SRPH)	2.65	0.77	0.45	0.64
Self-Reported Emotional and Psychological Status (SREPS)	3.27	0.82	0.19	0.16

3.1.2. Validity (construct validity)

Firstly, exploratory factor analysis (Table 2) was applied to determine the underlying factor structure of Ukrainian versions of PSS-14 and PSS-10. The 'Principal axis factoring' extraction method was used in combination with an 'oblimin' rotation. The KMO value was 0.856 (PSS-14) and 0.841 (PSS-10), suggesting a very good intercorrelation level among both PSS scores and the Bartlett's Test of Sphericity was significant ($p < .001$), suggesting that the results are acceptable.

According to exploratory factor analysis, two factors (involving negative and positive items) were extracted in both scales. Regarding PSS-14, the first factor (Helplessness) that explained 22.2 % of the variance included negatively stated items. The second factor (Self-efficacy) explained 20.9 % of the variance and related to positively stated items. The correlation between factor 1 and factor 2 was 0.187.

In accordance with the guidelines proposed by Watkins, we adopted a threshold of 0.32 for factor loadings. This decision aligns with the standard of ensuring both practical significance, accounting for at least 10 % of variance, and statistical significance at the $p < .01$ level (Watkins, 2021). All loadings exceeded 0.5 for one of either of the factors except item 7, 'How often have you felt that things were going your way?' (0.46), which could be explained by the sample - females mainly with children (71 %) and the situation of forced migration due to the war. Another item that loaded highly on both factors was 12: 'How often

Table 2
Exploratory Factor Analysis Factor Loadings.

PSS-14 Items:			PSS-10 Items:		
Items:	**Helplessness**	**Self-efficacy**	**Items:**	**Helplessness**	**Self-efficacy**
Item 3	0.761		Item 3	0.771	
Item 14	0.717		Item 14	0.719	
Item 2	0.699	0.129	Item 2	0.707	0.127
Item 11	0.682		Item 11	0.694	−0.141
Item 1	0.667		Item 1	0.683	
Item 8	0.538		Item 8	0.556	−0.149
Item 12	0.517	−0.316			
Item 6	0.104	0.727	Item 10		0.732
Item 5		0.690	Item 9	−0.106	0.668
Item 9	−0.104	0.660	Item 6	0.119	0.595
Item 4		0.646	Item 7		0.518
Item 10		0.638			
Item 13	−0.115	0.560			
Item 7	0.123	0.460			
KMO		**0.856**			**0.841**
Bartlett's Test of Sphericity		**<0.001**			**<0.001**

have you found yourself thinking about things that you have to accomplish?' because of the situation, the question could be as negative as positive. Regarding PSS-10, the first factor (Helplessness) explained 29.1 % of the variance, and the second factor (Self-efficacy) explained 16.7 % of the variance. The between-factor correlation was 0.216. All loadings exceeded 0.5 for one of either of the factors.

Secondly, the assessed goodness of models fit for the two-factor models to the 14-item and 10-item of PSS was made by using confirmatory factor analysis (CFA). CFA revealed that the two-factor model fitted mediocre well to both PSS-10 and PSS-14 (Table 3). Therefore, both the CFI and TLI values meet the recommended threshold of 0.95 or higher. However, the SRMR and RMSEA values remain above the 0.06 threshold. These suboptimal goodness-of-fit indices may be attributed to the online survey format and the characteristics of the participant population, which includes female refugees who may have encountered challenges in fully engaging with the survey due to factors such as stress or distraction.

Thirdly, based on previous evidence, a bifactor model was tested with two factors, and each item was loaded on a general factor. The results revealed that the bifactor model fit the data, with one general factor reflecting the overlap across all 14 items/10 items, and two subfactors representing 'Helplessness' (7 in PSS-14 and 6 in PSS-10 negatively stated items) and 'Self-efficacy' (7 in PSS-14 and 4 in PSS-10 positively stated items). Item 8 doesn't correlate with the general factor in both PSS-14 and PSS-10 but correlates with the subfactor 'Helplessness'. Item 5 doesn't correlate with the 'Self-efficacy' subfactor in PSS-14 but correlates with the general factor (Appendix C – Confirmatory factor analysis measurement model). All fit indices of the bifactor model reached acceptability criteria in the sample of the Ukrainian female refugees in the Czech Republic for PSS-14 (CFI = 0.985, TLI = 0.978, RMSEA = 0.071, SRMR = 0.054) and PSS-10 (CFI = 0.995, TLI = 0.992, RMSEA = 0.033, SRMR = 0.047).

Table 3
Confirmatory Factor Analysis: Distribution of Factor Loadings for Two-Factor Solutions.

PSS-14 Items:				PSS-10 Items:			
Helplessness		Self-efficacy		Helplessness		Self-efficacy	
Item1	0.735	Item 4	0.687	Item 1	0.741	Item 6	0.708
Item 2	0.781	Item 5	0.810	Item 2	0.783	Item 7	0.607
Item 3	0.845	Item 6	0.825	Item 3	0.851	Item 9	0.627
Item 8	0.541	Item 7	0.551	Item 8	0.538	Item 10	0.753
Item 11	0.694	Item 9	0.649	Item 11	0.676		
Item 14	0.768	Item 10	0.669	Item 14	0.761		
Item 12	0.426	Item 13	0.516				
Goodness of fit indexes for the confirmatory factor analysis							
CFI		0.954		CFI		0.976	
TLI		0.945		TLI		0.969	
SRMR		0.088		SRMR		0.067	
RMSEA		0.112		RMSEA		0.092	

3.1.3. Validity (convergent validity)

To provide additional support for the predictive validity of the Ukrainian version of PSS, the correlation between the 14-item/10-item PSS total stress scores (further - PSS-14/PSS-10) and the two 'Self-efficacy' (positive) and 'Helplessness' (negative) factors with the BRIEF-COPE (three-factor structure: problem-focused, emotional-focused and avoidant strategies), Self-Reported Physical Health (SRPH) and Self-Reported Emotional and Psychological Status (SREPS) was investigated. Pearson's correlation coefficients of |0.10| were considered as small of |0.30| as moderate, and of |0.50| or higher as strong correlations (Appendix D - The Correlation Matrix).

All correlations were significant at levels of at least 0.05. The total stress score for both 14-item and 10-item scales was moderately positively correlated with the avoidant coping strategy $r = 0.48$ and $r = 0.49$, respectively, so the higher the perceived stress, the higher the possibility for the respondent to employ the avoidant coping strategy. Moreover, there were strong positive correlations between perceived stress (PSS-14/PSS-10) and self-reported emotional and psychological status (r = 0.61 for both scales) and positive correlations with self-reported physical health ($r = 0.29$ for both scales). A higher level of perceived stress is related to worse self-reported physical and especially mental health. Also, there was a small negative correlation between perceived stress (PSS-14/PSS-10) and problem-focused coping strategy ($r = -0.13$/ $r = -0.10$), which means that the higher perceived stress, the fewer female refugees used problem-focused coping strategy.

Analysis of the PSS factors: 'Self-efficacy' and 'Helplessness' showed that there were significant correlations with coping strategies, Self-Reported Physical Health and Self-Reported Emotional and Psychological Status. There were strong positive correlations between 'Helplessness' (PSS-14/PSS-10) and Self-Reported Emotional and Psychological Status ($r = 0.55$/ $r = 0.56$) as well as an avoidant coping strategy (r = 0.50 for both scales). Small positive correlations were found between 'Helplessness' (PSS-14/PSS-10) and Self-Reported Physical Health (r = 0.23/ $r = 0.25$) as well as an emotion-focused coping strategy ($r = 0.22$/ $r = 0.20$). There was a significant moderate positive correlation between 'Self-efficacy' (PSS-14/PSS-10) and Self-Reported Emotional and Psychological Status ($r = 0.39$/ $r = 0.37$) and negative correlation with problem-focused coping strategy ($r = -0.30$/ $r = -0.26$). Small positive correlations were found between 'Self-efficacy' (PSS-14/PSS-10) and Self-Reported Physical Health ($r = 0.21$/ $r = 0.20$), and avoidant coping strategy ($r = 0.20$ for both scales), as well as a small negative correlation with emotion-focused coping strategy ($r = -0.14$/ $r = -0.12$). Therefore, the higher the 'Self-efficacy', the higher the possibility that the participant applied problem-focused strategy, and reversely, the higher the 'Helplessness', the more possible it is that the participant will use avoidant coping strategy.

3.2. Perceived stress and associated factors

Linear regressions (Appendix E – Linear Regressions Outcomes) were run to understand associations of physical health conditions with perceived stress (Model 1), barriers to adaptation with perceived stress (Model 2), the social determinants of health with perceived stress (Model 3), and finally all significant variables from Models 1, 2, 3 were included in the Final Model and adjusted additionally by coping strategies used by Ukrainian female refugees. All statistical analyses were performed at a 5 % level of significance. The scatterplots generated to

assess linearity indicated linear relationships. All regression models show no violations of the assumption of homoscedasticity. All Models were statistically significant.

Model 1 established that factors related to physical health conditions used in regression could statistically significantly predict the level of perceived stress and accounted for 22.6 % and 22.5 % of the explained variance in perceived stress measured by PSS-14 and PSS-10, respectively. Linear regression analysis showed that the worsening of self-reported health status from very good to very bad (β=1.89/0.16) was associated with increasing perceived stress levels. Also, losing health due to the war (β=4.20/0.29) increases the level of refugees' perceived stress compared to others, as well as losing hope of finding a family doctor for registration (β=2.15/0.21).

Model 2 appointed that barriers to adaptation in the host country could statistically significantly predict the level of perceived stress and accounted for 14.4 % and 15.6 % of the attributed variance in perceived stress measured by PSS-14 and PSS-10 accordingly. Model 2 revealed some statistically significant associations of such adaptation barriers as having a lack of living space (β=0.11 for PSS-10), living with strangers (β=1.42/0.10), having financial difficulties (β=2.02 for PSS-14), experiencing cultural differences (β=2.48/0.19) and discrimination (β=2.28/0.17) with increasing level of perceived stress.

Model 3 showed that determinants related to social health included in regression could statistically significantly predict the level of perceived stress and accounted for 44.2 % and 44.3 % of the explained variance in perceived stress measured by PSS-14 and PSS-10, respectively. Model 3 proved that reducing the frequency of communications of female refugees with close people who are staying in Ukraine from several times per day to once per several weeks (β=2.98/1.35) raises perceived stress levels. Moreover, lowering the level of self-reported emotional and psychological status from very good to very bad (β=4.49/0.28) is associated with an increasing level of perceived stress. Also, it was found that relations with other people affected the perceived stress of Ukrainian female refugees in the Czech Republic. Therefore, the level of perceived stress decreased when relationships with family members stayed the same as they were before the war (β=−1.69/−0.16) or got better (β=−2.06/−0.17), relationships with colleagues/neighbours stayed the same (β=−1.36/−0.12) or got better (β=−2.59/−0.22), relationships with locals got better (β=−2.59/−0.21). In addition, for females who participate in Ukrainian religious communities (β=−1.78/−0.13), perceived stress is lowering, but for females who rarely attend a meeting organised for refugees (β=1.03 for PSS-14), the level of perceived stress is increasing compared to other groups.

The final **Full Model** defined that factors related to physical and social health and adaptation barriers included in the study could statistically significantly predict the level of perceived stress and accounted for 50.4 % and 50.3 % of the explained variance in perceived stress measured by PSS-14 and PSS-10, respectively. The results showed that losing hope of finding a family doctor (β=1.53/0.14) increases the stress level for female refugees compared with other groups. There were associations of lacking living space (β=0.08 for PSS-10) and financial difficulties (β=0.09 for PSS-10) with increasing the perceived stress of participants. In addition, reducing the frequency of communications with close people who are staying in Ukraine from several times per day to once per several weeks (β=2.77/0.23) increases perceived stress levels. Furthermore, lowering the level of self-reported emotional and psychological status from very good to very bad (β=3.94/0.32) is associated with increasing levels of perceived stress. Moreover, the level of perceived stress decreased when relationships with family members stayed the same as they were before the war (β=−1.60/−0.14) or got better (β=−2.35/−0.18) as well as when relationships with colleagues/neighbours got better (β=−2.02/−0.17). Also, participating in Ukrainian religious communities (β=−1.60/−0.13) lowered perceived stress for this group compared with others. Regarding the used coping strategies of Ukrainian female refugees in the Czech Republic, the Final Model could significantly predict that using (more often >2.5) an avoidant coping strategy (β=2.95/0.24) is associated with increasing levels of perceived stress.

4. Discussion

Due to the war, refugees and forced migrants have experienced a wide range of traumatic and stressful situations, which have a long-term negative impact on their mental and physical health and well-being. The objectives of this study were to 1) examine the psychometric qualities of the Ukrainian versions of the PSS-14/10; 2) determine the level of perceived stress; 3) reveal factors associated with perceived stress in the sample of Ukrainian female refugees in the Czech Republic.

4.1. PSS-14 and PSS-10: Ukrainian language versions validity and reliability

The study outcomes support the adequate validity and reliability of both PSS-14 and PSS-10 Ukrainian language versions. Firstly, the results of the EFA suggested that the two-factor solution is appropriate for both Ukrainian versions of PSS-14 and PSS-10, as was reported previously (Andreou et al., 2011; Leung and Tsang, 2010; Smith et al., 2014). The negative-worded items were loaded on the Helplessness factor, while the positive-worded items were loaded on the Self-Efficacy factor. The correlation between the 'Helplessness' factor and the 'Self-Efficacy' factor was weak for both PSS-14 and PSS-10 as $r = 0.14$ and 0.19, respectively, which showed their difference. Then, the bifactor model revealed that the two-factor model fitted mediocre well to PSS-14 and PSS-10. As expected according to other studies results (Juarez-Garcia, A. et al., 2023; Ruisoto et al., 2020; Jovanović and Gavrilov-Jerković, 2015; Lee and Jeong, 2019; Park and Colvin, 2019; Wu, and Amtmann, 2013), the bifactor model demonstrated that all fit indices of the two-factor model reached acceptability criteria in the sample of Ukrainian female refugees in the Czech Republic in both the PSS-14 and PSS-10. Secondly, the reliability estimates of PSS-14/PSS-10 and their two factors (Helplessness and Self-Efficacy) demonstrated good internal consistencies, meeting the cut-off of $\alpha > 0.70$ and $\omega > 0.65$ in this sample. The internal consistency of the Ukrainian language version of PSS-14/PSS-10 measured with Cronbach's α was 0.80/0.78, respectively, comparable to previously reported values (Ruisoto et al., 2020; Lee and Jeong, 2019). The reliability estimates of PSS-14/PSS-10 and their two subfactors were consistent with those in previous studies (Jovanović and Gavrilov-Jerković, 2015; Park and Colvin, 2019).

Moreover, the external consistency was checked by analysing correlations of the PSS-14/PSS-10, their two factors ('Helplessness' and 'Self-Efficacy') scores, BRIEF-COPE (three-factor structure: problem-focused, emotion-focused, avoidant), self-reported physical health and self-reported emotional and psychological status. The outcomes showed that the higher the perceived stress, the higher the possibility for the respondent to employ an avoidant coping strategy, which is like other studies (Najam and Aslam, 2010; Doron et al., 2014; Thai et al., 2021). Furthermore, the analysis of the PSS factors revealed that the higher the 'Self-efficacy', the higher the possibility that the participant will apply a problem-focused strategy, and reversely, the higher the factor of 'Helplessness', the more possibility the participant will use an avoidant coping strategy. Additionally, there were strong positive correlations between perceived stress and self-reported emotional and psychological status and positive correlations with self-reported physical health. The higher level of perceived stress is related to worse self-reported physical and especially mental health, which was also proved in other studies (Bovier et al., 2004; Jankovic-Rankovic et al., 2022).

4.2. Perceived stress and associated factors in a sample of Ukrainian female refugees in the Czech Republic

The findings highlight that most of the Ukrainian females from this sample experienced moderate to severe stress levels due to full-scale war

and forced migration to the Czech Republic. The results obtained indicate a similar mean level of perceived stress in Ukrainian female refugees in the Czech Republic (PSS-14 score of 31.60 and PSS-10 score of 23.20) compared with Syrian refugee women (PSS-14 score of 31.60) (Atrooz et al., 2023) and Syrian refugee students (PSS-10 score of 23.40) in Jordan (Alhalaiqa et al., 2021).

One of the important discoveries in the social and health sciences over the past few decades has involved the realisation that psychosocial stressors are among the strongest drivers of human health and longevity (American Psychological Association, 2017; Hughes et al., 2017). In our study, high levels of perceived stress were associated with a drastic decrease in self-rated health (from very good to very poor) in a sample of Ukrainians. Also, the level of refugees' perceived stress was higher in those participants who reported worsening health due to the war; this was absent in those respondents who did not find that their health got worse. Moreover, the study showed that decreasing levels of self-reported emotional and psychological status are associated with increasing levels of perceived stress, which was confirmed by other studies where participants who experienced issues with their mental health also showed higher levels of stress (Bovier et al., 2004).

Female refugees who came to the Czech Republic were mainly from big cities and towns (89.8 %) and had employment in Ukraine (73.8 %), but because of forced migration, they lost their workplace and neighbourhood social networks, which additionally resulted in an increasing perceived stress level. Moreover, similar to other studies (Bovier et al., 2004; Bourion-Bédès et al., 2021; Jankovic-Rankovic et al., 2022), we found that the level of perceived stress of participants decreased with increasing social support. For those individuals who lack social support and fail to integrate into the social activities offered for the Ukrainians in the Czech Republic, the level of perceived stress is increasing.

Also, it was supported that there is a negative correlation between low housing quality, such as having a lack of living space and living with strangers, and the perceived stress of female refugees. These outcomes are in line with other studies which supported that stress increases with decreasing income (Cohen and Janicki-Deverts, 2012; Klimešová et al., 2022), as well as that the psychological well-being of refugees is affected by financial and housing insecurity (Porter and Haslam, 2005). Host countries' social policies have to secure housing and first aid necessities at least for vulnerable groups of refugees like women with children, as well as provide support with gaining appropriate employment for other categories because 42,9 % of Ukrainian female refugees from the study declared that it is impossible to find a job.

Additionally, the study revealed the negative correlation between experiencing issues with cultural differences and discrimination with perceived stress. This finding is in line with other studies that have found that females are one of the groups that deal with increasing levels of discrimination and the increased stresses of daily life (Li et al., 2016; Spiritus-Beerden et al., 2021).

Only 27.7 % of female refugees reported registration with family doctors, and half of all participants reported that they did not have enough necessary medical aid. Furthermore, increasing perceived stress was reported by those respondents who reported having given up hope of finding a family doctor, in contrast with those who were still hoping to find one or those referring to UA point. Also, 80.5 % of them admitted a lack of Czech language skills. According to another study of refugees, a lack of language and cultural competency to understand how the healthcare system works may make them subject to discrimination (Lebano, 2020).

The participants more often applied problem-focused coping strategies ($M = 2.79$; SD = 0.54) than emotion-focused coping strategies ($M = 2.31$; SD = 0.46) and avoiding coping strategies ($M = 2.18$; SD = 0.50). Additionally, the study showed that using avoidant coping strategies by Ukrainian female refugees in the Czech Republic is a factor associated with increasing levels of perceived stress, which is consistent with prior research outcomes with student cohorts (Doron et al., 2014; Thai et al., 2021).

Our research findings do not contradict the published results of the socio-epidemiological and nation-level studies reporting on this issue (Gradus research, 2022). Moreover, individuals in the sample were drawn from various regions of Ukraine, including those that had seen the most vicious hostilities directed at the civilian population (Kyiv metropolis region, Mariupol, etc.) and where actions against Ukrainians that have been characterised as genocide (Azarov, Koval, Nuridzhanian, and Venher, 2023) were committed. As refugee status is a potential determinant of health by itself, coupled with the original distress from not living in their own homes, it also adds to the cumulative load of stress due to the strains associated with the residence disruption, difficulties of the trajectory of movement from Ukraine and the stresses of organising one's new life outside of Ukraine post-migration. It is, therefore, plausible that the number of objective stressors individuals in the sample have been exposed to were of such nature and in such abundance that they became conducive to the intensified levels of perceived stress.

The main findings of this study are the factors associated with perceived stress. On the one hand, a decrease in self-reported physical and mental health statuses, worsening health due to the war, low housing quality, financial disadvantages, experience of cultural differences issues and discrimination, healthcare access inequalities, lack of Czech language skills, failure to integrate into the social activities within Ukrainian community, lack of social support, and applying an avoidant coping strategy are factors associated with forced migration that could increase perceived stress in the sample of Ukrainian female refugees. On the contrary, the level of perceived stress of participants could decrease with increasing social support, including such factors as regular communication with relatives and friends who are staying in Ukraine and having good relations with loved ones, friends, and locals.

To the best of our knowledge, the present study, up to now, is the first to investigate the psychometric properties of the Ukrainian language version PSS-14 and PSS-10 in the Ukrainian female refugee population in the Czech Republic and to measure the associations of some social factors and coping strategies with perceived stress. Nonetheless, it is important to note a few limitations. The study was cross-sectional, so cause-effect relationships could not be established. Participation in the study was restricted to females with digital skills who were able to use online questionnaires. Further analysis, including in-depth interviews with Ukrainian female refugees in the Czech Republic, will be conducted to triangulate the data, including senior women with low-level digital skills. While social desirability bias may also exist in self-reporting, the current study used some strategies to reduce it, such as forced-choice items, anonymity, and self-administered questionnaires.

5. Conclusion

Both Ukrainian versions, PSS-14 and PSS-10, are suitable, however, PSS-10 is more applicable. Despite good internal consistency for the total scale, the PSS-14/10 measures two aspects: perceived 'Helplessness' and perceived 'Self-efficacy', so future studies will analyse the two subscales separately. Most of the Ukrainian females from this sample experienced moderate to severe stress levels due to full-scale war and forced migration. Moreover, the study found factors such as deterioration of self-reported physical and mental health statuses, financial and housing disadvantages, experiencing discrimination and cultural differences issues, and healthcare access inequalities associated with increasing perceived stress, as well as factors such as social support, positive relationships with family members, colleagues, neighbours and locals, integration into the social activities offered for the Ukrainian refugees in the Czech Republic associated with decreasing perceived stress.

This study emphasised the necessity of psychosocial support services to lower Ukrainian female refugees' perceived stress levels during their stay in the host country. The outcomes may assist in the improvement and development of interventions designed to help female refugees cope

with stress.

Abbreviations

PSS: Perceived stress scale; BRIEF-COPE: Coping Orientation to Problems Experienced Inventory (28 items); EFA: Exploratory factor analysis; CFA: Confirmatory factor analysis; CFI: Comparative fit index; GFI: Goodness-of-fit index; RMSEA: Root mean square error of approximation; SRMR: Standardized root mean square residual.

Data availability

The data will be available upon reasonable request. Third parties may not be provided access to data if doing so would violate applicable EU data protection laws as well as national data protection laws in the project's member nations. The process can be started by interested researchers contacting Iryna Mazhak.

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CRediT authorship contribution statement

Iryna Mazhak: Writing – review & editing, Writing – original draft, Validation, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation. **Kateryna Maltseva:** Writing – review & editing, Formal analysis, Conceptualization. **Danylo Sudyn:** Writing – review & editing, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

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