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Modern views on biosocial risks in the management of older staff

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Subject. In many countries of the world the trend towards the demographic ageing of the population calls for reconsidering the approaches to human resource management and supplementing them with new knowledge that allows developing a strategy that helps them to continue their work-related activities. Therefore, the transdisciplinary approach is of the greatest interest as it allows identifying the determinants of a person's social and economic achievements throughout life as well as the underlying patterns of managing the age of staff. It seems highly relevant to study the relationship between the economic and social statuses of a person and medical and biological phenomena. On the one hand, the biological mechanisms and health paths are important factors for further social and economic results and achievements. On the other hand, the processes of social stratification throughout life have a strong effect on human health at all life stages. It is very important to understand the social and biological mechanisms of how the processes of social stratification determine a person's success in order to identify the biosocial risk factors for the implementation of the potential of older employees and to develop management strategies for preventing and overcoming them.

Objectives. It is necessary to justify the need for a biosocial approach in planning steps for the development of the potential for older workers to succeed.

Methodology. We used the following methods of scientific knowledge to achieve our goals: logical and historical methods; analysis and synthesis, and induction. The study was based on the research of modern scientific and periodical literature on the studied topic using the Pubmed database and the Google Academy.

Conclusions. The combination of biological information and the indicators of the social environment and lifelong behaviour provides unique ideas and unprecedented opportunities for discovering and developing strategies that can be used to prevent and overcome negative factors as well as extend the period of working ability and economically active life of older workers.

Keywords: social and economic status, biosocial factors, health, epigenetics, ageing.

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Introduction

Today, demographic ageing can be observed in many countries, and it is characterised by an increased average age, an increased share of the elderly in the total population, and a decreased share of young people. This demographic phenomenon is associated with a slowdown of the birth rate in developed and developing countries and an increase in life expectancy. Thus, in many countries, the development of management solutions that allow effectively using the labour potential of older employees is considered highly relevant (Vasilyeva & Polenova, 2021; Durakova & Mayer, 2022; Lukichev, 2019). There is no doubt that the people of “silver age” possess human capital in the form of general and specific knowledge, professional skills and competencies, and experience. This potential supplemented by such components as health and motivation can be implemented in the course of social reproduction (Shestakova et al., 2016). It is assumed that for this requires, first of all, securing stable working ability and providing older people with employment opportunities. There is an Older Generation project in Russia, a part of the Demography national project, according to which it is planned to increase the period of active ageing of Russians and provide opportunities for their professional retraining by 2030 (Goncharova et al., 2022). It may be useful to apply the biosocial approach for planning and implementing such projects, as it takes into account the dynamic and bidirectional interactions between human biology, on the one hand, and a person’s lifelong social and economic status, on the other hand. Therefore, the review of modern scientific and periodical literature in the field of transdisciplinary knowledge is of particular interest as it can be used to justify the need for the biosocial approach in planning steps for the development of the potential for older workers to succeed.

There are a number of studies dedicated to the impact of biological processes on an individual life cycle path, the formation of social

and educational achievements, and selection for the social and physical environment. For example, lower birth weight, determined by the genome, conditions of the development, as well as social factors, has an unfavourable effect on cognitive development and level of education in adults (Harris & McDade, 2018). Moreover, it was evidenced that there exists a relationship between parents’ birth weight and their children’s school test results, and both father’s and mother’s birth weights are equally important for the prediction of a child’s test results (Kreiner & Sieversten, 2019). The level of education is also a partial function of genotype, and shared genetic factors may explain the established link between education and health (Boardman et al., 2015; Malanchini et al., 2020).

It was shown that in the early stages of life health can be an obstacle to the implementation of the potential for success as an adult. For instance, obesity in teenagers and young adults influences social stratification results in adult life: those suffering from obesity since early teenage years have lower levels of education, marriage, salary, family income, employment, property, and subjective social status (Segal et al., 2021). These lifelong consequences of obesity operate through such mechanisms as low self-esteem, social isolation, social views on attractiveness, and lost working days. Similar effects can be found in case of chronic diseases and diabetes in teenagers and young adults, which shortens the educational paths and reduces job stability. (Segal et al., 2021).

Academic literature offers information about the identification of the most sensitive periods of human development to the influence of social factors. The sensitive period model states that early exposure (from the perinatal period to teenage years) has a greater effect on human health and development as compared to other stages of life. For example, low social and economic status at an early age increases the risk of poor health later in life, regardless of further social and economic status and

other intermediate risk factors. Social impacts are assumed to cause irreversible structural and functional changes in the developing organism (Yang et al., 2020). Early childhood environment may not always have a direct cause and effect influence on the health of adults.

The accumulation model takes into account the consequences of impacts over the entire life. They can be additive and can combine synergistically, thus influencing the health and development of a person through biological mechanisms. Multiple exposures to a repetitive stress factor (such as chronic poverty) or a series of contacts with various social environments or life experiences can have a cumulative effect. For instance, poverty experienced only in childhood is not as damaging to adult health as a long period of poverty covering childhood, teenage years, and the transition into adulthood (Mustillo et al., 2021). The cumulative theory states that the childhood environment has a prolonged effect as it presents different opportunities and limitations differentiating people at an early age. These initial differences may be aggravated from generation to generation, thus increasing the inequalities (Morton, 2020). Social studies show that initial advantages usually result in greater advantages, and vice versa, while life paths vary exponentially (Fletcher, 2020).

The model of paths assumes that childhood circumstances have an indirect influence on risks associated with adult health and work success through directing people along the paths differentiated by the types and levels of stress exposure. This model suggests that during each stage of life, social and economic status mediates the impact of early troubles causing risks to health later in life. Moreover, there is a relationship between intergenerational and intragenerational paths of social stratification, as at an early age social and economic status is determined by the social and economic status of the parents (Yang et al., 2020).

Research Materials and Methods

A possible mechanism of the impact of social determinants on a person's health and success in work

Stress is thought to be a key part of the cause-and-effect relationship connecting social issues with the physical health and active working period of employees, especially those of old age. The term "allostasis" has emerged as a basis for the complex physiological processes associated with the stress response. Allostasis is a complementary concept to homeostasis which deals with maintaining certain physiological parameters within very narrow limits. Unlike homeostasis, allostatic parameters are not maintained within narrow limits but fluctuate depending on such needs as increased heart rate and blood pressure during physical activities. Together, allostasis and homeostasis ensure a holistic model of the body's response to the changing requirements and possibilities of the local environment. Allostasis is maintained through integrated reactions of physiological systems, such as the hypothalamic-pituitary-adrenal system and the sympathetic-adrenal-medullary system, which allows adapting to both internal and external stress factors (Harris & Schorpp, 2018).

For example, socially and ecologically unfavourable situations or perceived danger triggers neural, physiological, and immunological responses that increase neural sensitivity to threats and activates the hypothalamic-pituitary-adrenal and sympathetic-adrenal-medullary systems, as well as the systemic inflammatory response syndrome. As a result, the production of cortisol, the most important hormone in the mobilisation of the body's response to stress, is increased. Once the threat is eliminated, cortisol production returns to the initial level. Repeated or chronic exposure to unfavourable environmental conditions (allostatic load) may have a cumulative lifelong effect on health and lead to the deterioration of key physiological systems, which will definitely affect the potential for older workers to succeed.

A lower social and economic status, a source of chronic stress, is related to high cortisol levels in the evening and a more even rhythm of its production during the day as compared to the normal pattern of cortisol production which declines during the day down to low levels in the evening (Cohen et al., 2006), (Karlman et al., 2022). Interestingly, a low social and economic status during childhood determined both the lowest and highest levels of morning cortisol release during adolescent years. This difference may be explained by different predispositions or different experiences of life with low-income conditions (Allen et al., 2019).

The biological response to the effect of social factors can be expressed in structural changes. For example, the impact of childhood abuse was associated with smaller sizes of the hippocampus and amygdala in young people several years later, which in its turn was associated with an increased probability of depressive symptoms in young people experiencing stressful life events (the so-called stress sensitisation). It is assumed that emotional and cognitive processes mediated by the hippocampus and the amygdala may result in the vulnerability to stressful life events in children who were exposed to violence, which will unfailingly affect their working ability as adults (Weissman et al., 2020).

Recent studies have determined that loneliness, or perceived social isolation, was among the most important factors causing poorer health, death, and loss of working ability. Older employees are particularly vulnerable to the impact of this factor, along with such established risk factors as smoking, obesity, and lack of physical activity.

Social isolation is associated with a dysregulation in the operation of the neuroendocrine-immune system, increased non-specific immunity, and suppression of humoral immunity, which can explain the increased predisposition to inflammatory and infectious diseases in people suffering from loneliness. The relationship between loneliness and excessive inflammation seems

to be bidirectional, as experimental induction of an inflammatory reaction using endotoxin made people feel socially disconnected (Venero et al., 2022).

Changes in brain structures, such as the reduced volume of grey matter in the areas responsible for memory and cognitive functions, are also directly related to social isolation. The risk of developing dementia in old age is 26% higher for unsociable people as compared to those more socialised. The data on the importance of social relationships for biological processes affecting health suggests that standard medical examinations should include questions about people's social relationships, especially when it comes to older employees (Harris & McDade, 2018).

The relationship between biological and social effects throughout the human life cycle

Human development is a process that has social and biological determinants and intergenerational links, and this process begins in the mother's womb and continues at all stages of life. Life phases and social roles are often closely related to biological events. For example, giving birth for the first time marks the woman's transition to a parental role while a menopause determines the end of the reproductive phase of life. And although biologically a woman can become a mother as soon as she reaches the age of puberty, most young people postpone parenthood until they are socially and emotionally mature and have completed their education and gained work experience. Thus, social and biological forces together shape the transitions between roles in different life phases, determining the implementation of the success potential.

The approach based on the life cycle analysis has significantly influenced the research into the determinants of disease risks in adults (Smith & Ryckman, 2015). It was established that the birth process was linked to childhood and physical health, as well as diseases and adult success potential (Chen

et al., 2022). In old age, chronic inflammation is given great importance as it is considered to be a biological signal of immune dysregulation which leads to Alzheimer's disease, cancer, cardiovascular diseases, disability, early loss of working ability, and premature death (Morton & Ferraro, 2020).

However, there is more and more evidence being accumulated that proves the relation between low social and economic status, in childhood as well, and the activation of physiological stress paths, which results in chronic inflammation and diseases accompanying ageing and threatening the implementation of work success potential (Yang et al., 2020).

The studies of the "long arm of childhood" associate early life environment with physiological processes or outcomes of chronic disease in adults. However, important processes occurring between them are neglected. For example, the age of adolescence is a stage of choosing a lifestyle, people around you, and health behaviour. During this period, social and biological paths that can be traced back to childhood can be modified. Significant physical, biological, and neurological changes associated with puberty occur in the bodies of teenagers (Berenbaum et al., 2015). Influenced by the hormones, the cortical and limbic circuits in the brain undergo rearrangement, which, combined with social experience, affects their cognition, decision making, and behaviour in adult life (Trova et al., 2021). This period of the life cycle is one of the critical stages of development, which comes with risks and obstacles to the potential for success later in life. According to a number of researchers, the duration of human maturation is underestimated, and the model of human maturation needs an additional 4–6-year period of "early adulthood" to be included (Hochberg & Konner, 2020). This is a period of strengthening previous friendly relationships, family-oriented socialisation, and obtaining social skills that are necessary for reproductive success. During this period, the brain continues to develop and it still developing even after

the puberty, when the brain reaches the size of an adult brain. The maturation of neocortical association areas, especially the frontal lobes, continues approximately until the age of 25 (Hochberg & Konner, 2020).

When young people enter adult life, they face new stresses come in their daily existence associated with the combination of many interrelated areas of life, such as relationships, school, work, and family. For some people, the middle of adulthood means greater stability and confidence in their social and economic status, work, and family. However, for others, this period is more dynamic due to high divorce rates, greater dependence on both children and parents, as well as uncertain work schedules and low salaries. Middle-aged people are highly involved in social relationships as compared to other stages of life: they communicate with ageing parents, children, parents of their children's friends, neighbours, work colleagues, etc. These relationships are important social mechanisms that can alleviate, through social support, or aggravate, due to tension and conflicts, the daily stresses of the middle age, which will definitely influence work performance.

Therefore, all life stages have their unique social and biological forces that function independently and jointly, thus affecting physical and social well-being at a certain stage of life and in the future as they determine the path towards the potential for success in work.

Risk factors affecting the potential for success caused by the mutual influence of the genotype and living conditions

It is known that human potential is formed by nature. Gene sequences are fixed, we inherit them from our parents, and they determine specific aspects of human physiology and mind to a great extent. However, external environment, including the quality of nutrition as well as the quality of social environment, is able to change gene expression, "switching on" or "switching off" certain genes and thus affecting physiological functions and social and behavioural results. For example, it was established that genetic

effects on children's cognition decrease in the environment with a low social and economic status, while genetic inclinations towards psychoactive substance use among teenagers can be increased or suppressed depending on whether the substance use is typical for their environment or not (Harris & McDade, 2018).

Epigenetic mechanisms that respond to exogenous impacts and change the gene expression without altering the main genetic sequence are with increasing frequency recognised as markers and potential mediators of differentiated ageing and life expectancy.

Lifestyle and environmental factors contribute to epigenetic modifications (changes in the DNA methylation pattern, histone modifications, micro-RNA expression) and have a cumulative effect in the course of ageing (McDade & Harris, 2022), which affects the working ability of older employees. Due to epigenetic mechanisms, unfavourable social and economic effects change the immune function, increase systemic inflammation, and also influence other markers of complex chronic diseases (Martin et al., 2022). Social and economic and psychosocial troubles in childhood are associated with the DNA methylation patterns in old age people (Gharipour et al., 2021). Research in this field reveals new prospects for the comprehension of the interaction between social and genetic factors which forms complex biological and social paths for success and well-being. There is a chance to reconsider the notions of the genome as a dynamic substrate that includes information from the environment over the entire course of development in contrast to the prevailing idea of the genome as static DNA sequences defined during conception.

It has been recognised now that the environment and the living conditions of both parents before conception are highly important for the process of imprinting, early embryonic development, as well as for the long-term physical and cognitive health of the offspring, which is ensured by epigenetic mechanisms. Behaviour or biological changes caused by the environment can be transmitted from

generation to generation through epigenetic mechanisms and without the involvement of the DNA sequence (Bacon & Brinton, 2021; Merrill et al., 2021; Takagi et al., 2021).

Parental features, such as their lifestyle, behaviour, and life habits, influence the well-being of children (Meloni & Müller, 2018).

Results and discussion

Two aspects can be identified in the interrelation between biological phenomena and social and economic achievements:

- biological factors and health level form the basis for the further social and economic success, including the active working period;

- the processes of social stratification determine the access to material and social resources and have both direct and indirect impact on human health at all life stages. Social impact can be positive, such as social support (Fairbank et al., 2022; Zhan et al., 2022), or negative, such as child poverty or troubled families (Green et al., 2022). Social and economic status is considered to be the fundamental reason for differences in people's health (Harris & McDade, 2018).

For this reason, the following steps can be identified in the development of management strategies to contribute to a stable and successful working life of older employees:

- I. *Creating a favourable working environment.* The impact of the work environment on the physical and mental health of employees as well as self-assessment of their health must be taken into account. Sufficiently good health is an essential condition for participation in working life.

However, professional work also influences the rate of biological ageing, physical and mental health, the needs for recovery due to physical and mental stress, and work-related deterioration, also caused by the increased impact of work.

The practice of flexible working schedule is a potential leverage for the management of older workers. Due to flexible schedule older workers can stay at home for longer periods of time, which will facilitate the adjustment and transition to

retirement and is also an important component of age management. A study which compared the implementation of flexible working hours in a number of European countries established that the freedom of choice regarding working hours can improve the work-life balance of employees (Lott, 2015).

II. *Assisting personal financial security.* The financial situation affects the need and willingness to work. Professional activity is often the main source of people's income.

III. *Providing opportunities for creativity, development of knowledge and internal work motivation:* motivation, satisfaction, and stimulation of the performance of work tasks, the importance of developing competence for personal growth. Encouraging continuous education is an important management strategy aimed at ensuring the active role of older employees in the overall workforce.

IV. *Assisting social security.* Relationships are considered in a social context: whether a person feels included or excluded from the group, whether they receive enough social support when necessary.

On the one hand, long-term work activity allows an employee to feel safe as they consider themselves to be a part of the group. On the other hand, working life may also include the accumulation of negative experiences involving neglect or even discrimination.

Conclusions

The analysis of publications dedicated to the risks of the development of the work success showed that biological and social factors are interrelated and occur over the entire life cycle of a person. The most important factors determining life success are considered to be the level of education, social support, and social and economic status of parents, and the environment of early childhood and even the parents' living conditions before the birth of a child are important for later success. The stress response and epigenetic mechanisms are believed to be the most significant biological

mechanisms for the implementation of social impacts. Excessive allostatic stress leads to chronic inflammation which is a precursor to diseases, especially those typical for older adults. Epigenetic mechanisms change gene expression without altering the main genetic sequence. Lifestyle and environmental factors contribute to epigenetic modifications with a cumulative effect during ageing and the possibility of being transmitted intergenerationally. It appears that biosocial risk factors associated with the potential for success at work have their roots deep in the past, linking different generations. The conclusions on intergenerational epigenetic inheritance may be of profound significance. Research in this field reveals new prospects for the comprehension of the interaction between social and genetic factors which forms complex biological and social paths for success and well-being.

The study of the comprehension of biosocial factors of lifelong well-being shows that the boundaries between phenomena occurring outside and inside the body are blurred. The integration of biological information and the indicators of the social environment and lifelong behaviour provides unique ideas and unprecedented opportunities for discovering and developing strategies that can be used to prevent and overcome factors that have a negative impact on people's health as well as extend the period of successful working ability. Today there is a great need for the studying the complex paths that connect society with the social and economic environment, biology, and health throughout people's lives.

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Conflict of Interest

The authors declare the absence of obvious and potential conflicts of interest related to the publication of this article.

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Современные взгляды на биосоциальные риски в управлении персоналом старших возрастов

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Предмет. Тенденция к демографическому старению населения во многих странах мира вынуждает пересмотреть подходы к управлению человеческими ресурсами, дополнив их новыми знаниями, позволяющими выработать стратегию, способствующую продолжению трудовой деятельности. В этой связи наибольший интерес представляет трансдисциплинарный подход для выяснения детерминант социально-экономических достижений человека на протяжении всей жизни, а также для раскрытия закономерностей, лежащих в основе управления возрастом сотрудников. Весьма актуальным является рассмотрение взаимосвязи экономического и социального статусов человека с медико-биологическими явлениями. С одной стороны, биологические механизмы и траектории здоровья являются важными факторами последующих социально-экономических результатов и достижений, а с другой – процессы социальной стратификации на протяжении всей жизни оказывают сильное влияние на здоровье человека на всех этапах жизненного пути. Понимание социальных и биологических механизмов того, как процессы социальной стратификации определяют успешность человека, имеет большое значение в выявлении биосоциальных факторов риска реализации потенциала работников старших возрастов, в разработке управленческих стратегий их предупреждения и преодоления.

Цель. Обоснование необходимости биосоциального подхода в планировании мер по развитию потенциала трудовой успешности работников старших возрастов.

Методология. В процессе достижения поставленных целей использовались методы научного познания: логические и исторические; анализа и синтеза; индукции. Исследование построено на изучении современной научной и периодической литературы по рассматриваемой теме с использованием баз данных Pubmed и Академия Google.

Выводы. Объединение биологической информации с показателями социальной среды и поведения на протяжении всей жизни дает уникальные идеи и беспрецедентные возможности для открытий и разработок стратегий предупреждения и преодоления негативно воздействующих факторов, prolongation периода трудоспособности и экономически активной жизни сотрудников старших возрастов.

Ключевые слова: социально-экономический статус, биосоциальные факторы, здоровье, эпигенетика, старение.

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