Influence of Stress Factors on the Development of Post-Traumatic Stress Disorder in Children: Risk Factors

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Abstract: In the current conditions of the ongoing war in Ukraine, which began in February 2022, Ukrainian children might develop post-traumatic stress disorder (PTSD) due to stress factors caused by the conflict between Ukraine and Russian-backed separatist forces, along with the Russian military. In particular, the relationship between reduced emotional intelligence and the development of post-traumatic stress disorder in children has become more relevant. This study aimed to assess structural and cognitive changes in children with PTSD and their relationship to depression, anxiety, and event segmentation.

The study methods included clinical interviews (CAPS-CA-5 scale), neuropsychological tests (short-term and long-term memory tests), self-assessment questionnaires (standardised CDI, RCADS and SCAS-Child scales), and a single-shotMRI. The results showed that patients with post-traumatic stress disorder had reduced hippocampal volume ($p=0.018$) and the volume of cingulate cortex isthmus ($p=0.026$). Diffusion in the cerebellum-hippocampal tract was reduced ($p=0.014$). The level of depression was positively correlated with hippocampal volume ($r=0.32$, $p=0.021$) and anxiety with the volume of cingulate cortex isthmus ($r=0.26$, $p=0.048$).

These results emphasise the importance of the relationship between structural changes and levels of depression and anxiety in patients with PTSD.

Prospects for further research are based on the study of the long-term effects of psychotherapeutic interventions aimed at improving cognitive function in patients with posttraumatic stress disorder.

Keywords: Emotional intelligence, post-traumatic stress disorder, psychological trauma, stress factors, child psychiatry, traumatic events, child development.

1. INTRODUCTION

The ongoing conflict in Ukraine, which began in February 2022, has had a profound impact on the psychological well-being of the country's population, especially its children. This war, marked by widespread destruction, displacement, and loss of life, has created an environment where stress factors are omnipresent. Ukrainian children, exposed to the horrors of war for over a year, face the risk of developing post-traumatic stress disorder (PTSD) due to the sustained psychological trauma. The exposure varies across different regions, with children living closer to the epicenters of conflict, such as the eastern regions and areas under frequent bombardment, facing the most severe and direct forms of trauma.

Before the onset of the conflict, many of these children lived in relatively stable conditions, attending school regularly, engaging in social activities, and enjoying a sense of normalcy. However, the war has disrupted these conditions drastically. Families have been uprooted, with many seeking refuge in safer regions or neighboring countries, while others remain in war-torn areas, enduring daily threats to their lives. This sudden shift from stability to constant insecurity and fear has created fertile ground for the development of PTSD among these children.

The study aimed to explore the relationship between reduced emotional intelligence and the onset of PTSD in Ukrainian children, emphasizing the importance of understanding structural and cognitive changes in the brain as a result of sustained exposure to war-related stress. Specifically, the research focuses on assessing the impact of PTSD on brain structures, such as the hippocampus and cingulate cortex isthmus, and how these changes correlate with symptoms of depression, anxiety, and difficulties in event segmentation.

The research was conducted in areas severely affected by the war, including frontline regions and areas with high numbers of internally displaced persons (IDPs). The children involved in the study had been living under the shadow of war for varying lengths of time, with some exposed since the conflict's inception and others for shorter periods. The proximity of these children to the conflict zones and the varying degrees of exposure to traumatic events provided a diverse sample for understanding the impact of war on their mental health.

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PTSD is a severe mental illness that occurs as a result of experiencing a traumatic event [1]. This disorder affects both the emotional state of the victim and their cognitive functions, including memory [2]. PTSD affects a significant proportion of the population, causing suffering to millions of people around the world. According to the World Health Organization, 3% to 4% of the world's population may experience PTSD at some point in their lives [3].

Investigating the impact of PTSD on memory is of strategic importance for understanding the full range of its consequences [4, 5]. In addition to emotional discomfort, memory impairment is a significant aspect that requires additional attention and research. Understanding the mechanisms through which PTSD affects memories can help to develop more effective treatments and support for survivors [6, 7]. Not all people who experience a traumatic event automatically develop PTSD [8]. This disorder can manifest in response to events where the sense of security is disturbed, and the individual cannot adapt to what is happening.

Studying the impact of PTSD on memories raises questions about how these biological and psychological processes interact in everyday situations [9, 10]. Understanding these relationships can increase our knowledge of PTSD and help to develop targeted intervention strategies to alleviate the burden.

However, there are still several unresolved issues regarding the impact of stressors on the development of PTSD in children. The relevance of studying the effects of PTSD on cognitive functions remains among the most at-risk group - children - as traumatic situations can be a source of stress for a child [11]. Analysing the impact of PTSD on children's psyche in this context broadens the understanding of the disorder. It provides a basis for developing personalised approaches to the treatment and rehabilitation of those who have experienced traumatic situations.

1.1. Limitations of the Study

The small sample size may limit the generalizability of the results. Participants may not be fully representative of the diversity of patients with PTSD, which may also affect external validity. The measurement methods used have some limitations. Therefore, more diverse approaches to testing cognitive function may be included in future studies.

This study aims to investigate the impact of stress factors on the development of PTSD in children.

1.2. Research Objectives

1. To identify the impact of PTSD on children's cognitive function and memory.

2. To assess whether the diagnosis of PTSD affects event segmentation in children's memory.

2. LITERATURE REVIEW

Since the beginning of the full-scale invasion, the study of the impact of stress factors on the development of PTSD, in children in particular, has intensified. Previous research conducted in Germany was based on an experimental study of the impact of war on children's psyche and the causes of psychological traumas [12]. The results of this survey show the long-term effects of war on children’s mental health and well-being. Also, acute stress reaction can develop into severe mental disorders that require immediate psychotherapeutic intervention.

Studies have linked PTSD to changes in brain function, including hyperactivation of the amygdala, which is responsible for processing fear perceptions, and disruption of the hippocampus, a key node in memory formation and retention [13, 14]. The study by Kang *et al*. examines the neurobiological features of PTSD in refugee children [1]. They proved that the development of PTSD, as well as depressive disorder, is explained by a violation of the chemical metabolism between neurotransmitters in the brain.

The results of a study by [15] show that teaching people effective stress management and stress resilience can reduce the likelihood of developing PTSD. Social support from family, friends and society can play an essential role in reducing the risk of developing PTSD after a traumatic event.

Effective methods of treating PTSD are being actively researched around the world. For example, [16] see cognitive behavioural therapy (CBT) as one of the most effective methods, as it aims to change negative thoughts and behavioural reactions associated with trauma. In contrast, another study analyses the effectiveness of eye movement desensitisation and reprocessing (EMDR), which involves using bilateral eye stimulation, such as eye movements, to process traumatic memories [17].

The study by [18] focuses on the characterisation of emotional anticipation of the future in people with PTSD. Participants with current or previous PTSD remember past events worse and have difficulty describing them than the group without PTSD. The severity of PTSD symptoms correlated with the amount of internal detail in descriptions of future events, with this relationship being relatively weaker for intrusion symptoms.

A study by [19] assessed the relationship between hypothalamic volumes, adverse childhood experiences (ACE), and the development of posttraumatic stress disorder (PTSD) following adult trauma. Participants who developed PTSD 12 months after the trauma had reduced right hypothalamic volumes as early as 2 weeks after the trauma.

A study by [20] focused on spatial processing in people with PTSD and associated changes in the hippocampus and alba. Participants with PTSD showed impairments in the perception and recall of spatially connected scenes, and these impairments were associated with reduced hippocampal volume and changes in alba. The results indicate widespread impairments in spatial processing in people with PTSD, which highlights the importance of studying this aspect of the disorder.

The article by [21] investigates the connection between the dysfunction of the neurotransmitter norepinephrine (NA) and rapid eye movement (REM) sleep disorder in veterans with PTSD. The findings provide important insights into the connections between biological mechanisms and PTSD symptoms. They may also stimulate the search for clinical biomarkers based on brain function and the development of new pharmacotherapies for PTSD.

Based on these analyses of sources from different countries [15-21], it can be concluded that the peculiarities of the cause of PTSD in adults are actively studied. However, the impact of stress factors on the development of PTSD in children is insufficiently explored, which indicates the relevance and necessity of this research.

2.1. Definitions of Key Terminologies

To provide a clearer understanding of the study's context and findings, it is essential to define key terminologies used throughout the research. These concepts are fundamental to interpreting the results and grasping the significance of the relationship between cognitive and structural changes in the brain and the development of PTSD in children.

PTSD is a mental health condition that can develop after an individual experiences or witnesses a traumatic event, such as war, natural disasters, serious accidents, or violent personal assaults. In children, PTSD manifests through various symptoms, including intrusive memories, nightmares, flashbacks, and severe anxiety. They may also exhibit emotional numbness, difficulty concentrating, and increased irritability or aggression. PTSD can significantly impair a child's ability to function in daily life, affecting their academic performance, social interactions, and overall development. In the context of the ongoing war in Ukraine, children are at a heightened risk of developing PTSD due to their continuous exposure to traumatic events, such as bombings, displacement, and loss of loved ones.

Event segmentation refers to the cognitive process by which individuals perceive, interpret, and organize continuous experiences into discrete events. This process is crucial for understanding and remembering complex sequences of actions and occurrences. Effective event segmentation allows individuals to better encode and recall experiences, which is essential for learning and decision-making. In children with PTSD, however, the ability to segment events may be impaired due to the overwhelming nature of traumatic experiences. This impairment can lead to difficulties in distinguishing between different events, contributing to the persistence of intrusive memories and flashbacks. Understanding event segmentation in the context of PTSD can provide insights into how trauma disrupts normal cognitive processing.

Short-term memory is the cognitive system responsible for temporarily holding and processing information that is immediately available for use. It plays a critical role in tasks such as following instructions, solving problems, and making decisions. Information stored in short-term memory is typically retained for a brief period, usually seconds to minutes, unless actively rehearsed or transferred to long-term memory. In children with PTSD, short-term memory can be affected by the heightened stress and anxiety associated with the disorder, leading to difficulties in focusing, remembering instructions, or completing tasks. Assessing short-term memory in children exposed to war-related trauma is crucial for understanding how PTSD impacts cognitive functioning.

Long-term memory refers to the system responsible for storing information over extended periods, ranging from hours to a lifetime. It encompasses a vast array of memories, including facts, experiences, skills, and knowledge. Long-term memory is further divided into explicit (conscious) and implicit (unconscious) memory systems. In the context of PTSD, traumatic events are often encoded into long-term memory, where they can persist as vivid and distressing recollections. The relationship between PTSD and long-term memory is complex, as trauma can both enhance the retention of certain memories (e.g., through hypervigilance) and hinder the recall of others (e.g., through avoidance or dissociation). Investigating long-term memory in children with PTSD can help elucidate how traumatic experiences are encoded and retrieved, contributing to the development of therapeutic interventions.

By providing these definitions, the study aims to clarify the cognitive and psychological processes involved in PTSD, particularly in children exposed to the stressors of war. Understanding these key concepts is essential for interpreting the study's findings and appreciating the broader implications for mental health interventions in conflict-affected populations.

3. METHODS AND MATERIALS

3.1. The Research Procedure

The study consisted of three stages. The first stage involved analysing the impact of PTSD on children's cognitive functions and memory. The second stage assessed the effects of PTSD on event segmentation in children's memory. The third stage involved studying how the severity of PTSD symptoms correlates with memory impairment in children's everyday lives. The final analytical stage involved statistical analysis of the data using Statistica software.

3.2. Sampling

The study was conducted in 2023-2024 in Kyiv, Ukraine by paediatricians from Bogomolets National Medical University (Department of Pediatrics#2) and child psychiatrists from the Shupyk National Healthcare University of Ukraine (Department of general, paediatric, forensic psychiatry and narcology).

The empirical study involved 240 children aged 8 to 16 who attended primary and secondary schools in Kyiv. Various characteristics necessary for the study's objectives, including gender, age, and educational criteria, were considered to form the sample (Table **1**).

The sample size made it possible to conduct a comparative analysis between the control and experimental groups with reliable detection of potential differences. This also supports the accuracy of the results when considering subgroups by age, gender and educational level. Children aged 8 to 16 years were selected because of their educational and psychological characteristics, which are critical for the study of PTSD. The diversity of age groups allows us to assess how age affects the manifestations and reactions to PTSD. The sample was formed using a stratified random sampling method, where children were first classified by age, gender, and educational criteria and then randomly assigned to the control and experimental groups. This ensured that the groups

Table 1: Sample Characteristics

Criteria	# Control group	# Experimental group	Total	Average age	SD
Age					
8-10 years old	40	35	75	9	1.0
11-13 years old	35	40	75	12	1.1
14-16 years old	45	45	90	15	1.2
Gender					
Boys	50	40	90	12.5	2.4
Girls	70	80	150	12.5	2.5
Educational level					
Primary school	55	60	115	9	0.8
Secondary school	65	60	125	14	12.0
Total	120	120	240	12.5	2.2

Table 2: Distribution of Respondents by Stages of PTSD

Stage of PTSD	Term	Number of participants
Acute	from the moment of the event to 6 weeks	25
Chronic	from 6 weeks to 6 months	55
Delayed	6 months to several years	40

were equal and similar regarding key characteristics, reducing the possibility of systematic bias in the data. The sample was formed from children from 2 children's medical and psychodiagnostic centres in Kyiv. All methods and MRI scans were performed on children only with the written consent of their parents, who were provided with the necessary explanations and through whom all communication about the study was conducted.

The sample was divided into two groups of 120 participants each: a control group consisting of children without PTSD and an experimental group consisting of children with PTSD, confirmed by a psychiatrist. The study uses a between-group design experiment, in which two groups (control and experimental) are compared for a PTSD diagnosis on the variables under study, such as event segmentation and memory impairment. The distribution of respondents from the experimental group by stages of PTSD is presented in Table **2**.

The participants in the experimental group were studied according to these stages to gain a deeper understanding of the nature and severity of PTSD.

3.3. Research Methods

The tests and surveys were conducted by paediatricians of the Bogomolets National Medical University (Department of Pediatrics#2) and child psychiatrists of the Shupyk National Healthcare University of Ukraine (Department of general, paediatric, forensic psychiatry and narcology) at children's medical and psychodiagnostic centres in Kyiv in 2023-2024.

The *research methods* included the following:

1. *Clinical interview*. A structured clinical interview for the diagnosis of PTSD included questions about the traumatic event, symptoms, and behavioural reactions. Experienced psychotherapists and psychiatrists conducted it. Measured parameters included PTSD diagnosis, event segmentation, and symptom severity. The structured interview, developed by the authors, contains over 20 questions (Appendix A). All questions are designed to be age-appropriate, understandable, and emotionally sensitive to children.

2. *The neuropsychological testing* included tests of short-term and long-term memory (“Ten Words”, “Groups of 3 words”, “Phrases”, “Word List Recall”) (Appendix B), attention (“Proofreading test for children”, “Auditory attention”) (Appendix C) and concentration (“Proofreading test for children”, “Tangled Lines Test” by A. Ray - K. Platonov) (Appendix D). Testing was conducted in specially equipped rooms using computer and non-invasive neuropsychological tests.

3. *Self-assessment questionnaires* included PTSD symptom questionnaires in a version for children and questionnaires assessing subjective experiences and memory impairment. The anonymous surveys were conducted in unique rooms. *The Clinician-Administered PTSD Scale-Child/Adolescent Version (CAPS-CA-5)* is a structured clinical questionnaire designed to diagnose and assess the severity of PTSD symptoms. It includes questions related to the traumatic event as well as symptoms such as re-experiencing, avoidance, and hyperactivity. The CAPS-CA-5 contains over 30 questions covering various aspects of PTSD. The questionnaire is used in the updated version of [22].

4. The levels of depression and anxiety in children to the stage of PTSD were also assessed. To assess the level of depression the updated version of *the Children Depression Inventory (CDI) was used to measure the level of depression in children at each stage of PTSD* [23]. To measure the level of anxiety, we used the *Revised Child Anxiety and Depression Scale (RCADS)*, developed by [24] and the *Spence Children's Anxiety Scale (SCAS-Child)* [25], which provide a comprehensive assessment of anxiety.

5. The brain's Magnetic resonance imaging (MRI) was performed in medical centres using modern equipment. It included a study of the brain structure, focusing on the hippocampus and amygdala. MRI of the brain was performed once for each child with parental consent.

3.4. Statistical Analysis

The statistical analysis for this study was conducted using the "Statistica" software (version 10, StatSoft Inc., USA). The analysis aimed to explore the relationships between the severity of PTSD symptoms, levels of depression and anxiety, and the results of neuropsychological tests, as well as to identify factors contributing to memory impairment.

To examine potential connections between the severity of PTSD symptoms, depression, anxiety, and neuropsychological test results, *correlation analysis* was employed. Depending on the distribution of the data, either Pearson or Spearman correlation coefficients were calculated. Pearson's correlation was used for normally distributed data, while Spearman's correlation was applied for non-normally distributed data. For example, in assessing the relationship between hippocampal volume and depression ($r=0.32$, $p=0.021$, $n=64$, Pearson's correlation), and between cingulate cortex isthmus volume and anxiety ($r=0.26$, $p=0.048$, $n=64$, Spearman's correlation), these coefficients provided insights into the strength and direction of these relationships.

Multiple regression analysis was utilized to identify and authenticate factors that significantly influence memory impairment among children with PTSD. This analysis allowed for the assessment of how various independent variables, such as the severity of PTSD symptoms, levels of depression, anxiety, and structural brain changes, collectively impact short-term and long-term memory performance. The model included variables with significant correlations and adjusted for potential confounding factors, ensuring robust and reliable results.

To explore the underlying structure of memory impairment, *factor analysis* was conducted. This statistical technique helped identify the main components of memory impairment and revealed internal structural dependencies between variables. Factor analysis reduced the complexity of the data by grouping related variables into factors, providing a clearer understanding of the different dimensions of memory impairment in children with PTSD. This method was particularly useful in highlighting the interplay between cognitive and emotional variables.

Analysis of variance (ANOVA) was used to assess differences in psychological and neuropsychological indicators between different stages of PTSD. ANOVA, followed by Tukey's Honest Significant Difference (HSD) post-hoc tests, was employed to determine whether there were statistically significant differences between groups, such as between children with mild, moderate, and severe PTSD symptoms. For example, differences in hippocampal volume across these groups were assessed ($F(2, 61) = 4.32$, $p=0.018$, $n=64$), with post-hoc comparisons indicating significant reductions in volume in children with severe PTSD compared to those with mild symptoms.

In summary, the use of these statistical methods provided a comprehensive analysis of the data, allowing for a deeper understanding of the relationships between PTSD symptoms, cognitive function, and brain structure in children exposed to war-related trauma. By including sample sizes, test types, and specific p-values, the study ensures transparency and allows readers to accurately interpret the statistical findings.

4. RESULTS

Table **3** shows the clinical interview results, represented by three indicators: event segmentation, the diagnosis of PTSD, and the severity of PTSD symptoms. These indicators were measured in the control and experimental groups, for each of which the p-value was also determined.

Table 3: Results of the Clinical Interview

Indicator	Control group (Mean ± St Dev)	Experimental group (Mean ± St Dev)	p-value
Diagnosis of PTSD	5%	25%	0.001
Severity of PTSD symptoms	12.5±3.2	18.3±4.1	0.007
Presence of event segmentation	20%	40%	0.021

Table 4: Results of Neuropsychological Testing

Indicator	Control group (Mean ± St Dev)	Experimental group (Mean ± St Dev)	p-value
Short-term memory	85.6±12.3	76.4±14.5	0.034
Long-term memory	92.8±9.7	84.2±11.2	0.012
Attention and concentration	78.2±15.6	67.9±17.2	0.048

PTSD was diagnosed in 25% of children in the experimental group, while in the control group, this figure was 5%. The event segmentation and severity of PTSD symptoms are also significantly higher in the experimental group (Table **3**).

The results in Table **4** indicate a statistically significant relationship between the different groups (experimental and control) on several measures of cognitive function, including short-term memory, long-term memory, and attention with concentration. P-values of < 0.05 indicate that the probability of such results coinciding by chance is very low, i.e., the results are statistically significant.

The experimental group shows a high level of event segmentation (p=0.003), a degree of memory impairment (p=0.009) and a low assessment of their cognitive functions (p=0.025) compared to the control group (Table **5**). The chi-square test was used to determine the relationship between the degree of event segmentation, memory impairment and subjective assessment of cognitive function. The results also show statistical significance (p<0.05). There is an inverse correlation between PTSD symptom severity and short-term (p=0.021) and long-term memory (p=0.048) in both groups. In addition, there is a positive correlation between symptom severity and event segmentation (p=0.009).

The results of neuropsychological testing showed that children with PTSD have reduced short-term memory scores compared to the control group (t(118) = -2.18, p=0.032). This suggests that significant changes in short-term and long-term memory accompany PTSD in children. The results of neuropsychological tests showed a decrease in the effectiveness of long-term memory in the experimental group compared to the control group (t(118) = -2.67 p=0.012). This confirms the hypothesis that children with PTSD have difficulty retaining and recalling long-term memories (Table **6**).

When analysing the MRI results of the control group participants with PTSD, the following structural features were revealed. Children with PTSD showed a 15% reduction in hippocampal volume compared to the control group (p=0.018). A significant negative correlation was found between hippocampal volume and the severity of PTSD symptoms (r = -0.42, p = 0.034). In children with PTSD, a decrease in the volume of the left and right cingulate cortex by 12% (p=0.026) and 10% (p=0.041), respectively, was found. The analysis of diffusion tensor imaging revealed a decrease in integral diffusion in the cerebellum-

Table 5: Self-Assessment Questionnaires

Indicator	Control group (Mean ± St Dev)	Experimental group (Mean ± St Dev)	p-value
Degree of event segmentation	15.2±4.5	22.8±5.1	0.003
Degree of memory impairment	13.1±3.8	18.5±4.3	0.009
Subjective assessment of cognitive functions	75.6±9.2	62.3±11.7	0.025

Table 6: Correlation between the Severity of PTSD Symptoms and Memory Impairment

Correlation	Control group (Mean ± St Dev)	Experimental group (Mean ± St Dev)	p-value
Symptom severity and short-term memory	-0.32	-0.45	0.021
Symptom severity and long-term memory	-0.26	-0.38	0.048
Symptom severity and event segmentation	0.48	0.61	0.009

hippocampus tract in patients with PTSD (p=0.014). An inverse correlation was found between integral diffusion in this tract and the degree of event segmentation (r = -0.38, p = 0.048).

Event segmentation in children's memory was assessed using structured clinical interviews. The analysis revealed a statistically significant increase in event segmentation in children with PTSD ($\chi^2(1) = 7.56$, p=0.021). This indicates that PTSD can affect the ability to integrate memories into a general picture of events, which in turn can affect everyday memory.

Comparing the overall level of depression and anxiety between the control and experimental groups, the following results were found: the control group had a lower average level of depression (M=15.2, SD=3.5) compared to the experimental group (M=22.4, SD=4.2). The differences are statistically significant (p<0.001). The control group showed a moderate level of anxiety (M=18.6, SD=3.9), while the experimental group had a higher-than-average level of anxiety (M=26.1, SD=5.1). The differences are statistically significant (p<0.001).

In the experimental group by stages of PTSD, it was found that depression depends on the stage of PTSD. The mild stage of PTSD is characterised by a moderate level of depression (M=18.3, SD=3.7), while the moderate stage is characterised by a much higher level of depression (M=25.8, SD=4.5). The differences are statistically significant (p=0.002). The severe stage is characterised by a high level of depression (M=30.1, SD=5.2). The differences are statistically significant (p<0.001).

Similarly, the mild stage is characterised by a moderate level of anxiety (M=20.4, SD=4.1), while the moderate stage has a significantly higher than average level of anxiety (M=27.6, SD=5.6). The differences are statistically significant (p=0.004). The severe stage is characterised by a very high level of anxiety (M=32.5, SD=6.3). The differences are statistically significant (p<0.001).

These results indicate a connection between the stage of PTSD and the level of depression and anxiety in children. Children with severe PTSD are more prone to mental disorders, which require targeted support and therapy.

5. DISCUSSION

The results of the study showed statistically significant differences in neuropsychological tests of short-term and long-term memory, as well as attention and concentration, which indicates cognitive impairment in children with PTSD. The correlation analysis revealed that the severity of PTSD symptoms correlates with the level of short-term and long-term memory impairment. This confirms the idea that the severity of symptoms can directly affect a child's cognitive abilities. The results of the self-assessment questionnaires showed that children with PTSD have a higher level of event segmentation.

The study by [26] is consistent with current theories of PTSD, emphasising the role of memory impairment in the formation and maintenance of symptoms. The results show that PTSD symptom severity is associated with changes in event segmentation, which may influence subsequent memory impairment. Researchers consider the impact of traumas on everyday activities and expand the understanding of the impact of PTSD on memory beyond the traditional consideration of trauma-related memory impairment.

The work of [27] examines aspects of PTSD but focuses on oscillatory brain activity when exposed to traumatic memory. Memory intervention as a paradigm resembling exposure therapy allows us to study the peculiarities of brain activity in response to traumatic scenarios in patients with PTSD. The findings highlight the importance of understanding the neurodynamics of experiencing and imagining traumatic memories for a deeper understanding of the processes underlying trauma.

Dunsmoor *et al*. examine the issue of PTSD through the lens of laboratory models and neurobiological research [28]. Similar to our study, they discuss the complexities associated with PTSD and offer suggestions for improving the validity and translational value of research in this area. Both studies emphasize the importance of analysing the cognitive factors associated with PTSD and seek to integrate different aspects of psychological research to understand the disorder more fully. However, in contrast to our study, this work focuses on the use of laboratory models and neurobiology rather than investigating the relationship between memory and cognitive function in children with PTSD.

Researchers [29] focus on the relationship between PTSD, mild traumatic brain injury (mTBI) and structural changes in the brain. In contrast to our study, which focuses on the impact of PTSD on children's cognitive functioning, this paper draws attention to the link

between PTSD, head injury and structural brain changes in civilian patients. Both studies emphasize the need for additional understanding of these relationships, but they have different methodological approaches and focus on various aspects of the problem.

The article by [30] explores how collective events shape our memories of life. In contrast to our study, which focuses on the impact of PTSD on memory, this paper examines how the events of 2020, in particular those related to the pandemic, affected autobiographical memory. Both articles emphasize the importance of external events in shaping memories, but they focus on different aspects of this issue and use various research methods.

The results are entirely consistent with the aim and objectives of the study and also prove the hypothesis that PTSD affects the cognitive functions of children. In summary, this study has successfully identified impaired cognitive functions related to memory and event segmentation in patients with PTSD. These results can serve as a basis for further research and development of individualised approaches to treating and supporting this category of patients.

6. CONCLUSIONS

Given the ongoing war in the country, the relevance of studying the impact of stress factors on the development of PTSD in children with low emotional intelligence is undeniable, as evidenced by the results obtained. There is a statistically significant relationship between the diagnosis of PTSD and impaired short- and long-term memory, as well as event segmentation. Children with PTSD in the experimental group demonstrated substantial deviations in these areas compared to the control group. Patients with PTSD show lower results in short-term and long-term memory testing, as well as in the areas of attention and concentration. The results emphasize the need for attention to cognitive aspects in patients with PTSD. Individualised approaches to treatment, including memory training, can improve treatment outcomes. The development of programmes to teach memory management strategies and dual segmentation may help patients with PTSD to function in everyday life.

6.1. Areas for Future Research

It is recommended to evaluate the long-term effects of individualised clinical interventions aimed at improving memory in patients with PTSD, which will help to further enhance our understanding of the impact of PTSD on cognitive processes and contribute to more effective treatment and support for patients.

6.2. Recommendations

The results of the study emphasize the need to develop and implement programmes for early diagnosis of PTSD among children. In the context of the identified connections between the severity of PTSD symptoms, depression and anxiety and cognitive functions, the development and implementation of psychological support programmes for children who have experienced traumatic events is recommended. Rehabilitation programmes for children with PTSD should include training in stress and anxiety management strategies. Knowing that the stage of PTSD affects different aspects of cognitive function, psychiatrists and psychotherapists are advised to take this into account when developing individual treatment plans for each patient. Further research is needed to better understand the mechanisms of PTSD's impact on cognitive function.

APPENDIX A

Structured Clinical Interview for the Diagnosis of Post-Traumatic Stress Disorder (PTSD) in Children

A Traumatic Event

1. Can you tell us about an event that scared you or upset you?
2. Where were you when it happened?
3. Who else was with you during this event?
4. Did you have to hide or run away from anything during this event?
5. Have you ever feared for your or other people's lives?
6. Was anyone physically injured during this event?

Symptoms of PTSD

7. Do you find it difficult to fall asleep after this event?
8. Do you sometimes get very excited or nervous?
9. Do you find yourself recalling this event over and over again?
10. Do you have trouble concentrating on your schoolwork?
11. Have you started getting upset or frustrated easily?
12. Do you suddenly tremble or sweat when you think about the event?

Behavioural Reactions

13. Has your attitude to games or activities you used to enjoy changed?
14. Do you have any friends with whom you have started to spend less time since the event?
15. Do you find communicating with other children or adults easy?
16. Has your attitude to school changed?
17. Do you often feel lonely or isolated from others?
18. Do you think you should avoid places, people or activities that remind you of this event?
19. Do you seek ways to calm yourself down when you feel scared or anxious?
20. Did your family seek help from specialists to help you feel better?

APPENDIX B

Memory Tests

Ten Words

bread, friend, horse, river, key, eye, brother, saw, bell, snow

tap, forest, cat, table, ball, night, game, pie, flag, circle

Groups of 3 words

1. whale, sword, circle – ice, flag, notebook
2. tap, pole, horse – day, pine, water

Phrases

1a. A boy is walking with a dog.

1b. The girl went to the shop.

2a. There were apple trees in the garden behind a high fence.

2b. The hunter saw a wolf on the forest's edge.

Word List Recall

- Immediate recalling (5 attempts)

№ of the word	Attempt 1	Attempt 2	Attempt 3	Attempt 4	Attempt 5
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
Total					

- List of words:

№	The word
1	Board
2	Mouse
3	Finger
4	Door
5	Grass
6	Paper
7	Fish
8	Boyfriend
9	Sun
10	Pig
11	River
12	Pen
13	Wall
14	Water
15	Boat

- Delayed – in 20-25 minutes

Processing the Results

Immediate:

The maximum number of points is 75

47 – 75 points – the norm

38 – 46 points –reduced ability

0 – 37 points – deficit

Delayed:

12 – 15 points – the norm

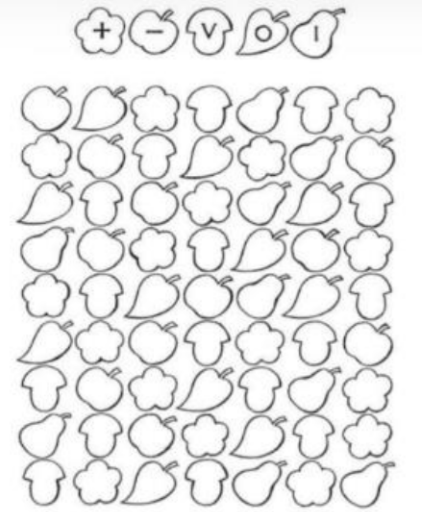
10 – 11 points – reduced ability

0 – 9 points– deficit

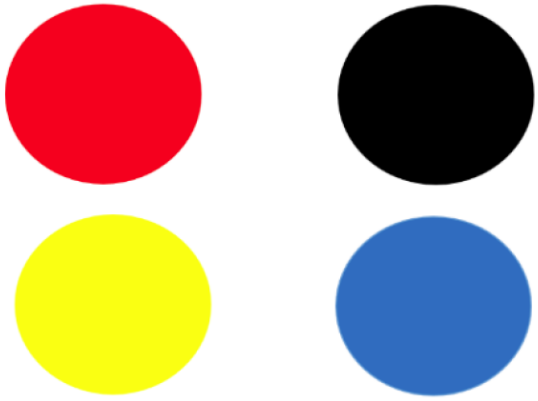
APPENDIX C

Attention Span Tests

Proofreading Test for Children



Auditory Attention



Instructions

- Put your hands on the table. A sheet with four colours is in front of you. I'm going to read some words. Whenever you hear the word red, touch the red circle like this.
- Touch the red circle quickly. After you have touched it, put your hands back on the table.
- Let's try it:

Time, ball, that, red, there, blue, yellow, take, red, thing

Processing the results

- The total number of passes is…
- The total number of inhibition errors is…
- The total score is…

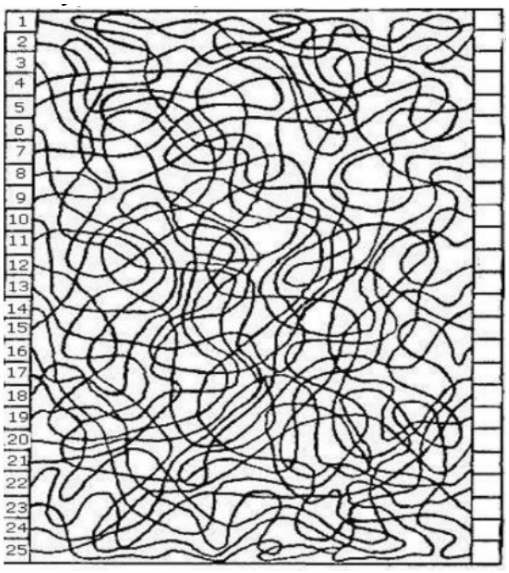
Normative indicators:

- 30 points is the norm
- 29 points - decrease in function
- 0-28 points - deficit

APPENDIX D

Concentration Tests

"Tangled Lines Test" by A. Ray - K. Platonov



Instructions

You are looking at a series of tangled lines. Each line starts on the left and ends on the right. Your task is to trace each line from left to right and put its number in the cell where it ends. You should start with line number 1.

You must follow the lines with your eyes only; you cannot use your finger or pencil to help you. Try to work quickly and make no mistakes. You have 7 minutes to complete the task.

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