

## References:

1. Mokaniuk OI, Havryliuk AO, Perebetiuk AM, Dzhurabaiev VS, Olchedai VM. Vstanovlennia koloru travmovanoi shkiry za dopomohoiu shkaly koloriv. Sudovo-medychna ekspertyza. 2011(4):15-16. (in Ukrainian).
2. Mokaniuk OI. Suchasnyi pidkhid shchodo vyznachennia koloru syntsia pry sudovo-medychnii ekspertyzi zhyvykh osib (analiz arkhivnoho sudovo-medychnoho materialu). Zbirnyk naukovykh prats spivrobotnykiv KMAPO im. P.L. Shupyka. 2001 (10):1310-1317. (in Ukrainian).
3. L.J.P. van der Maaten, G.E. Hinton. Visualizing Non-Metric Similarities in Multiple Maps. Machine Learning 87(1):33-55, 2012.
4. L.J.P. van der Maaten. Learning a Parametric Embedding by Preserving Local Structure. In Proceedings of the Twelfth International Conference on Artificial Intelligence & Statistics (AI-STATS), JMLR W&CP 5:384-391, 2009.
5. L.J.P. van der Maaten. Accelerating t-SNE using Tree-Based Algorithms. Journal of Machine Learning Research 15(Oct):3221-3245, 2014.
6. Belkina, A.C., Ciccolella, C.O., Anno, R. et al. Automated optimized parameters for T-distributed stochastic neighbor embedding improve visualization and analysis of large datasets. Nat Commun 10, 5415, 2019.
7. Mokanyuk, O., Perebetiuk, A., & Gunas, V. (2019). Determination of the informativeness of the criteria for diagnosing timing of bruising by the Cox model. Folia Societatis Medicinae Legalis Slovaca 9 (1), 28-30
8. Mokanyuk, O., Perebetiuk, A., & Gunas, V. (2019). Logic-mathematical analysis of the informativeness of the criteria for diagnosing timing of bruising. 100 years of institute of forensic medicine 1919-2019, 96-101
9. Gunas, V., Bobkov, P., Plakhotniuk, I., Olhovenko, S., & Solonyi, O. (2021). Specifics of fire damage to cotton clothing while shooting point-blank at a human torso simulator from a Fort-12RM pistol. Theory and Practice of Forensic Science and Criminalistics, 23(1), 175-187.

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## ACUTE REACTION TO STRESS – FORENSIC IMPLICATIONS

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**Summary:** The choice of theme lies in the importance of stress in people's daily lives, representing a response of the body to the action of physical agents (sound, light, temperature), chemical (radiation, pollution), biological (disease, lack of food, etc.) or psychic (excess or lack of activity, social interactions, mood, etc.). Thus, each individual reacts differently to some stressors. The assessment of the stressful potential of a situation is the objective of the primary assessment, and the evaluation of the adaptive resources available to the subject is subject to secondary evaluation. The relationship between stressor and reaction depends on primary and secondary assessment. Modern studies reveal that the psychosomatic health of the human person is more closely dependent on the mechanisms of control or adaptation to stress than on the intensity and forms of stress to which he is subjected. Adaptation to stress causes mechanisms, some mechanisms are intuitive, and others are learned in a psychological intervention. Acute stress refers to an immediate response of the human body to an event, which is perceived as an urgent challenge that requires activation of coping mechanisms. As a process, the instinct of survival and adaptation to the environment is activated, thus developing those mechanisms of adaptation and defense. Acute stress can occur in serious situations, accidents, crimes, situations that can endanger life, resulting in the person suffering from emotional and physical disorders (post-traumatic stress disorder or acute stress disorder) with cognitive and physical implications. People with acute stress have a decrease in emotional reactivity, they feel guilty about completing tasks and find it very difficult to experience pleasure even if they perform activities that they previously considered pleasurable. The traumatic event is expressed as persistent, and most of the time the individual will try to avoid everything that we have in trauma tests (whether we are talking about people, places or activities).

**Keywords:** stress, adaptation, emotional reactivity, trauma.

### Introduction: Exploring acute stress response and its forensic implications

Stress, in its various forms, is an inevitable component of human life, representing the body's adaptive response to environmental factors or events that are perceived as threatening or dangerous. Among its forms, acute stress is an immediate and effective reaction, mobilizing the body's resources to cope with crisis situations. However, despite its often-beneficial nature for survival, the acute stress response can bring with it significant medical and legal implications.

The conceptualization of the acute reaction to stress and the detailed understanding of its physiological mechanisms have evolved in recent decades, providing deeper insight into how the body responds quickly to stressors. This response is orchestrated by the sympathetic nervous system, which, in moments of imminent danger, triggers what's known as the "fight or flight response." It involves the rapid release of stress hormones such as adrenaline and norepinephrine, increased heart rate, blood pressure and accelerated breathing, all of which are designed to prepare the body for immediate action [1].

However, despite its effectiveness in critical situations, the acute reaction to stress can have complex and profound consequences for the body, including here effects on the functioning of the central nervous system and endocrine system. These changes can influence cognitive abilities, memory and psychological well-being, and their impact can persist in the long term, evolving into posttraumatic stress disorder or other psychological conditions.

In the forensic context, exploring the acute reaction to stress becomes essential for the correct assessment of the individual's behavior and decisions in crisis or risk situations. This has significant implications in areas such as forensic investigation, emergency care and assessing culpability in the event of traumatic events or crimes.

The **purpose** of this paper is explaining the physiological mechanisms of acute stress response, explore its consequences on memory and mental health, and analyze in detail the forensic implications. By addressing this theme, we propose to contribute to the complex understanding of how acute stress affects individuals and highlight the importance of an informed forensic assessment in crisis and conflict situations.

**Material and methods:** The paper represents a systematized literature review of 7 sources, enriched with results of proper studies.

#### **Results:** *Physiological mechanisms of acute stress*

The acute stress response, also known as the "fight or flight response", is a complex manifestation of the body faced with of a stimulus perceived as threatening or dangerous. The physiological mechanisms involved in this reaction are intricate and fascinating, reflecting the adaptive evolution of the human body to the environment.

The sympathetic nervous system is a vital component of the autonomic nervous system, being responsible for activating the body in situations of stress or imminent danger. This system is associated with the "fight or flight" response and activates in times of emergency, releasing stress hormones like adrenaline and norepinephrine from the adrenal glands. These hormones increase the heart rate, dilate pupils, speed up breathing and redistribute blood flow to muscles and vital organs, thereby preparing the body for rapid action. It also suppresses digestive activity to direct resources to priority functions. The sympathetic nervous system and parasympathetic nervous system work together to maintain balance in the body, and proper activation of this system is essential for effective adaptation to stressful situations and for survival.

The cardiovascular response in the acute reaction to stress involves significant changes in the cardiovascular system in response to stressful stimuli. Under the influence of the sympathetic nervous system, the heart begins to beat faster (tachycardia) to ensure effective distribution of blood to the tissues. Blood pressure rises through vasoconstriction and vasodilation, and blood flow is redistributed to muscles and organs which are essential to support physical exertion and enhance cognitive capabilities in stressful situations. The release of cortisol contributes to the increase of glucose concentration, providing the body with additional energy to face challenges. These physiological adaptations are essential for preparing the body for immediate action, but in the case of persistent stress they can have long-term consequences for cardiovascular health.

In the context of the acute reaction to stress, the release of cortisol is a significant aspect of the body's physiological response. Cortisol, also known as the 'stress hormone', is released into the blood following the activation of the hypothalamic-pituitary-adrenal (HPA) system. This release is initiated by corticotropin-releasing hormone (CRH) produced by the hypothalamus, subsequently stimulating the production of adrenocorticotrophic hormone (ACTH) by the pituitary gland. Cortisol has multiple functions in adapting the body to stressful situations, including mobilizing energy resources by stimulating gluconeogenesis, suppressing the inflammatory response to limit inflammation, regulating fat metabolism, and influencing cardiovascular function. Although this adaptive response is essential for immediate survival, elevated cortisol levels under chronic stress can have health consequences, affecting an individual's immune system, metabolism, and mental state [2].

In the brain's response to the acute reaction to stress, the amygdala and hippocampus, two essential regions, are actively involved. The amygdala, known for processing emotions and danger signals, reacts

quickly to stress, triggering the “fight or flight” response. At the same time, the hippocampus, responsible for regulating and storing memories, interacts with the amygdala to manage emotional responses. This complex interaction contributes to the formation and consolidation of memories related to stressful experiences. In the context of the acute reaction to stress, these two regions play a central role in the rapid adaptation of the body to situations of pressure and imminent danger. However, chronic stress can negatively affect these processes, contributing to long-term cognitive and emotional impairment [3].

The respiratory system responds by increasing the respiratory rate, facilitating oxygen supply and efficient removal of carbon dioxide. Under the influence of stress hormones such as adrenaline, the bronchi dilate, optimizing gas exchange in the lungs. In parallel, the sympathetic nervous system activates an increase in muscle tone, preparing muscles to cope with “fight or flight” situations. This includes mobilizing energy reserves, breaking down glycogen, and using fatty acids to provide additional energy. Skeletal muscles involved in rapid movements are mobilized, and blood vessels in these muscles can undergo adjustments such as vasoconstriction or vasodilation, depending on blood flow needs. All these changes are essential strategies to adapt to the demands of a stressful and dangerous environment, but it must be emphasized that chronic stress can have negative consequences on these systems, contributing to various health problems [4].

#### *Acute stress and forensic implications*

Acute stress, a natural and vital physiological reaction, can become a crucial factor in assessing and understanding human behavior in the forensic context. Exploring the forensic implications of acute stress takes us into a complex and dynamic field, where interactions between stress response and judicial processes, investigations and medical assessments are extremely varied and often underestimated.

The assessment of acute stress in a forensic context is a crucial component in investigations related to behavior and individual decisions in crisis situations. By analyzing the diagnostic criteria of acute stress disorder, forensic experts can gain meaningful insights into the impact of stressful events on an individual's mental health. This detailed assessment involves analyzing specific symptoms, such as reexperiencing trauma, avoiding stimuli associated with the traumatic event, hypervigilance, cognitive and emotional changes, and identifying clinical signs that go beyond normal reactions to stress. In addition, environmental factors and circumstances that may influence the stress response are examined. By integrating medical and legal information, acute stress assessment becomes an essential tool for a deeper understanding of the psychological consequences of stressful events within a legal framework, thus providing solid foundations for judicial decision-making and the development of appropriate intervention strategies [5]. This multidisciplinary approach contributes to ensuring justice and providing appropriate care and support to individuals who have been exposed to traumatic events.

Memory and acute stress are intricately intertwined in the context of confrontation with the law, having significant implications for the reliability of individual testimonies and memories. Acute stress can negatively influence the processes of memory formation and retrieval, which can lead to distortions or fragmentation of memories related to traumatic events. In forensic evaluations, it is essential to understand the mechanisms by which stress can affect memory, including excessive release of stress hormones and activation of the amygdala, the region of the brain associated with the response to danger. These neurobiological changes can lead to increased focus on negative details or the formation of false memories [6]. It is therefore crucial to sensitively address the relationship between stress and memory in a forensic context so as to provide an accurate assessment of individual memories. This becomes essential in depositions and in court, where memories directly influence the course of the legal process. In these assessments, stressful circumstances and factors that may influence memory formation and recovery are carefully examined, thus ensuring a balanced and informed approach to assessing the credibility of testimonies and their relevance in legal proceedings. Through this deep understanding of the interaction between stress and human memory, one can contribute to ensuring a fairer and equitable judicial system.

The link between acute stress and post-traumatic stress disorder (PTSD) is a complex issue in forensic context, with profound consequences for an individual's long-term mental health. The initial reaction to stress, manifested by a series of physiological and psychological adaptations, can evolve into a persistent and debilitating response, characteristic of PTSD. In forensic evaluation, understanding this development is crucial to appreciate the profound impact of traumatic events on the individual and to reveal signs and symptoms that may indicate the presence of PTSD [7].

The effects of acute stress on judgment and immediate behavior become essential in a legal context. In the case of crime or accidents, assessing how acute stress can influence an individual's responsibility and cul-

pability is of crucial importance for the judicial and forensic process. Acute stress can affect decision-making, concentration, and reasoning, which can influence how an individual responds to tense circumstances. In addition, understanding the link between acute stress and the potential development of PTSD can provide crucial information on the need for therapeutic interventions and support for an individual's mental health. Thus, exploring and detailing this complex connection between acute stress and progression to PTSD provides a comprehensive framework for forensic assessments, contributing to a better understanding of the psychological consequences of traumatic events and to the implementation of appropriate intervention and support strategies in the judicial system.

Forensic doctors and mental health experts play a central role in assessing the consequences of this complex phenomenon. These specialized professionals can provide expertise in interpreting the physical and psychological signs of acute stress, contributing to a comprehensive understanding of its impact in specific situations, especially in a forensic context. Physical evaluation may involve analyzing physiological changes, such as increased heart rate, high blood pressure, or other visible external signs of stress. In parallel, mental health assessment can target issues such as behavioral changes, the presence of psychological symptoms and potential mental health disorders, including post-traumatic stress disorder. In a forensic setting, these experts can shed light on how acute stress can influence an individual's ability to cope with tense situations and provide scientifically based interpretations to support judicial decisions. They can also help identify the need for therapeutic interventions and develop appropriate treatment plans. Through this multidisciplinary approach, forensic doctors and mental health experts ensure a detailed and balanced assessment of the impact of acute stress in a forensic context, thereby contributing to justice and improving assistance to individuals affected by such stressful events.

#### *Emotional trauma and forensic consequences*

Emotional trauma, especially those associated with acute stress response, can generate significant consequences for the individual, influencing both mental health and how they interact with the forensic system [1].

Posttraumatic stress disorder (PTSD) is a complex and persistent manifestation of the impact of emotional trauma, in which the initial reaction to stress evolves into a state of significant psychological dysfunction. This condition is characterized by reviving traumatic events, manifested by involuntary recurrence of memories, nightmares and flashes of consciousness. At the same time, active avoidance of associated stimuli and feelings of emotional numbness become manifest, along with neurovegetative hyperactivity such as hypervigilance, irritability and difficulty concentrating. In the forensic context, understanding the connection between emotional trauma and PTSD development becomes essential for assessing an individual's mental health. Emotional trauma, whether it's the result of a single event or repeated experiences, can create lasting changes in how the brain perceives and processes stimuli associated with the threat. These changes can contribute to the development and maintenance of PTSD symptoms, and forensic expertise can help identify and interpret specific signs of this disorder in a legal context. In this regard, careful assessment of the history of emotional trauma and symptoms associated with PTSD becomes crucial to understanding the complexity of mental health within a legal framework and to ensuring appropriate treatment and support to the affected individual.

The impact of emotional trauma on cognitive processes is obvious and has significant consequences, especially in forensic investigations. Trauma can affect essential cognitive functions, such as memory and attention, having a direct impact on how the individual manages and remembers information. Memory can be impaired by the appearance of traumatic flashes or by distorting memories associated with stressful events. Attention span can change, leading to difficulty concentrating and focusing on important details. In a forensic context, careful evaluation of these cognitive changes is crucial, as they can have implications for the reliability of an individual's testimony and his ability to efficiently participate in the legal process.

Emotional trauma can serve as triggers for a variety of mental health disorders, including anxiety, depression, and personality disorders. In a forensic context, understanding the depth of the relationship between trauma and these mental conditions becomes essential for assessing an individual's mental health in court. Emotional trauma can contribute to the emergence and exacerbation of these disorders by affecting the neurobiological balance, stress-regulating system, and structural changes in the brain, especially in regions associated with emotions and traumatic memory.

Trauma coping behaviors are also crucial aspects in forensic evaluation. Individuals who have experienced trauma may develop coping mechanisms to handle persistent stress. These mechanisms may include

avoiding certain stimuli or developing self-defense behaviors that can influence their behavior and decisions significantly. In the judicial courts, it is imperative to understand these coping behaviors in order to properly assess the impact of trauma on the individual and consider its context in the legal process [8].

Forensic experts and mental health professionals have a crucial role to play in managing emotional trauma within judicial systems. Their interventions may include detailed psychological assessments, specialized counseling, and recommendations for appropriate treatment. A holistic approach, integrating medical and legal expertise, can ensure a complete understanding of the impact of emotional trauma on the individual and help develop personalized strategies for intervention and support in court. These forensic interventions can have a significant impact on an individual's resilience and facilitate the process of recovery and adaptation to trauma [9].

By thoroughly investigating the link between emotional trauma and forensic consequences, we can develop more informed and effective strategies for treating and evaluating individuals who have been exposed to traumatic stress.

#### *Forensic interventions and prevention*

Forensic interventions and prevention are key aspects for managing emotional trauma and acute stress. For a detailed analysis of forensic strategies, we need to highlight the importance of comprehensive approaches to improve mental health and minimize adverse legal consequences.

Education and counselling are significant interventions in the forensic context for understanding and managing acute stress. Educational programs provide essential information about how the stress response affects physical and mental health, providing effective management strategies. These programs have the potential to enhance an individual's knowledge, contributing to a deeper understanding of the impact of stress on the body and the cognitive processes. In parallel, counseling is a therapeutic framework where mental health professionals can facilitate open discussions, providing emotional support and practical tools for stress management. This therapeutic approach not only develops coping skills, but also identifies available internal and external resources to deal with tense situations. In a forensic context, promoting education and counselling becomes essential, having a positive impact on the individual's adaptation and ability to manage stress effectively, especially in situations related to trauma or involvement in judicial processes. Preventive approaches, including education and counseling, can not only prevent potential mental health disorders, but also promote resilience and adaptability in the face of acute stress challenges.

Forensic doctors and mental health professionals play an essential role in intervening and managing the consequences of emotional trauma within the forensic context. Through their professional assessments, these experts can provide detailed insight into the impact of trauma, identifying specific signs and symptoms that may influence an individual's mental health. Following these assessments, personalized treatment recommendations and interventions tailored to individual needs can be developed. Their expertise in mental health and forensics is crucial in providing meaningful information for the courts, helping to understand the complexity of traumatic situations and identifying appropriate therapeutic responses. Through their multidisciplinary collaboration, forensic doctors and mental health professionals ensure a comprehensive approach to intervening and managing the consequences of emotional trauma, helping to promote mental health and facilitate the affected individual's recovery process.

Behavioral therapies and psychotherapy are fundamental tools in managing emotional trauma and acute stress, offering effective solutions in the context of forensic intervention. Approaches such as cognitive-behavioral therapy (CBT) focus on identifying and changing negative thoughts and dysfunctional behaviors associated with trauma, promoting cognitive and behavioral adaptation. EMDR (Eye Movement Desensitization and Reprocessing) therapy focuses on bilateral stimulation of the brain to facilitate the processing of trauma-related information and reduce the intensity of negative emotional reactions. Exposure therapy consists of gradual and controlled confrontation with stimuli that trigger trauma, helping to reduce avoidance reactions and to appropriately manage associated emotions. Integrating these therapies into forensic intervention plans can facilitate recovery, reducing persistent symptoms and minimizing the long-term impact on the mental health of the individual affected by emotional trauma. Through these specialized approaches, therapists and forensic professionals help provide personalized solutions, supporting the individual in the process of healing and adapting to the consequences of trauma within the judicial system.

The development and implementation of forensic prevention programs is an essential proactive strategy to minimize the effects of emotional trauma within communities and in the legal context. These programs may involve training mental health professionals, providing them with knowledge and skills for recognizing and managing trauma at individual and community levels. The development of community support reso-

urces, such as crisis centers or helplines, can provide vital support to people in need. Facilitating access to counselling services, including individual or group therapy, can be a crucial component in preventing and managing the effects of emotional trauma. These programs not only contribute to raising awareness and intervention capacity at the local level, but also to building a well-structured and effective forensic support network. Through the preventive approach, these programs can significantly contribute to reducing the incidence of emotional trauma and increasing individual and community resilience to stressors.

Addressing emotional trauma within forensic systems requires close collaboration between professionals in the fields of mental health, forensic medicine and justice. Interdisciplinary efforts are an essential framework for ensuring comprehensive assessment and effective trauma management. Mental health professionals bring their expertise in the assessment and treatment of psychological impairment, facilitating the recovery process of individuals affected by emotional trauma. Forensic doctors bring a medical and legal perspective, providing crucial information for assessing the consequences of trauma in the legal context. Working with justice system professionals contributes to a deeper understanding of the complexity of traumatic situations, ensuring that proposed responses and solutions are fair and appropriate. This interdisciplinary collaboration promotes fairer justice and contributes to improving the mental health of communities, as the convergent efforts of specialists from various fields can provide comprehensive and personalized solutions for those affected by emotional trauma in the forensic system.

In conclusion, forensic interventions and prevention are vital components in addressing emotional trauma and acute stress. Taking a holistic and collaborative view can help improve individuals' resilience and minimize negative impacts on their mental health and legal processes. By developing and implementing these strategies, we can build healthier communities and more informed and equitable judicial systems.

**Conclusions:** By exploring the acute stress response and its forensic implications, we opened a window into the complexity of interactions between physiological response and legal and medical consequences. This trip looked at the deep physiological mechanisms of acute stress, from activation of the sympathetic nervous system to the release of stress hormones and its impact on the brain and other vital systems.

Next, we investigated the forensic implications of acute stress, with a focus on forensic assessment, memory, and the link to posttraumatic stress disorder (PTSD). We also looked at how emotional trauma can persist and influence behavior, judgment, and long-term mental health. In this complex setting, forensic doctors, mental health professionals and the judiciary system play crucial roles in understanding and effectively managing the consequences of emotional trauma.

The chapter on emotional trauma and forensic consequences highlighted how these traumas can contribute to mental health disorders and affect cognitive and behavioral processes. Forensic interventions and prevention have been presented as essential tools for effectively managing these consequences. Approaches such as education, counseling, behavioral therapies, and interdisciplinary collaboration have been proposed to build a holistic framework and minimize the impact of emotional trauma.

In conclusion, this detailed analysis of acute stress response and forensic implications underlines the importance of an integrated approach to mental health and justice. Promoting education and awareness, developing preventive programs and facilitating access to specialized services can help improve the lives of those affected by acute stress and emotional trauma. Through interdisciplinary collaboration and effective strategies, we can build more resilient societies and a more adaptive and equitable forensic system.

## References:

1. American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Arlington, VA: American Psychiatric Publishing.
2. Bryant R.A. The current evidence for acute stress disorder. *Curr psychiatry reports*, 2018; 20:1-8
3. McEwen B.S. The neurobiology of stress: from serendipity to clinical relevance. *BRAIN*, 2000; 886(1): 172-189
4. Bowers M.E., Ressler K.J. An overview of translationally informed treatments for posttraumatic stress disorder: an animal models of Pavlovian fear conditioning to human clinical trials. *Biol psychiatry*, 2015; 78(5): 15-27.
5. Ressler K.J., Bolshakov V.Y., Rosso, I.M., Meloni E.G., Raunch S.L., Carlezon W.A. Posttraumatic stress disorder: clinical and translational neuroscience from cells to circuits. *Nature Rev Neurol*, 2022; 18(5): 273-288.
6. Zhou P., Zhang Y., Wei C., Liu Z., Hannak W. Acute stress disorder as a predictor of posttraumatic stress: a longitudinal study of Chinese children exposed to the Lushan earthquake. *Psych J*, 2016; 5(3): 206-214
7. Gunnar M., Quevedo K. The neurobiology of stress and development. *Annu Rev Psychol*, 2007; 58: 145-173.

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