

Analysis of the link between stress and cancer: implications for patient support

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Abstract

In a world where oncological diseases remain a serious problem for many people, the study of stress management and the provision of psychological support to prevent and treat oncological diseases are becoming increasingly relevant. The purpose of the article is to identify stress mechanisms that affect the human body and provoke the development of cancer. Additionally, it seeks to investigate the global scope of the stress-cancer connection. The methods used in the study include generalisation, analysis, synthesis, and systematisation. The study found that chronic stress can affect the immune system, neurological activity, and other processes contributing to cancer development. In addition, the study has managed to shed light on the mechanisms of stress impact on oncology, including oxidative stress and replication stress, as stimuli that threaten the normal functioning of the human body. A support program for patients with oncological diseases was developed, which included assessment, psychoeducation, methods of stress reduction, and post-treatment support for patients with oncological diseases or those predisposed to them. The study found that the introduction of stress reduction programs for cancer patients is an important step in improving their well-being and treatment outcomes.

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Introduction

Investigation of the impact of stress on the body and its association with cancer is important in understanding the causes and developing effective strategies for prevention and treatment. Studying the link between stress and oncology on a global scale can help influence global factors, such as the social environment and economic conditions, to decrease the incidence of oncological diseases and enhance people's quality of life. This paper aims to comprehend and establish the correlation between stress and the progression of oncological diseases, identify the mechanisms through which stress influences the human body, and determine the factors that enhance the development of cancer in stressful conditions.

Globally, there were an estimated 19.3 million new cancer cases and 10.0 million cancer deaths in 2020, with breast, lung, colorectal, and prostate cancers being the most common types worldwide.¹ In the United States, around 1.9 million new cancer cases are expected in 2023, with an overall prevalence rate of around 542 cases per 100,000 people.² For stress disorders, Post-Traumatic Stress Disorder (PTSD) affects around 3.5% of U.S. adults annually and has a global lifetime prevalence of around 1 in 13 people, while acute stress disorder prevalence is estimated at 6.3% following trauma exposure.³ Adjustment disorders are quite common at 5-20% among general medical patients, and certain populations like military personnel and abuse survivors report much higher PTSD rates of 15% or higher.⁴ The substantial global burden of these conditions highlights the need for comprehensive prevention and treatment efforts.

This issue was investigated by I.V. Serhet,⁵ who noted that oncological disease affects the psychological state of the patient, which is associated with stress that arises during diagnosis, treatment, and even periods of remission. In people with cancer, this level of anxiety, classified into various types such as generalized anxiety disorder or situational anxiety, often triggers autonomic reactions that cause discomfort due to a lack of emotional perception skills and adaptation to them.⁶ Makarova and Chervonyi⁷ distinguished between different types of stress, in particular emotional and psychological. These concepts are characterised by a state of pronounced psycho-emotional experience of conflictual life situations that acutely or permanently limit the satisfaction of social or biological needs. Miaskowski *et al.*⁸ observed high levels of stress and significant negative symptoms among cancer patients. The results show the importance of a more detailed study and coverage of the causes of stress among cancer patients, identifying the factors that cause its increase, developing effective strategies for psychological support, and minimising stress effects on these patients.

Chronic stress can significantly impact cancer development and progression through various mechanisms. As Yan *et al.*⁹ noted, stress activates the classic neuroendocrine system, including the Hypothalamic-Pituitary-Adrenal (HPA) axis and the Sympathetic

Nervous System (SNS), leading to the production of stress hormones that can promote tumorigenesis and cancer development. Additionally, chronic stress, according to Lempesis *et al.*,¹⁰ can cause changes in immune function and inflammatory responses, affecting the body's ability to combat cancer. The study by S.V. Petrinović *et al.*¹¹ showed that chronic stress influences tumour growth and metastasis by activating specific signalling pathways, such as the Akt pathway in breast cancer and the STAT3 pathway in lung cancer. Furthermore, stress-related factors like catecholamines, glucocorticoids, and hormones like prolactin and oxytocin play roles in promoting cancer progression through various mechanisms.

F. Tausk¹² adheres to the belief that chronic stress has a significant impact on the development, growth, and spread of cancer. This influence is determined by the activation of adrenergic (nervous system) and peptide (chemical signalling) pathways, as well as glucocorticosteroids (steroid hormones). The researcher claims that the stress response system, which was originally developed to help people avoid life-threatening situations, can turn into something life-threatening in itself. The study by Dai *et al.*¹³ delves into the molecular mechanisms, primarily focusing on the activation of the HPA axis and the SNS under the influence of chronic stress, which in turn leads to dysfunctions in brain regions such as the prefrontal cortex and hippocampus. Stress hormones produced during this process promote tumour formation through DNA damage, immune suppression, inflammation, and interaction with the tumour microenvironment.¹⁴

This study introduces a novel psychotherapy program tailored to cancer patients, addressing the psychological stress associated with the disease – a contribution that distinguishes it from existing literature. Moreover, it underscores the need for further research into the molecular and biological mechanisms underlying the connection between stress and cancer, advocating for a deeper understanding of specific interaction pathways. Thus, the aim of this research is to investigate the intricate connection between stress and cancer, recognizing stress as a significant factor affecting the human body's physiological processes and its potential contribution to the development and progression of cancer. The task involves exploring the various mechanisms through which psychological stress influences cancer, such as oxidative stress and its impact on immune function, neurological activity, and endocrine regulation. Additionally, the study endeavours to develop effective strategies for supporting cancer patients in managing stress, thereby improving their overall well-being and treatment outcomes. The significance of this research lies in its potential to inform cancer prevention, diagnosis, and treatment approaches, ultimately leading to better support for individuals affected by cancer.

Materials and Methods

The following methods were used to investigate the influence of stress and oncological diseases on the human body and their interrelation on a global scale: generalisation, analysis, synthesis, and systematisation. To search for literature on the topic, the authors used such platforms as Scopus, Web of Science, and PubMed. The articles were searched using keywords such as “stress”, “cancer”, “cancer development”, “connection”, and, for a more extensive analysis, covered the time period from 2010 to 2024. The generalisation revealed the influence of psychological stress on the human body. Based on this method, it was possible to establish a link between stress and cancer development and identi-

fy the reverse path of this link, in particular that the diagnosis of cancer can lead to significant psychological stress in patients. Using generalisation, the sphere of influence and physiological response of the body to stressful situations were established.

Through the analytical method of research, it was possible to identify a wide range of effects of stress on physiological processes, especially on the immune system, neurological activity, and endocrine regulation. Based on the analysis, the factors of influence and psychological stress that contribute to the development and progression of cancer were identified. The analysis has contributed to the argument for the necessity of developing strategies for preventing, diagnosing, and treating cancer patients that aim to reduce stress levels and enhance their psychological well-being. The analysis revealed that psychological stress affects the quality of life, mood, and social connections of cancer patients. A support program was created based on the results of the study, which included assessment, psychoeducation, and methods for reducing stress levels and maintaining emotional well-being. The analytical method has allowed the authors to obtain important conclusions and broaden their understanding of the connection between stress and oncology on a global scale. By synthesizing the data, a holistic comprehension of the impact of stress on cancer and human physiology at large was attained. This method allowed the combining of different aspects of cancer and stress on a global scale, revealing important connections between them. Using systematisation, it was found that stress has a significant impact on the development of cancer in the human body. The systematisation revealed that stress contributes to the development of anxiety and other conditions that worsen the overall quality of life in cancer patients. The use of this method confirmed the significant physical impact of stress on the body in cancer.

Results

Oncological diseases, as a result of unpredictable and dangerous cell mutations in the body, are one of the most threatening problems in the modern world. The connection between stress and cancer and their impact on the human body is complex and multifaceted. Stress, as a reaction of the body to danger, threat, or negative events, leads to the activation of physiological and psychological mechanisms.⁸ These mechanisms encompass processes within the body, such as the release of stress hormones like adrenaline and cortisol, increased heart rate, and changes in blood pressure. Additionally, they include cognitive and emotional responses like heightened alertness, increased focus on potential threats, and feelings of anxiety or fear.^{12,15} In the case of prolonged or excessive stress, these mechanisms can become dysfunctional and contribute to the development or exacerbation of various diseases, including cancer. In addition to physiological mechanisms, stress can also affect a person's lifestyle, which plays an important role in cancer development.¹⁶ Negative habits associated with stress, such as smoking, excessive alcohol consumption, poor nutrition, and insufficient physical activity, are more common.¹⁷

High levels of stress in cancer patients are associated with an increased sense of pain in patients receiving chemotherapy.¹⁸ Stress can deepen the perception of pain and reduce the effectiveness of its treatment, as cancer patients often experience the emotional distress that accompanies the disease, which can include fear, anxiety, and depression and negatively affect the quality of life.¹⁹ In addition to its detrimental effects on physical and mental health, stress can profoundly diminish the quality of life for cancer patients, manifesting in decreased energy, sleep disturbances,

mood alterations, and overall well-being deterioration.²⁰ In this regard, cancer patients should use their internal reserves to adapt to new living conditions and maintain psychosocial resilience. People with cancer experience reduced adaptive capacity associated with the use of strategies such as denial, avoidance, and self-blame aimed at avoiding stressors. The appearance of anxiety associated with the current state and future prospects overloads the patient, which hinders their adaptation. Therefore, the motivational and volitional components of the internal picture of cancer play a key role in shaping the overall perspective and approach of the patient to their disease. This component determines how the patient perceives their situation and how they will react to it in the future. The motivational and volitional components determine how the patient will direct their efforts and resources to fight the disease and build their life in the context of the disease. This element has the potential to influence the choice of treatment approaches, shape the planning and decision-making processes concerning the patient's well-being, and impact the patient's confidence and self-discipline.

It is worth noting that stress can contribute to the development of oxidative stress, which, in turn, can have a negative impact on the body's cells and contribute to the appearance of cancer. Oxidative stress is an imbalance between the body's production of free radicals and antioxidant defense mechanisms.^{21,22} Elevated levels of oxidative stress can be a prognostic factor for radiation and carcinogenic risks.²³

It is also worth paying attention to replication stress, which occurs during the process of DNA replication and can play an important role in the development of cancer cells. A malfunction in the replication process can cause DNA damage and the accumulation of genetic mutations that are the basis for the development of cancer. Stressors such as chemicals, UV radiation, and infections can cause replication stress. This leads to increased activation of signalling pathways, such as the ATR/CHK1 pathway, designed to restore the replication process and prevent the accumulation of DNA damage. However, if replication stress is excessive or prolonged, these defense mechanisms can be overloaded and lead to genetic damage and genome instability, which increases the development of cancer.²⁴ The emotional component of the internal picture of cancer contains various emotions, but above all, the fear of death, pain, and a number of other negative feelings associated with cancer. Cancer brings with it significant losses and changes in a person's life, which cause emotional tension and instability. Fear of the unknown, fear of possible complications, and concerns about the effectiveness of treatment affect the patient's emotional state. This emotional component can have a significant impact on the patient's psychological state, motivation, and ability to effectively interact with medical procedures and therapy.

Difficult life events, anxiety, depression, and a lack of perception of social support and survival strategies have a significant impact on the development of cancer. An increase in risk factors for stressful life events also affects other types of cancer, a decrease in the positive impact of treatment, and an increase in mortality. Thus, psychosocial factors play an important role as risk factors for certain types of cancer.²⁵ Patients with high levels of stress experience poor health and are at an increased risk of complications. Stress can affect the effectiveness of treatment, reducing the response to therapy and contributing to negative consequences.²⁶ It is worth noting that stress management and psychological support can play an important role in improving the course of the disease and increasing the chances of recovery in cancer patients.

The impact of stress on a person includes the physiological response of the body to stressful situations. Stress activates the ner-

vous system and affects the functioning of the body's organs and systems, leading to changes in the cardiovascular system, hormonal regulation, immune system, and other physiological processes. In addition, stress can lead to a decrease in mood, feelings of anxiety and depression, increased irritability, problems with concentration, and a negative impact on mental health in general. It is necessary to identify ways to overcome stress, including various strategies such as social network support, physical activity, relaxation techniques, cognitive behavioural techniques, and other approaches to recognising stressful situations and responding to them in healthy ways.²⁷ Considering these aspects, a program of work by a psychotherapist was developed to reduce the symptoms of stress in a person who is ill or has a predisposition to cancer (Table 1). The main goal of the program is to support the client, reduce stress levels, improve psychological well-being, and promote overall well-being.

Before using this programme, it is recommended to consult with a doctor or therapist who will be able to assess whether the program meets the patient's individual needs and discuss the optimal number of meetings and the thematic focus of therapy.

Chronic stress can increase the production of stress hormones, such as cortisol and adrenaline, which can modulate the interplay between tumour and stromal cells, leading to the regulation of signalling pathways that impact cancer progression. This can result in increased tumour growth and metastasis, making cancer treatment less effective.²⁸ Stress can also affect the immune system, which plays a crucial role in cancer treatment. Chronic stress can suppress the immune system, reducing the effectiveness of immunotherapy and other treatments that rely on the immune system to target cancer cells.

Discussion

In the modern world, where new technologies and research are constantly developing, understanding complex issues related to human health remains one of the most important issues. Among these problems, oncology is one of the most common and dangerous diseases that requires constant research and the search for effective approaches to treatment and prevention. In recent years, there has been a growing emphasis on researching the link between stress and oncology. Stress, as a complex physiological and psychological phenomenon, has a significant impact on the functioning of the human body.²⁹ Its role in the development and spread of cancer and its impact on treatment outcomes have become the subject of increasingly detailed research in the scientific community. Research in a global context confirms the connection between stress and cancer, drawing attention to the destructive effects of stress on the course of the disease.³⁰ It is worth studying the specific positions and opinions of scientists regarding the connection between stress and oncology for a more detailed investigation of this area on a global scale.

Hoffman *et al.*³¹ considered the connection between stress and oncology from a socio-cognitive perspective. The influence of personal factors on stress, in relation to oncological diseases, is indeed significant and requires separate attention from specialists during the treatment of patients. Finset *et al.*³² highlighted the influence of stress and oncology on communication between doctors and patients. Researchers have found that cancer consultants who actively promote the expression of emotions by patients create a more receptive atmosphere for further disclosure of emotional signals and problems, including identifying signs of stress and anxi-

ety. Based on the results of this study, emotional support and communication between doctors and patients in the oncological context are important aspects and can really contribute to improving the quality of treatment and the psychological state of cancer patients.

Singer *et al.*³³ noted that emotional stress is more common in patients with head and neck tumours, which may be conditioned by the specifics of this form of cancer and its effect on important functions such as speech, swallowing, and appearance. The study highlighted the importance of psychosocial support for patients with head and neck cancer, as it can help manage emotional stress and improve patients' overall health. Consideration of the emotional factor when planning treatment and providing support to patients to improve their physical and psychological well-being is an essential element of the course of treatment for cancer patients, which is

confirmed by the results of this study. J.D. Hayes³⁴ argued that stress can influence the development and spread of cancer by inducing oxidative stress in the body. Scientists note that the effects of stress can increase the production of free radicals, which can lead to damage to cellular components and contribute to the development of cancer. Comparing with this study, it is worth noting that stress and cancer have a rather strong connection, and oxidative stress can act as one of the mechanisms of this connection.

In turn, Eckerling *et al.*³⁵ emphasised that stress can affect the development and progression of cancer through various mechanisms. Researchers also emphasise the importance of considering individual responses to stress in cancer patients, since not all people respond to stress in the same way, and some may have a higher vulnerability to cancer development as a result of stress exposure. Such factors as genetic predisposition and environmental condi-

Table 1. Stress reduction program for individuals who have or are prone to oncological diseases.

Number of meetings on the specified topic	Subject	Content description
1-2 sessions	Initial assessment and medical history	The first meeting is dedicated to collecting information about the client, their medical history, experience of stress and cancer development. The psychotherapist works to build trust and establish an emotional connection with the client.
2-3 sessions	Understanding stress and its impact on cancer	Meetings dedicated to understanding the mechanisms of stress and its impact on the body. The psychotherapist provides information about the physiological and psychological aspects of the stress response and its possible impact on the development of cancer.
3-5 sessions	Stress reduction techniques	Meetings are aimed at teaching the client various stress reduction techniques, such as relaxation techniques, breathing exercises, meditation, music therapy, or creative techniques. The psychotherapist helps the client choose the appropriate method and establish a regular practice.
3-5 sessions	Maintaining emotional well-being	Meetings are aimed at understanding and expressing emotions, especially fear, anxiety, and sadness. The psychotherapist provides support and assistance to the client to manage emotions, develop positive perception, and increase the level of satisfaction with life.
4-6 sessions	Cognitive behavioural approach	Meetings aim to explore and change negative thoughts and beliefs that can support stress and unhealthy practices. The psychotherapist works with the client to recognise and replace destructive thoughts and behavioural patterns with more positive and constructive ones.
2-4 sessions	Social support	Meetings aim to provide psychological support and understanding of the social context in which the client is situated. The therapist works with the client to attract support from family, friends, or support groups that can help in difficult life situations.
1-2 sessions	Creating an action plan	A meeting during which the therapist helps the client develop an action plan to overcome stress and maintain psychological well-being. The plan may include regular stress management practices, maintaining a healthy lifestyle, connecting with supportive people, and seeking medical attention.
1 session	Evaluation and correction of the programme	A meeting during which the therapist evaluates the effectiveness of the programme, monitors the client's progress, and makes adjustments to the programme if necessary.
The number of sessions can be individual and depends on the client's needs and progress.	Post-treatment support	Meetings aimed at supporting the client after the end of the main treatment. The therapist helps the client integrate the acquired skills and strategies of psychological well-being into their daily life.
1 session	Final assessment and summary	A meeting during which the therapist conducts a final assessment of the programme, summarises the client's achievements, and provides recommendations for further self-support and psychological development.

tions can also influence the link between stress and cancer. Comparing the results with this study, it is worth noting that it is an individual approach to each patient that is one of the key elements of a well-coordinated course of treatment and stabilisation of the emotional sphere of a cancer patient. Coyne *et al.*³⁶ argued that various stress factors, such as psychological stress, emotional stress, social connections, and stress associated with specific events (such as cancer diagnosis and treatment), can have an impact on cancer development, disease progression, and survival of cancer patients, particularly psychological and emotional stress. Instead, social support has proven to be a protective factor that reduces the impact of stress on cancer. Compared to this study, it is worth noting that stress can actually increase the development of and complicate cancer in the human body.

Ebstein *et al.*,³⁷ who have studied the effects of stress on pancreatic cancer, note that stress is important in the lives of patients with pancreatic cancer, as it is the experience of unpleasant emotional or environmental demands related to age, as well as physical, social, psychological, or spiritual events reported by patients during the diagnosis, treatment, and follow-up of the disease. The researchers also point to a possible link between psychological stress and cancer mortality in a particular location. This means, according to the researchers, that patients with high levels of stress may have a poorer predicted life expectancy or significantly more complex consequences from the disease. Comparing the results of this study, it is worth noting that psychological stress in patients with existing cancer has a significant impact on the course of the disease and can lead to negative consequences. Prevention of distress during cancer treatment requires considering the psychological state of patients and providing support and psychological assistance, which can contribute to improving their general condition, better treatment, and better results.³⁸ In turn, Sosa *et al.*³⁹ reported that oxidative stress, which occurs due to an incorrect balance between the development of free radicals and the antioxidant system of the body, can contribute to DNA damage, damage to cellular structures, and disruption of cellular signalling pathways, which can lead to the development of cancer pathologies. Thus, according to researchers, stress, including oxidative stress, is a factor that contributes to the development of cancer. Comparing with this study, it is necessary to note the impact of this type of stress on the general psychological state of cancer patients, since physical and psychological indicators exacerbate destructive emotions, intensifying anxiety and depression in patients.

The results of global research, analysis of data, and results are important in understanding the connection between stress and cancer. The constant development of scientific research and methodological approaches provides a unique opportunity to explore the depth of the problem and the impact of stress on oncological processes. Understanding this connection on a global scale will allow for developing new prevention strategies, improving diagnosis and treatment, and improving the quality of life of patients facing stress and cancer. Studying the research on the correlation between stress and oncology contributes to the further advancement of effective approaches in the sphere of human health preservation globally.

Conclusions

Stress is a serious stimulus for the human body and can pose threats to its normal functioning on a global scale. Chronic stress can affect the immune system, neurological activity, endocrine regulation, and other physiological processes that can contribute to the

development of a variety of diseases, including cancer. However, the diagnosis of cancer itself can lead to significant psychological stress in patients. Such stress can affect the quality of life, mood, social connections, and treatment outcomes. Understanding this link between stress and cancer is important for developing strategies for cancer prevention, diagnosis, and treatment. As a result of the study, a wide range of effects of stress on the human body were investigated on a global scale. It has been found that psychological stress can be a factor that contributes to the development and progress of cancer. The study highlights various mechanisms, including oxidative stress, replication stress, and the overall impact of emotional state on the course of the disease.

The authors of this study managed to develop a strategy to support patients with cancer in the context of stress, in particular a psychotherapy program for working with clients who have or are prone to cancer. The program included assessment and collection of medical histories, psychoeducation of clients about the impact of stress on oncological diseases, methods of stress reduction, cognitive and behavioural approaches, and action plan development. Emotional well-being support and post-treatment support were also included in the program. To expand their understanding of the link between stress and cancer, future researchers should focus on studying the molecular and biological mechanisms underlying this connection. Identifying specific interaction pathways will help clarify the exact mechanisms behind stress's influence on the development and progression of cancer. These studies will help to better understand the link between stress and cancer and develop strategies to improve the diagnosis, treatment, and support of cancer patients.

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