ORIGINAL ARTICLE

CONTENTS

Analysis of the impact of traumatic stress on the health of children and adolescents

Hanna O. Shlieienkova[1], Mykhailo M. Cherkashyn[1], Kostiantyn V. Voloshyn[1], Olga O. Rzhevska[1,2], Oksana M. Tsiura[1], Natalia S. Shevchenko[1]

[1]V.N. KARAZIN KHARKIV NATIONAL UNIVERSITY, KHARKIV, UKRAINE;

[2]PRIVATE INSTITUTION OF HIGHER EDUCATION «KYIV MEDICAL UNIVERSITY», KYIV, UKRAINE

ABSTRACT

Aim: To analyze the health status of children and adolescents depending on the severity of traumatic stress.

Materials and Methods: The study involved 105 children and adolescents (mean age [mean ± standard deviation] 11,3±2,7; 48 [45,7%] boys and 57 [54,3%] girls), who suffered to some extent from the Russian army's invasion of Ukraine. The respondents' mental and somatic states were assessed using the Child Traumatic Stress Scale – Pediatric Traumatic Stress Screening Tool (PTSST) and the Children's Somatic Symptoms Inventory (CSSI-24).

Results: According to the screening data on the PTSST, 42,9% of children presented with a moderate risk, and 40,0% with a high risk of developing post-traumatic stress reaction (PTSR) (83% in total). We revealed a trend towards an increase in the PTSST score with respect to the increase in the stress burden per participant. The PTSST score was comparable between children who remained in the fighting zone and those who left and live abroad. The CSSI-24 data suggested that 44,8% of children had somatic symptoms of high or moderate intensity. Gastrointestinal complaints were identified more often than others and had a pronounced degree of severity. A strong direct correlation was revealed between PTSST and CSSI-24 scores ($\rho=0,726$; $p<0,05$).

Conclusions: The mental state of children was characterized by the risk of developing PTSR in more than 80% of children. A strong direct correlation between the level of traumatic stress reaction and the severity of somatic complaints indicates a high risk of developing somatic diseases as a result of the stress experienced.

KEY WORDS: health status, traumatic stress, mental state

Wiad Lek. 2025;78(6):1059-1065. doi: 10.36740/WLek/207365 DOI

INTRODUCTION

After the invasion of Ukraine by Russian invaders, many families with children were forced to flee abroad or to relatively safe regions of Ukraine. More than 1.5 million children are among those who have left [1, 2]. Forced displacement puts adults and children at increased risk of somatic and mental disorders. Numerous international organizations are working to solve this problem, including the World Health Organization, which created the project «Health emergency in Ukraine and refugee-receiving and -hosting countries, stemming from the Russian Federation's aggression», which provides medical care to refugees in need [3]. At the same time, a large number of children and adolescents have remained and continue to live in the regions under constant attack and shelling by the occupiers.

The majority of the war-affected population has negative consequences from the impact of stress on mental health [4-6]. For example, according to German researchers, 45,0% of children who left Ukraine for Germany after the outbreak of war have clinically significant signs of post-traumatic stress reaction (PTSR) and need professional help [7-8]. In their publications, doctors from Israel point out that more than half of the children who were forced to move from the war zone have general mental health problems [9]. Among refugees who have moved to Poland, 73,0% of respondents have PTSR [10].

In addition, the current situation has a negative impact not only on the mental but also on the somatic health of children and adolescents [11-13]. It is known that stress has a negative impact on the functional state of many organs and systems, which, on the one hand, may be due to the direct influence of hormones and neurotransmitters on the function of a particular organ, and on the other hand, to changes that occur during PTSR [14, 15]. For example, according to some researchers, during PTSR, limbic instability and changes in the hypothalamic-pituitary-adrenal and sympathetic-adrenal medullary axes occur, which in turn affects neuroendocrine and immune functions and causes dysregulation of the autonomic nervous system [16].

These factors lead to complaints from the child's somatic state, which can be a manifestation of both a pure stress response and a manifestation of a functional or organic disease [17,18].

Given the continuing impact of stress on children and adolescents in Ukraine, there is a need for a detailed analysis of their mental and physical health.

AIM

The aim of the study was to analyze the health status of children and adolescents depending on the severity of traumatic stress.

MATERIALS AND METHODS

The multicenter study involved 105 children and adolescents aged 8 to 17 years (average age [mean ± standard deviation] 11,3 ± 2,7 years, of whom (relative frequency [%] ± standard error) 45,7 ± 4,9 % (n=48) were boys and 54,3 ± 4,9 % (n=57) were girls, who were affected to varying degrees by the Russian army's invasion of Ukraine.

We analyzed the social and demographic characteristics: city of residence of the child at the time of the research (the area where the shelling continues, a relatively safe region of Ukraine or the European Union [EU] countries); food and/or drinking water shortages experienced during the war; staying in a bomb shelter for more than three days; and prolonged separation from close family members (as well as the total number of influencing factors). At the time of the survey, 21,9 ± 4,0 % (23/105) lived in Ukraine in relatively safe regions; 30,5 ± 4,3 % (32/105) lived in regions of Ukraine where shelling continued; and 47,6 ± 4,9 % (50/105) lived in EU (Table 1).

To assess the mental status of the respondents, a screening for childhood traumatic stress was conducted using the Child Traumatic Stress Scale – Pediatric Traumatic Stress Screening Tool (PTSST), developed by researchers in Utah and widely used around the world [19]. This questionnaire allows us to assess the level of traumatic stress disorder in points. Thus, the total number of points in the range from 0 to 10 indicates a mild risk or no risk of PTSR, from 11 to 20 – a moderate risk, and ≥21 – a high risk of developing PTSR.

The CSSI-24 (Children's Somatic Symptoms Inventory) scale was used to assess somatic symptoms, which measures the severity of somatic symptoms experienced by children and adolescents. The CSSI-24 measures 24 common symptoms from 0 to 4 in a form that is easy for children or parents to use. According to clinical guidelines [20], the total CSSI-24 score should be interpreted as follows: <18 – low; 19-31 – moderate; and ≥32 – as high. In addition, the CSSI-24 scale, according to the authors' recommendations, allows the division of somatic complaints into four main groups: gastro-, cardio-, pain/weakness, and pseudo-neurological complaints [20].

In Ukraine, the survey was conducted in general schools after obtaining written consent from parents or guardians. In other countries (Great Britain, Germany), the survey was conducted in support centers for Ukrainian refugees.

The statistical data analysis was carried out by the use of Statistica v. 14.0 (TIBCO Software Inc., USA), IBM SPSS Statistics v. 27.0 (Armonk, NY: IBM Corp., USA) and EZR v. 1.68. Quantitative data were presented as M ± SD, where M – mean, SD – standard deviation; or Me (IQR), where Me – median, IQR – interquartile range (first and third quartiles). Qualitative data were presented as absolute and relative (%) frequency with a standard error. The quantitative characteristics of two independent samples were compared using the Mann-Whitney U test. The Kruskal-Wallis test was used to compare the quantitative characteristics of four independent samples, with the following a posterior comparison between the study groups using the Mann-Whitney U test (considering the Bonferroni correction). The correlation analysis was performed using Spearman's rank correlation coefficient (ρ). A p-value <0,05 was considered as statistically significant (considering the Bonferroni correction).

ETHICS

The authors adhered to the principles contained in the Declaration of Helsinki and its latest amendments. All the participants gave oral and written voluntary informed consent for examination, tests, treatment, operation, analgesia and data processing (up to 14 years of age, the consent was signed by parents, after 14 years of age – by children). The work with participants was prepared and carried out in accordance with the principles of bioethics. The permission to conduct the study and the study protocol were approved of by the bioethics committee of the V.N. Karazin Kharkiv National University.

RESULTS

According to the screening data on the Child Traumatic Stress Scale – Pediatric Traumatic Stress Screening Tool, the average PTSST score for the entire sample was 19 (14-22) points, of which 17,1±3,7 % (18/105) of children had a score of from 0 to 10 points, which corresponded to a mild degree of childhood traumatic

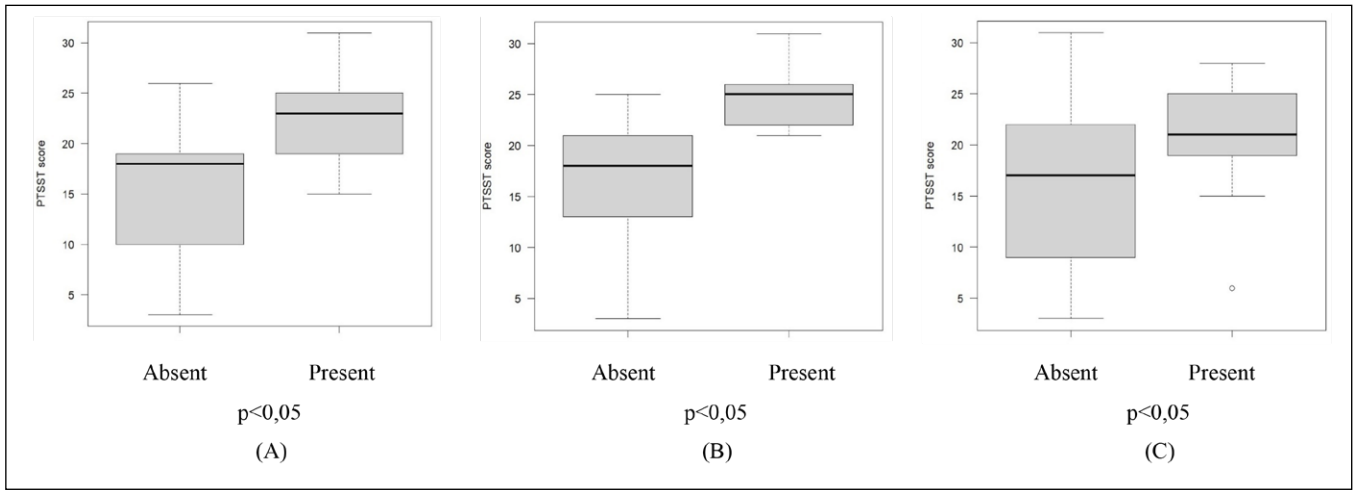

Fig. 1. The level of stress (by PTSST score) according to the presence of certain stressful factors among the enrolled children/adolescents (A – factor «Stayed in the bomb shelter for more than three days»; B – factor «Have experienced food and/or drinking water shortages»; C – factor «Witnessed the shelling and destruction of their hometown»; box-and-whisker plots)

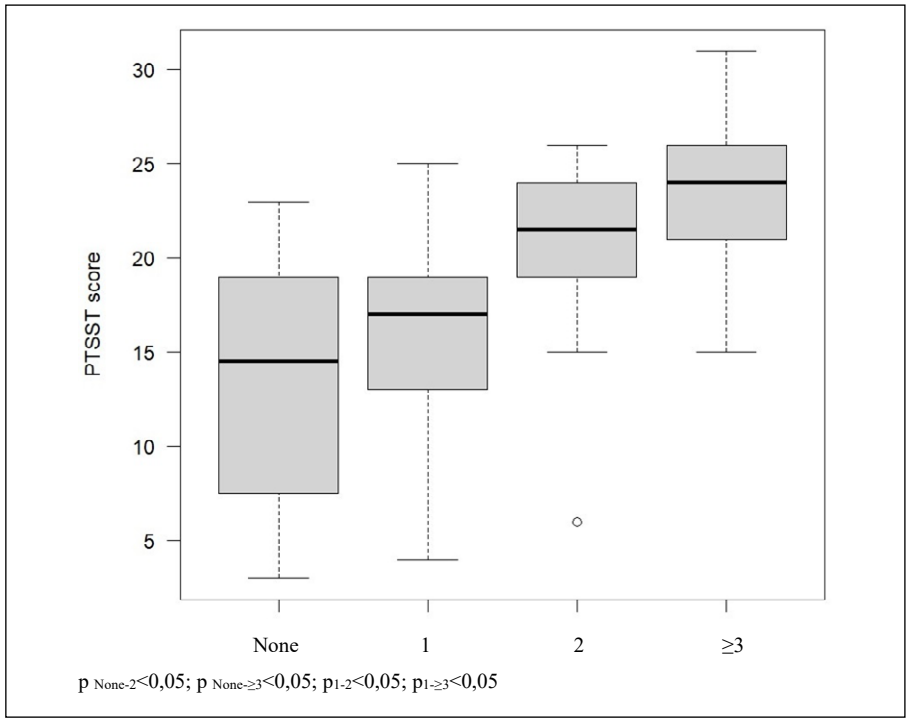

Fig. 2. The level of stress (by PTSST score) according to the number of stressful factors per participant (none, 1, 2 and ≥3; box-and-whisker plot). p_{None-2} – the significance of difference between «none» and «2» factors groups; $p_{None-\geq 3}$ – the significance of difference between «none» and «≥3» factors groups; p_{1-2} – the significance of difference between «1» and «2» factors groups; $p_{1-\geq 3}$ – the significance of difference between «1» and «≥3» factors groups. ρ = 0,633 (p<0,05 [n=105])

stress; 42,9 ± 4,8 % (45/105) from 11 to 20 points – an moderate degree of traumatic stress; 40,0 ± 4,8 % (42/105) above 21 points – a high degree of traumatic stress. Thus, more than 80 % of children were at risk of developing PTSR. In addition, boys and girls demonstrated the comparable PTSST score: 19 (13-22) vs. 19 (17-23), respectively (p=0,12).

When analyzing the relationship between the socio-demographic living conditions and traumatic stress indicators, we found that children who had been in the shelter for more than three days, who had experienced a shortage of food and/or drinking water, and those who witnessed the shelling and destruction of their hometown, had significantly higher levels of stress, as compared to their factor-free counterparts (Fig. 1). Moreover, we revealed a clear trend towards the rise of PTSST score with respect to the increase in the stressors burden per participant, indicating the growing need of psychological assistance at the background of stressful factors cumulation (Fig. 2).

When comparing PTSST score among children living in regions where shelling continues, children who have moved abroad, and children living in relatively safe regions of Ukraine, an interesting fact was revealed: the level of stress was almost the same for those who remained in the fighting zone and those who left and live abroad (19 [17-24] and 19 [15-23], respectively; p=0,96). At the same time, children living in relatively

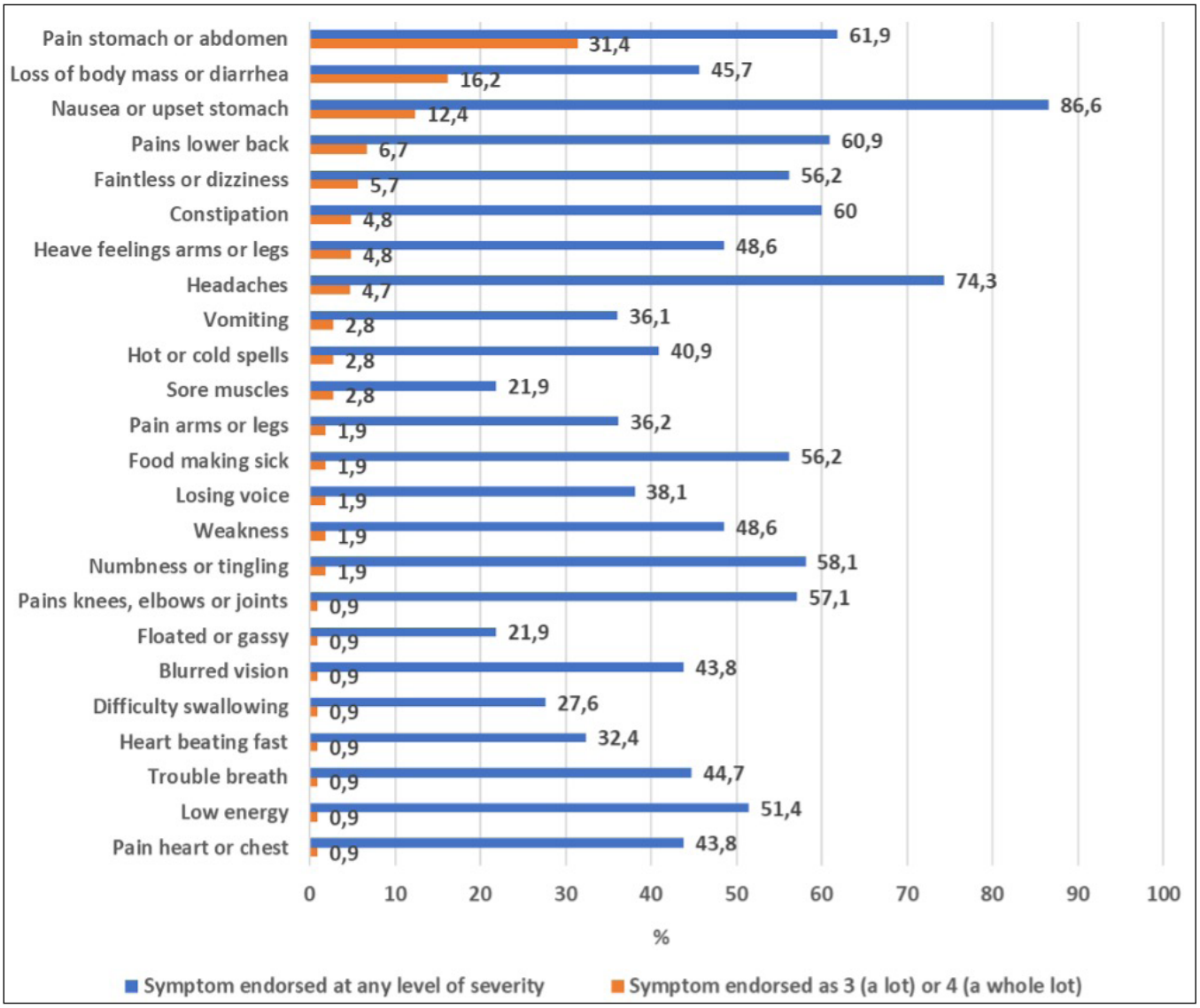

Fig. 3. The frequency of 24 CSSI-24 indicators at any level of severity, and with severity of 3-4 levels among the enrolled children (n=105)

Table 1. The social and demographic characteristics of the participants (n=105)

Parameters		n	% ± SE
Sex	Boys	48	45,7 ± 4,9
	Girls	57	54,3 ± 4,9
Have experienced food and/or drinking water shortages		18	17,1 ± 3,7
Stayed in the bomb shelter for more than three days		34	32,4 ± 4,6
Witnessed the shelling and destruction of their hometown		39	37,1 ± 4,7
Had a long separation from close family members		53	50,5 ± 4,9
The number of influencing factors per participant	None	28	26,7 ± 4,3
	1	30	28,6 ± 4,4
	2	30	28,6 ± 4,4
	3	14	13,3 ± 3,3
	4	3	2,8 ± 1,6
Living status	Reside in Ukraine in relatively safe regions	23	21,9 ± 4,0
	Reside in regions where shelling continues	32	30,5 ± 4,5
	After the outbreak of war left for the EU countries	50	47,6 ± 4,9

Note: SE – standard error

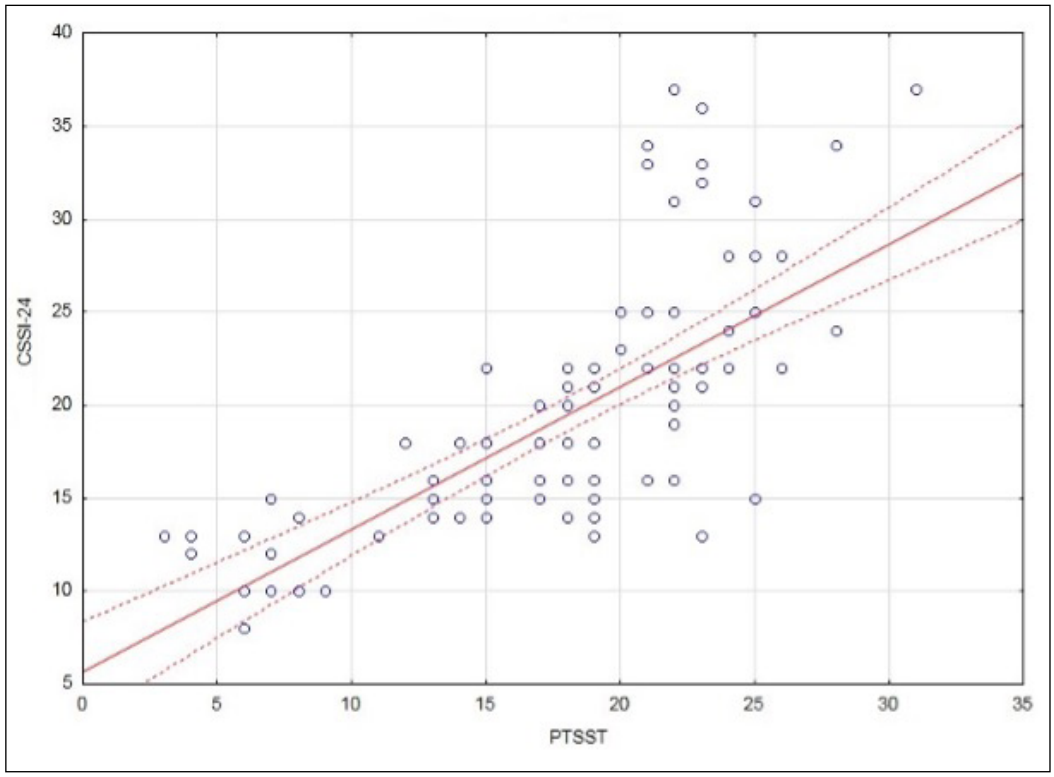

Fig. 4. The correlation between PTSST and CSSI-24 scores (dashed lines – 95 % confidence interval limits)

safe regions of Ukraine demonstrated significantly lower PTSST score (14 [8-19]) as compared to those living in regions with ongoing shelling ($p<0,05$), and a trend towards its lower value as opposed to those moving to EU countries ($p=0,06$).

So, the level of traumatic stress disorder was quite high both among children who went abroad due to the war and among children who did not leave their hometowns. This fact can be explained by the negative impact of forced migration, separation from loved ones and the difficulty of adapting to new conditions [3, 4].

The assessment of somatic symptoms using the CSSI-24 showed that most children had complaints of poor health. Thus, the mean value of the total CSSI-24 score for the entire sample was 20,0 ± 6,56. A high score (≥32) on the somatic symptoms assessment scale was reported by 19,1 ± 3,8 % (20/105) of respondents, a moderate (19-31) – 25,7 ± 4,3 % (27/105), and a low score (0-18) – 55,2 ± 4,9 % (58/105). There was no significant difference in the total CSSI-24 score between boys and girls. More detailed information on the presence and severity of each CSSI-24 indicator is provided in Fig. 3.

According to the results of the analysis, children noted gastrointestinal disorders more often than other somatic complaints during the questionnaire. Among the somatic complaints, pain in the stomach or abdomen, loss of body mass or diarrhea and nausea or upset stomach. Moreover, these complaints had a 3-4 degree of severity (Fig. 1). This fact can be explained by the existence of a close relationship between the functional state of the gastrointestinal tract and the psychological state. Thus, according to the literature, negative psychological states can affect immunity by changing the intestinal microbiome. The intestinal microbiota is important for human health, playing a specific role in the bidirectional communication between the gastrointestinal tract and the central nervous system. In turn, disturbances in the development of the intestinal microbiota can affect the state of the nervous system and potentially lead to adverse consequences for mental health [21].

In addition to the negative impact of stress on the intestinal microbiota, it is impossible to exclude the fact that changes in the usual diet and disturbances in the eating regimen affect the gastrointestinal tract of children who have suffered from military conflict.

The Spearman's correlation analysis revealed a direct strong correlation between PTSST and CSSI-24 scores ($\rho=0,726$; $p<0,05$ [n=105]) (Fig. 4).

Thus, children and adolescents with high scores on the PTSST scale had more numerous and severe somatic complaints, which can be explained both by the negative impact of pathophysiological mechanisms that are activated during stress on the somatic state of the child's body, and by the somatic manifestation of the stress reaction itself.

DISCUSSION

The analysis demonstrated that more than 80 % of the enrolled children and adolescents, who were af-

fected to some extent by the Russian army's invasion of Ukraine, had manifestations of traumatic stress reactions. The reaction of each child to stress is individual and depends on many factors, such as age, gender, economic status of the family, education of the parents, problems of integration into society in the country where the child is forced to live. According to many authors, the development of PTSR is due to many factors, namely negative "stressful experience", individual characteristics and adaptive capabilities of the child [2-3].

It is interesting to note that children, who were forced to leave their homes and went abroad, had almost the same level of PTSR as compared to children who remained in the regions with ongoing shelling. These observations coincide with the opinion of many authors about the negative impact on the mental state of internally displaced persons of such factors as difficult adaptation to a new environment, language barrier, lack of friends, disruption of the usual rhythm of life, limited circle of communication [7, 9, 10].

In addition, in the modern digital world, even children who left Ukraine at an early stage of the war and did not witness hostilities often continue to indirectly experience the conflict through extensive coverage in the media, social media, and communication with family members who remained in Ukraine.

According to the literature, traumatic stress reactions negatively affect the general health of children and adolescents and, if not treated in a timely manner, can lead to somatic diseases [11, 16, 17]. According to the results of our study, almost half of the children had moderate or pronounced somatic symptoms on the CSSI-24 scale.

A clear correlation has been established between the level of traumatic stress reaction and the severity of somatic complaints, which must be taken into account for the timely diagnosis and treatment of mental and somatic disorders.

CONCLUSIONS

1. A high risk of developing health disorders among children affected by the armed conflict in Ukraine has been identified. The mental condition of children was characterized by a risk of developing PTSR in 83 % of children, including a high degree of traumatic stress disorder in 40,0 % of respondents. The simultaneous influence of several negative factors on a child causes a cumulative effect and strengthens the manifestations of PTSR, which must be taken into account when developing tactics for providing psychological assistance to these children.
2. The analysis of the results of the PTSST scale showed a high level of traumatic stress reaction in children, regardless of their place of residence (staying in Ukraine in the regions of ongoing shelling or going abroad).
3. A strong direct correlation between the level of traumatic stress reaction and the severity of somatic complaints indicates a high risk of somatic diseases due to stress, which is the basis for additional medical examination of children at increased risk of developing PTSR.

REFERENCES

1. The Lancet Child Adolescent Health. Children: innocent victims of war in Ukraine. Lancet Child Adolesc Health. 2022;6(5):279. doi: 10.1016/S2352-4642(22)00102-X. DOI
2. Beyrer C. Assessing the Impact of Russia's Invasion of Ukraine on Health Services: Crimes of War. JAMA Health Forum. 2024;5(5):e240924. doi: 10.1001/jamahealthforum.2024.0924. DOI
3. Hodes M. Thinking about young refugees' mental health following the Russian invasion of Ukraine in 2022. Clin Child Psychol Psychiatry. 2023;28(1):3-14. doi: 10.1177/13591045221125639. DOI
4. Khailenko O, Bacon AM. Resilience, avoidant coping and post-traumatic stress symptoms among female Ukrainian refugees and internally displaced people. Int J Soc Psychiatry. 2024;70(6):1164-1174. doi: 10.1177/00207640241264662. DOI
5. Ben-Ezra M, Goodwin R, Leshem E et al. PTSD symptoms among civilians being displaced inside and outside the Ukraine during the 2022 Russian invasion. Psychiatry Res. 2023;320:115011. doi:10.1016/j.psychres.2022.115011. DOI
6. Johnson RJ, Antonaccio O, Botchkovar E et al. War trauma and PTSD in Ukraine's civilian population: comparing urban-dwelling to internally displaced persons. Soc Psychiatry Psychiatr Epidemiol. 2022;57(9):1807-1816. doi: 10.1007/s00127-021-02176-9 DOI
7. Bürgin D, Anagnostopoulos D, Board and Policy Division of ESCAP et al. Impact of war and forced displacement on children's mental health-multilevel, needs-oriented, and trauma-informed approaches. Eur Child Adolesc Psychiatry. 2022;31(6):845-853. doi: 10.1007/s00787-022-01974-z. DOI
8. Zasiekina L, Duchyminska T, Bifulco A et al. War trauma impacts in Ukrainian combat and civilian populations: Moral injury and associated mental health symptoms. Mil Psychol. 2024;36(5):555-566. doi: 10.1080/08995605.2023.2235256. DOI
9. Kapel Lev-Ari R, Aloni R, Ari AB. Children Fleeing War-Exploring the Mental Health of Refugee Children Arriving in Israel after the Ukraine 2022 Conflict. Child Abuse Negl. 2024;149:106608. doi: 10.1016/j.chiabu.2023.106608. DOI
10. Rizzi D, Ciuffo G, Sandoli G et al. Running Away from the War in Ukraine: The Impact on Mental Health of Internally Displaced Persons (IDPs) and Refugees in Transit in Poland. Int J Environ Res Public Health. 2022;19(24):16439. doi: 10.3390/ijerph192416439. DOI

11. Armitage R. War in Ukraine: the impacts on child health. Br J Gen Pract. 2022;72(719):272-273. doi: 10.3399/bjgp22X719621. DOI
12. Chudzicka-Czupała A, Hapon N, Chiang SK et al. Depression, anxiety and post-traumatic stress during the 2022 Russo-Ukrainian war, a comparison between populations in Poland, Ukraine, and Taiwan. Sci Rep. 2023;13(1):3602. doi: 10.1038/s41598-023-28729-3. DOI
13. Thabet AA, Abed Y, Vostanis P. Comorbidity of PTSD and depression among refugee children during war conflict. J Child Psychol Psychiatry. 2004;45(3):533-542. doi: 10.1111/j.1469-7610.2004.00243.x. DOI
14. Stone AL, Epstein I, Bruehl S et al. Twenty-year Outcomes of a Pediatric Chronic Abdominal Pain Cohort: Early Adulthood Health Status and Offspring Physical and Behavioral Health. J Pain. 2023;24(1):145-156. doi: 10.1016/j.jpain.2022.09.007. DOI
15. Lynch T, Davis SL, Johnson AH et al. Definitions, theories, and measurement of stress in children. J Pediatr Nurs. 2022;66:202-212. doi:10.1016/j.pedn.2022.07.008. DOI
16. Gupta MA. Review of somatic symptoms in post-traumatic stress disorder. Int Rev Psychiatry. 2013;25(1):86-99. doi:10.3109/09540261.2012.736367. DOI
17. Pinto RJ, Vieira de Castro M, Correia-Santos P et al. The mediating role of posttraumatic stress symptoms on somatization in adolescents: A two-wave longitudinal study. Psychol Trauma. 2023;15(1):S47-S54. doi: 10.1037/tra0001331. DOI
18. Lee RY, Oxford ML, Sonney J et al. The mediating role of anxiety/depression symptoms between adverse childhood experiences (ACEs) and somatic symptoms in adolescents. J Adolesc. 2022;94(2):133-147. doi: 10.1002/jad.12012. DOI
19. Keeshin B, Byrne K, Thorn B et al. Screening for Trauma in Pediatric Primary Care. Curr Psychiatry Rep. 2020;22(11):60. doi: 10.1007/s11920-020-01183-y. DOI
20. Walker LS, Beck JE, Garber J et al. Children's Somatization Inventory: psychometric properties of the revised form (CSI-24). J Pediatr Psychol. 2009;34(4):430-440. doi:10.1093/jpepsy/jsn093. DOI
21. Chang H, Perkins MH, Novaes LS et al. Stress-sensitive neural circuits change the gut microbiome via duodenal glands. Cell. 2024;187(19):5393-5412.e30. doi:10.1016/j.cell.2024.07.019. DOI

The work is a fragment of research work of the Department of pediatrics of V. N. Karazin Kharkiv National University "To investigate the features of the course of chronic diseases in adolescents in war and post-war conditions and to improve the system of their medical and psychological rehabilitation" (№ state registration 0119U102002; deadline: 2024-2026).

CONFLICT OF INTEREST

The Authors declare no conflict of interest

CORRESPONDING AUTHOR

Hanna O. Shlieienkova

V.N. Karazin Kharkiv National University
52a Yuvileyny Ave., 61024 Kharkiv, Ukraine
e-mail: shleenkova@karazin.ua

ORCID AND CONTRIBUTIONSHIP

Hanna O. Shlieienkova: 0000-0001-9775-4324 A D
Oksana M. Tsiura: 0000-0001-8245-015X B
Natalia S. Shevchenko: 0000-0003-4407-6050 F
Kostiantyn V. Voloshyn: 0000-0001-8262-5159 C
Mykhailo M. Cherkashyn: 0009-0005-8163-5976 B
Olga O. Rzhevska: 0000-0002-6410-7769 E

A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval of the article

RECEIVED: 09.02.2025
ACCEPTED: 02.06.2025