The expectation of retirement as a psychological stress that affects the biological age in the person of the Russian Federation

La expectativa de jubilación como un estrés psicológico que afecta la edad biológica en las persona de la Federación de Rusa

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ABSTRACT

The method of age-related samples is used. Biological age is estimated using a formula including indicators of metabolism, cardiovascular, respiratory, equilibrium systems, and psychological health questionnaire data. The biological age, proper biological age, and relative aging index have been researched. Examinees were adults of 26 - 88 years old, divided into 9 age groups. We've founded two types of psychological stress affecting a person's biological age: stress caused by the expectation of retirement and stress on the retirement. Upon the results of the study, it's stated that in Russia the biological age of a person is associated with a calendar inverted U-shaped dependence. The peak of relative aging happens on the pre-retirement and post-retirement ages. In women, biological aging begins to intensify in the period of 51-60 years, in men in 46-50 years, in women it stops in the period of 66-70 years, and in men only after 71 years. The maximum of biological consenescence in women occurs immediately after retirement (56-60 years), and in men at the age of the expectation of retirement (56-60 years). Based on the achieved data, it can be concluded that psychological stress caused by the expectation of retirement exists, it's more severe in men than in women.

Keywords: Psychological stress, biological age, retirement, pension/retirement stress, pre-retirement stress.

RESUMEN

Se utiliza el método de muestras relacionadas con la edad. La edad biológica se estima utilizando una fórmula que incluye indicadores de metabolismo, cardiovasculares, respiratorios, sistemas de equilibrio y datos de cuestionarios de salud psicológica. Se ha investigado la edad biológica, la edad biológica adecuada y el índice de envejecimiento relativo. Los examinados eran adultos de 26 a 88 años, divididos en 9 grupos de edad. Hemos fundado dos tipos de estrés psicológico que afectan la edad biológica de una persona: el estrés causado por la expectativa de jubilación y el estrés en la jubilación. Sobre los resultados del estudio, se afirma que en Rusia la edad biológica de una persona está asociada con una dependencia de calendario en forma de U invertida. El pico del envejecimiento relativo ocurre en las edades previas y posteriores a la jubilación. En las mujeres, el envejecimiento biológico comienza a intensificarse en el período de 51-60 años, en los hombres en 46-50 años, en las mujeres se detiene en el período de 66-70 años, y en los hombres solo después de 71 años. El máximo de consenso biológico en las mujeres ocurre inmediatamente después de la jubilación (56-60 años) y en los hombres a la edad de la expectativa de jubilación (56-60 años). Con base en los datos obtenidos, se puede concluir que el estrés psicológico causado por la expectativa de jubilación existe, es más severo en los hombres que en las mujeres.

Palabras clave: estrés psicológico, edad biológica, jubilación, estrés de pensiones / jubilación, estrés previo a la jubilación.

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INTRODUCTION

Biological age is an indicator that is determined by a combination of metabolic, structural, functional, regulatory features and adaptive capabilities of the body. Among peers by chronological age, there are usually significant differences in the rate of age-related changes. The discrepancy between chronological and biological age allows us to evaluate the intensity of aging and the functional capabilities of the individual in different periods of his life. The period of the life path, which includes the person's retirement and the expectation of this exit, is under the influence of strong psychological stressors that affect both the well-being of the person and the functioning of his body. However, the effect of stress on the expectation of retirement and subsequent release on a person's biological age remains poorly understood.

LITERATURE REVIEW

Retirement is the strongest stressor. As studies conducted in many countries show, retirement affects somatic and mental health and increases the likelihood of premature death. Many researchers have come to the conclusion that there is an increased risk of premature death after retirement, regardless of the country where the survey was conducted: Greece (Bamia et al., 2008), Germany (Brockmann et al., 2009); Sweden (Karlsson et al., 2007); United States (Tsai et al., 2005). Psychological factors also affect life expectancy in Russia (Berezina, 2017).

According to a study by A. Kuhn (Kuhn et al., 2010), in Austria, male blue-collar workers who retire one year ahead of schedule have a higher probability of dying compared to those who continue to work (by 13%). Moreover, with mandatory dismissal, the probability of premature death in men increases significantly, especially for men with high professional status (Haynes et al., 1978). However, among women, the mortality rate remains virtually unchanged, which is explained by the involvement of women in family affairs and the household, while men after retirement lose their role as the bread earner of the family not gaining a different status in return.

If we analyze specific diseases, then the effect of premature death is even higher, including from diseases of the cardiovascular system. This is all more important because the evaluation of the cardiovascular system is included in almost all methods of assessing biological age. A study of English older men (Morris et al., 1994) showed that mortality due to cardiovascular (and cancer) diseases is significantly higher among retired people, compared to those who continued to work (86%).

Many researches have been devoted to the health deterioration after retirement, with most authors showing that the health deterioration is observed in both men and women (Tretyakova & Khasanova, 2018). According to a representative post-retirement health survey (HRS) in the United States, the dismissal of workers after they reach retirement age leads to the increase of myocardial infarction by 2.48 percentage points and stroke by 2.43 p.p. (Gallo et al., 2006) These data were confirmed by another study, also conducted on the basis of HRS. Analysis of statistical data showed that for a 6-year period after retirement, difficulties in moving increase by 5–16%, and the overall incidence by 5–6%. The greatest negative effect is manifested among people who did not experience health problems before retirement: among them, difficulties in moving increase by 17–22%, and the general incidence by 6%. At the same time, with part-time employment after reaching retirement age, the incidence increases by only 4.2%, and difficulties in performing daily activities - 10% (Dave et al., 2008). Upon that, the psychological components of pension stress (for example, anxiety) affect not only the health, but also the effectiveness of the treatment of cardiovascular disorders (Chumakova et al., 2014). Age-related changes are also a stressor; a person's lifestyle changes with age, the daily routine, his social role changes, all of which can affect the indicators of biological age (Neupert et al., 2019; Asadi Bidmeshki & Taheri, 2018).

Biological age is an integral indicator of somatic and psychological health. There are a large number of methods for measuring biological age used in interdisciplinary research related to psychology: from classical methods for assessing telomerase activity and telomere length (Werner et al., 2019) to methods for evaluating age-related measurements of the brain, in this case clinically act as biomarkers significant neurological syndromes that appear at the end of life (Liem et al., 2017), there is even the concept of "brain age" (Rudolph et al., 2017). It is stated that human behavior, his daily routine, his attitude to life, his lifestyle influence his biological age, even determined at the chromosomal level (Boutari et al. 2017; Werner et al. 2019; Stellos et al., 2019; Farooq & Hussain, 2017; Kord et al., 2017). As known, telomeres and telomere-related proteins play an important role in cell aging, which is important for global health. A recent study by C Werner et al. showed that changes in the normal behavior of healthy people, in particular the inclusion of endurance training in the normal routine of the day, affect telomerase activity and telomere length (TL) (Werner et al., 2019).

MATERIALS AND METHODS

The aim of the study is to study the dynamics of biological age in the Russian Federation before and after retirement and its relationship with the dynamics of due biological and calendar ages.

To study the dynamics of biological age, the method of age samples was used. To assess the indicators of biological age, we used the following methods.

1. Methodology "Determination of biological age according to V.P. Voitenko. " This technique consists of a questionnaire "Health self-esteem determination" and a formula for determining biological age (the formula includes indicators: blood pressure, breath holding after inhalation, static balancing, and body weight). An integral indicator is BA - biological age.

2. Methodology for determining the proper biological age for different age groups - PBA. The indicator characterizes

the average biological age for a specific age group currently in the Russian Federation. This indicator is considered the statistical norm of biological age for a given year of birth.

3. BA - PBA Index (biological age - proper biological age), this is an indicator of relative aging. Negative values indicate individual youth of a person, and positive values indicate individual aging relative to statistical norms.

These techniques (the methodology for determining biological age, proper biological age, individual aging index) are described in more detail in a manual published in Russian (Markina, 2001). These are the options for measuring biological age that we have chosen, because they are considered the most valid for diagnosing age-related changes precisely in the pre-retirement and post-retirement age, which we were most interested in.

4. Questionnaire. On the basis of which the sex and age of a person was determined.

5. Methods of mathematical statistics (Statistica 12 software package). To assess the influence of factors of gender and calendar age (age group) on indicators of biological age, we used the analysis of variance Anova. Factorial. To compare the groups with each other, we used the Fisher LSD test, which is part of the analysis of variance (Fisher LSD).

Subjects 1546 people were examined, of which 809 were women and 737 were men. More detailed age and gender composition is presented in table 1.

Gender	Age group	25-35	36-45	46-50	51-55	56-60	61-65	66-70	71-80	Above 81
women	Mean age	28,5	41,0	47,8	53,0	57,8	62,9	67,9	75,3	84,1
	p	97	80	60	44	98	126	118	150	36
men	Mean age	31,3	40,3	48,1	52,0	58,7	63,2	67,9	74,3	83,8
	p	132	66	111	41	50	97	122	92	26

Table 1. Age and gender composition of the sample.

The sample was formed on a territorial basis. Several territorial entities were surveyed (sites belonging to a particular medical or educational institution). The districts were taken in Moscow, Ufa, the Moscow region, the Republic of Bashkortostan, the Republic of North Ossetia. All adults from the age of 25 years and above related to this institution (a clinic, or a school) were examined. The sample obtained by sex and age characteristics is a representative of the general population of Russian residents (in accordance with the data of the Federal State Statistics Service).

RESULTS

We have researched the dynamics of biological age in adults using the method of age samples.

The results are presented in table 2.

Gender	Age group	25-35	36-45	46-50	51-55	56-60	61-65	66-70	71-80	Above 81
	Average calendar age	28,5	41,0	47,8	53,0	57,8	62,9	67,9	75,3	84,1
women	Average biol. age	33,6	38,1	42,7	47,4	53,3	55,8	56,8	57,6	60,3
	St. dev.	0,84	0,93	1,07	1,25	0,84	0,74	0,77	0,68	1,39
	Average calendar age	31,3	40,3	48,1	52,0	58,7	63,2	67,9	74,3	83,8
men	Average biol. age	37,4	43,3	51,0	55,4	60,1	62,3	66,0	66,0	66,2
	St. dev.	0,72	1,02	0,79	1,30	1,18	0,84	0,75	0,87	1,63

Table 2. Dynamics of biological age in men and women over the course of their life.

As follows from the table, the biological age naturally grows with increasing the calendar age of a person, this effect persists for both men and women. Moreover, in women, the biological age is below the calendar in all groups. In men, the biological age in most groups exceeds the calendar one, it becomes equal to the calendar age only at an older age, after 61 years, and subsequently decreases relative to the calendar age.

We performed a variance analysis of the effect of gender and age factors on the biological age and evaluated the effect of the interaction of factors. The influence of the gender and age factors was significant with p <0,000, the interaction of factors exists at the level of a good trend: F (8, 1528) = 1.8093, p =, 07112.

We also studied the dynamics of Proper Biological Age by groups. The results are presented in table 3.

Gender	Age group	25-35	36-45	46-50	51-55	56-60	61-65	66-70	71-80	Above 81
women	Average calendar age	28,5	41,0	47,8	53,0	57,8	62,9	67,9	75,3	84,1
	Av. Proper biol. age	33,8	41,1	45,1	48,1	51,3	54,2	57,2	61,4	66,9
	St. dev.	0,18	0,20	0,23	0,27	0,18	0,16	0,17	0,15	0,30
men	Average calendar age	31,3	40,3	48,1	52,0	58,7	63,2	67,9	74,3	83,8
	Av. Proper biol. age	38,5	44,3	48,8	51,3	55,5	58,3	61,1	64,9	70,5
	St. dev.	0,16	0,23	0,17	0,28	0,26	0,18	0,16	0,19	0,37

Table 3. The dynamics of the proper biological age in men and women throughout the life.

As follows from the table, indicators of proper biological age also naturally increase with increasing calendar age in both men and women. Proper biological age is a statistical norm, i.e. our average subjects should have such average bio-ages. We see that for young groups the proper biological age must exceed the calendar. In women, it must exceed the calendar up to 45 years, and then it becomes smaller than the calendar. In men, it must exceed the calendar to 50 years, and then it also becomes smaller than the calendar. These are the norms for our sample.

We performed a variance analysis of the influence of gender and age factors on the proper biological age and evaluated the effect of the interaction of factors. The influence of the factors of the carrion and age is significant with p <0,000, the interaction of factors is also significant: F (8, 1528) = 3.2661, p =, 00107. The interaction of factors suggests that in men and women in different age groups, the patterns of dynamics of a proper biological age are different

Next, we looked at the dynamics of the relative aging BA- PBA index - our most informative indicator. It shows how old men or women are older than their statistical norm. The results in table 4.

	Age groups								
	25-35	36-45	46-50	51-55	56-60	61-65	66-70	71-80	Above 81
№	1	2	3	4	5	6	7	8	9
women	$-0,23^{2,3,8,9}$	$-3,00^{1,5,6,7,9}$	$-3,85^{1,5,6,7}$	$-0,74^{8,9}$	$2,03^{2,3,7,8,9}$	$1,53^{2,3,8,9}$	$-0,43^{2,3,5,8,9}$	$-3,93^{1,4,5,6,7,9}$	$-6,56^{1,2,4,5,6,7,8}$
men	$-1,10^{3,4,5,6,7}$	$-1,023,^{3,4,,5,6,7}$	$2,20^{1,2,9}$	$4,08^{1,2,9}$	$4,63^{1,2,8,9}$	$3,99^{1,2,8,9}$	$3,87^{1,2,8,9}$	$1,09^{5,6,7,9}$	$-4,26^{3,4,5,6,7,8}$

1,2,3,4,5,6,7,8,9 - the differences are significant with the groups under these numbers to Fisher LSD with p <0.05.

Table 4. The dynamics of the relative aging index (BV - DBV) in men and women from different age groups. Analysis of variance also showed a significant effect of gender and calendar age on the dynamics of the relative aging index (p <0,000). The interaction of indicators is also significant: F (8, 1528) = 2.9485, p =, 00283

The effect of age on the relative aging index is inverted U shaped with a peak in the middle of the scale. In women, consenescence begins to intensify sharply at the age of 51-55 years, reaches a maximum at the age of 56-60 years (at this age it becomes positive, that is, the biological age begins to exceed its statistical norm). This persists throughout the following age period: 61-65 years. And in subsequent years it decreases, starting from 66-70 years, the biological age falls below the proper biological age, i.e., women begin to grow old more slowly than the statistical norm. In men, an inverted U-shaped relationship is also observed between relative aging and the age group. Enhanced aging begins at the age of 46-50 years, already at this period, the biological age begins to exceed PBA. The maximum relative aging occurs at the age of 56-60 years, after which the index begins to decrease and becomes negative at the age of over 81 years.

DISCUSSIONS

The problem of retirement and its impact on human health is highly significant in connection with the ongoing pension reform in many countries and the postponement of the retirement age. In the twentieth and twenty-first centuries, many countries underwent pension reform, the essence of which is to increase the person's retirement age and expand his working period. In most countries, the retirement age is 65-67 years for both men and women.

The retirement age in Russia in 2019 is 55.5 years for women and 60.5 years for men. Until last year, that is, at the time when our subjects of retirement age lived and retired, it was 55 years old for women and 60 years old for men. Now in

Russia there is a pension reform, according to which, men will retire at the age of 65, and women at 60.

According to the results of our study, we can argue that the phenomenon of pension stress, described for many countries, exists in Russia, and that pension stress affects the biological age of a person. Studies in Germany, Greece, the United States, Sweden, and other countries have previously shown the effects of retirement stress on the likelihood of premature death (Haynes et al., 1978)., On the occurrence of health problems (Tretyakova & Khasanova, 2018); retirement leads to an increase in diseases of the cardiovascular system (Morris et al., 1994.), a risk of myocardial infarction (Gallo et al., 2006), and deterioration of the musculoskeletal system (Dave et al., 2008). and other issues.

As our study showed, retirement stress exists in both men and women. For women, it manifests itself as an increase in biological age relatively due immediately after retirement, in the period 56-60 years. In this period, the relative aging index in women becomes positive (equal to +2.03 years) and it significantly exceeds that in very young and very elderly groups. High relative aging also persists between 61-65 years - an age that will become post-retirement after the completion of the pension reform.

In men, pension stress is even more pronounced than in women, it becomes almost maximum in the period 61-60 years (the relative aging index is positive and equal to + 3.99 years), and this index is significantly higher than the youngest and subsequent older age groups.

However, our study also showed that there is no less pronounced pre-retirement stress - stress from the expectation of retirement. In men, it has maximum level, it is even higher than retirement stress itself. In the period before men retire, the relative aging index is maximum and reaches +4.08 years, which is significantly higher than the youngest and oldest age groups. In women, pre-retention stress is less pronounced. The relative aging index is close to zero (-0.74) and is significantly different only from the oldest groups: the difference with the younger groups is only at the level of the trend.

In psychology, a lot of data has been collected suggesting that in many cases, the stress of anticipation is a stronger irritant than the stressful event itself. For example, this is shown for Russian cosmonauts, the stress of waiting for a flight (especially unrealized) affects health and life expectancy more than space flight itself (Berezina, Mansurov, 2017).

Perhaps in other countries, pre-retirement stress will not be so pronounced. Why is the expectation of retirement causing so much stress that affects the biological age of people near retirement age in Russia? First, the ongoing pension reform in Russia has caused a huge social resonance, incomparable with many other countries, including post-Soviet countries, for example, Kazakhstan (Zhumanova, 2018). This is due to mass discussions on the problem, with an increased representation of this topic in the media. In other words, the problem is presented in the mass consciousness of Russians, and it was shown that in Russia, sociocultural factors, especially those presented in the media, have a strong influence on the behavior and psychophysiology of age groups (Litvinova, 2014; Gutiérrez-Artacho & Olvera-Lobo, 2017). Secondly, it is an unexpectedness of a pension reform in Russia. In psychology, there is such a term as an attitude: if people know and expect that they will retire at the age of 55-60, and suddenly it turns out that they are not, then they are in a state of collapse of nervous processes, destruction of the attitude, which effects painfully on the adaptation of the Russian to the environment (Koteneva, Kobzarev, 2019) and negatively affects his mind and the body. This causes especially severe stress among people of pre-retirement age, since they are who expect the retirement very soon and the burden of the reform lays precisely on them. Thirdly, the attitude to the pension reform, it is negative for most Russians. Fourth, there is the likelihood of the cancelation of the pension reform, in Russia it began recently, unexpectedly, and public discontent has already led to a reduction in the retirement age for women from 63 to 60. All this leads to the fact that Russians worry about this problem, focus on it, especially at pre-retirement age, which leads to the occurrence of pre-retirement stress. There may be other psychological reasons of pre-retirement stress common for people from different countries, but this requires additional research.

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Biological age is an integral indicator of health. There are many methods for evaluating it: from molecular to psychological. The present study uses the most popular method in Russia by V.P. Voitenko. It includes the characteristics of health: the work of the cardiovascular system, respiratory system, the equilibrium system, metabolism, as well as indicators of the psychological assessment of someone's health. We examined 1546 people, adult men and women living in different regions of the Russian Federation. The survey was conducted on a territorial basis, several territorial sites assigned to a medical or educational institution have been examined. According to the results of our study, the existence of pension-related stress for Russians was shown, after retirement, their biological age sharply increases, this applies to both men and women, their biological age begins to exceed the statistical norm. In men, retirement stress is more pronounced than in women. Our data coincide with the results obtained in other countries, both in terms of the presence of pension-related stress and in the aspect of its greater severity in men than in women.

In addition, we discovered the phenomenon of pre-retirement stress in Russia. For men and women, the expectation of retirement in the last five years before going on a well-deserved rest also worsens indicators of biological age. In men, pre-retirement stress is more pronounced than in women. The value of relative aging among them is at the greatest level in pre-retirement age.

It should be noted that in Russia there is an inverted U - shaped relationship between the calendar age and biological one. At a younger age (long before the retirement) for men and women, the biological age is lower than the calendar and statistical norms, that is, they are younger than they should be. At the pre-retirement and retirement ages, the sharp consenescence is observed among them, and then at later age, a few five years after retiring, their biological age decreases again, and they become younger than it is assumed by statistical norms and calendar age.

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