УДК 314.14:616-039.4-053”450*2018/2022”
https://doi.org/10.20538/1682-0363-2024-4-129-135

Analysis of the rate and changes in the incidence of age-related diseases (by medical care uptake) in 2018–2022 (through the example of a municipal hospital in Saint Petersburg)

Saginbaev U.R., Akhmedov T.A., Rukavishnikova S.A., Davydova E.P.

St. Petersburg Institute of Bioregulation and Gerontology
3, Dinamo Av., Saint Petersburg, 197110, Russian Federation

ABSTRACT

The **aim** was to study the rate and changes in the incidence (by uptake) of age-related diseases (ARDs) in 2018–2022 through the example of a municipal hospital in Saint Petersburg.

Materials and methods. The study was carried out on the basis of records and reports for the period of 2018–2022 for the main statistical age groups (adult population (AP), working age population (WAP), persons over working age (POWA)). The incidence was analyzed for the most common ARDs (hypertensive diseases; coronary heart disease; type 2 diabetes mellitus; senile cataract, and glaucoma). The assessment of the incidence rate was carried out both for ARDs in general and for particular diseases.

Results. A long-term observation revealed that the incidence of ARDs has been increasing. In WAP, the rate of the increase in the incidence of ARDs was more pronounced compared to the same indicator in the general population surveyed (16.1 versus 5.4%). Moreover, in the post-COVID period, the incidence rate of a number of ARDs increased. In addition, a regular sequence was found in the manifestation of ARDs: hypertensive diseases, coronary heart disease, type 2 diabetes mellitus, senile cataract, glaucoma.

Conclusion. The incidence rate of age-related diseases has been increasing, which is especially pronounced among WAP. In the post-COVID period, these diseases were found to develop much faster. ARDs are characterized by a sequence of manifestations as patients get older, which in the future will allow to develop clearer approaches to the prevention, diagnosis, and treatment of ARDs depending on the age of the patient.

Keywords: age-related diseases, aging, incidence, post-COVID period, sequence of manifestations

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

Source of financing. The authors state that they received no funding for the study.

For citation: Saginbaev U.R., Akhmedov T.A., Rukavishnikova S.A., Davydova E.P. Analysis of the rate and changes in the incidence of age-related diseases (by medical care uptake) in 2018–2022 (through the example of a municipal hospital in Saint Petersburg). *Bulletin of Siberian Medicine.* 2024;23(4):129–135. https://doi.org/10.20538/1682-0363-2024-4-129-135.

✉ *Saginbaev Ural R.,* ural-spb-sag@mail.ru

Анализ уровня и динамики заболеваемости (по обращаемости) возраст-ассоциированной патологией в 2018–2022 гг. (на примере муниципальной поликлиники г. Санкт-Петербурга)

Сагинбаев У.Р., Ахмедов Т.А., Рукавишникова С.А., Давыдова Е.П.

Автономная научная некоммерческая организация высшего образования научно-исследовательский центр (ФННО ВО НИЦ) «Санкт-Петербургский Институт биорегуляции и геронтологии»
Россия, 197110, г. Санкт-Петербург, пр. Динамо, 3

РЕЗЮМЕ

Цель: изучить уровень и динамику заболеваемости (по обращаемости) возраст-ассоциированной патологией (ВАЗ) в 2018–2022 гг. на примере муниципальной поликлиники г. Санкт-Петербурга.

Материалы и методы. Исследование проведено на основе учетно-отчетной документации за период 2018–2022 гг. по основным учетно-статистическим возрастным группам (взрослое население (ВН), лица трудоспособного возраста (ТВ), лица старше трудоспособного возраста (СТВ)). Проводился анализ по наиболее распространенным ВАЗ (болезни, характеризующиеся повышенным кровяным давлением; ишемическая болезнь сердца; сахарный диабет 2-го типа; старческая катаракта и глаукома). Оценка уровня заболеваемости осуществлялась как в целом по ВАЗ, так и по отдельным нозологиям.

Результаты. Многолетняя динамика заболеваемости возраст-ассоциированными заболеваниями характеризовалась восходящей тенденцией. У лиц ТВ темп прироста заболеваемости ВАЗ был более выражен по сравнению с аналогичным показателем в целом у обследованного населения (16,1 против 5,4%). Более того, в постковидном периоде наблюдалось повышение уровня заболеваемости рядом ВАЗ. Кроме того, обнаружена закономерная очередность в манифестации ВАЗ: болезни, характеризующиеся повышенным кровяным давлением, – ишемическая болезнь сердца – сахарный диабет 2-го типа – старческая катаракта – глаукома.

Заключение. Динамика заболеваемости ВАЗ характеризуется восходящей тенденцией, особенно выраженной среди лиц ТВ. В постковидном периоде обнаружено более ускоренное развитие данной категории заболеваний. Для ВАЗ характерна очередность манифестации по мере увеличения возраста, что в перспективе позволит выработать более четкие подходы к профилактике, диагностике и лечению ВАЗ в зависимости от возраста пациента.

Ключевые слова: возраст-ассоциированные заболевания, старение, заболеваемость, постковидный период, очередность манифестации

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

Источник финансирования. Авторы заявляют об отсутствии финансирования при проведении исследования.

Для цитирования: Сагинбаев У.Р., Ахмедов Т.А., Рукавишникова С.А., Давыдова Е.П. Анализ уровня и динамики заболеваемости (по обращаемости) возраст-ассоциированной патологией в 2018–2022 гг. (на примере муниципальной поликлиники г. Санкт-Петербурга). *Бюллетень сибирской медицины.* 2024;23(4):129–135. https://doi.org/10.20538/1682-0363-2024-4-129-135.

INTRODUCTION

From the age of 25–30 years, the probability of developing pathological processes associated with aging begins to increase [1]. Modern researchers note that aging in most cases occurs early, and premature aging has the greatest medical, social, and economic significance as a trigger for the development of age-related diseases [2].

Age-related diseases (ARDs) are a heterogeneous group of pathologies, the likelihood of which increases as the body ages and is characterized by the following features: the predominance of chronic forms; polymorbidity; a decrease in the diversity

of nosological forms; change in the pathogenetic mechanisms of diseases; and, as a result, an atypical course [3]. The most typical representatives of ARDs include hypertension, type 2 diabetes mellitus, senile cataract, primary open-angle glaucoma, Alzheimer's disease, Parkinson's disease, a number of malignant neoplasms, etc.

Atherosclerosis is considered one of the main factors determining the nature of aging and its rate [4]. Moreover, there is an opinion that atherosclerosis is a widespread age-related change in the cardiovascular system and one of the leading pathogenetic links for most ARDs. In turn, atherosclerosis is closely related to arterial hypertension. Undoubtedly, early detection of these pathological processes can reduce (or delay) the likelihood of developing other ARDs and improve the quality of life of older people [5]. The study of patterns in the sequence of development of ARDs and their relationships in order to develop strategies for the prevention and timely diagnosis of age-related conditions is a promising field of research.

The aim of the study was to investigate the level and changes in the incidence (by uptake) of age-related diseases in 2018–2022 through the example of a municipal hospital in Saint Petersburg.

MATERIALS AND METHODS

The study was carried out on the basis of records and reports of a large municipal hospital in Saint Petersburg for the period of 2018–2022. The epidemiological features of ARDs were studied for the main statistical age groups (adult population (AP), working age population (WAP), persons over working age (POWA)). The materials were data from the form of federal statistical observation No. 12 "Information on the number of diseases registered in patients living in the service area of a medical organization". Table 1 shows the number of people registered in order to seek medical care at the polyclinic both on the whole and by individual age groups for the specified study period.

Table 1

Population registered at the polyclinic (number of people) on the whole and by individual age groups in 2018–2022

Year	AP	WAP	POWA
2018	77,259	53,338	23,921
2019	78,361	57,413	20,948
2020	80,457	56,186	24,271
2021	82,748	58,173	24,575
2022	84,126	59,101	25,025

We analyzed the incidence of the most common ARDs: I10–I15 "Hypertensive diseases" (HD), I20–I25 "Coronary heart disease" (CHD), E11 "Type 2 diabetes mellitus" (T2DM), H25 "Senile cataract" (SC), H40 "Glaucoma" (POAG). The assessment of the level and changes in the incidence was carried out both in general for ARDs and for individual diseases.

The conducted study is a comprehensive epidemiological study with time series analysis (the autoregressive moving-average model was used), including the calculation of the incidence (*Yi*), error (*m*), smoothed incidence rate (the autoregressive moving-average model), ranking and trend (*Yt*; the calculation was carried out using the method of least squares). To describe the trend, we calculated the rate of an increase or decrease in the incidence (Rid) as the ratio of an absolute increase or decrease to the previous level of the series. Statistical processing was carried out using the Statistics 20.0 and MS Excel 2010 software.

RESULTS

The assessment of the long-term changes in the incidence of ARDs both among the entire adult population and among the WAP group demonstrated an unambiguous unfavorable upward trend (Fig. 1, 2). In WAP, the rate of the increase in the incidence of ARDs was more pronounced compared to the same parameter in the general population surveyed (16.1 vs 5.4%).

It is worth noting that the incidence rate in the age groups under consideration was characterized by a sharp decrease in 2021 and a significant increase in 2022. This circumstance is probably associated with a decrease in the public uptake of medical care during the COVID-19 pandemic in 2021 and, conversely, a sharp increase in the number of people seeking medical care in 2022, which was more favorable in epidemiological terms. In addition, the increase in the incidence of ARDs in 2022 could be influenced by infection with COVID-19. The number of researchers note the unequivocal impact of COVID-19 on accelerated population aging [6].

ARDs are a heterogeneous group of pathologies, the likelihood of which increases along with aging. Figures 3 and 4 show the long-term changes in the incidence of the diseases (HD, CHD, T2DM, SC, and POAG) among the WAP group. It was established that the incidence of almost all the examined diseases (with the exception of POAG) was characterized by an unfavorable upward trend. The long-term changes in

the incidence of HD were characterized by an increase of 12.2%; for CHD, the increase was 23.0%, and for T2DM and SC, it was 25.3 and 9.3%, respectively. The long-term changes in the POAG incidence were characterized by a slight downtrend with a decline rate of –6.3%.

We calculated the ratio of the incidence of a specific disease in the examined population on the whole to the same parameter in the WAP group (Table 2). It is worth noting that the smaller this ratio, the less pronounced the difference in the incidence rate between different age groups.

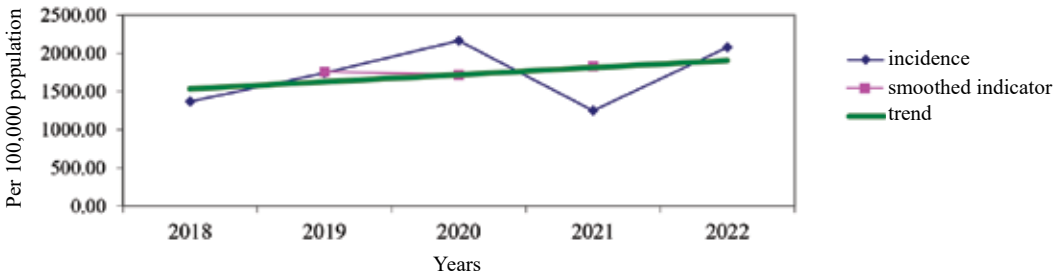

Fig. 1. Long-term changes in the incidence of ARDs in the adult population in 2018–2022

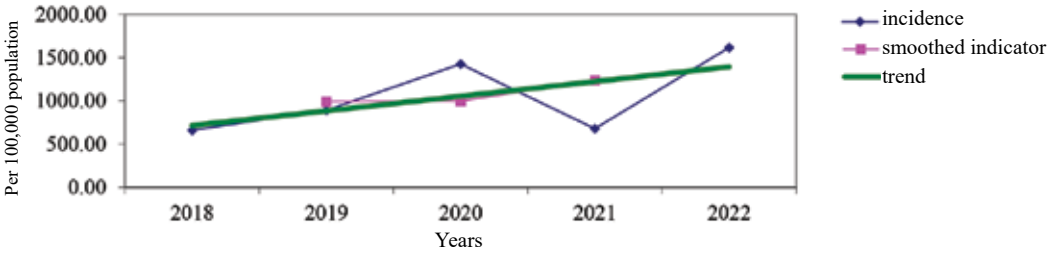

Fig. 2. Long-term changes in the incidence of ARDs in the WAP group in 2018–2022

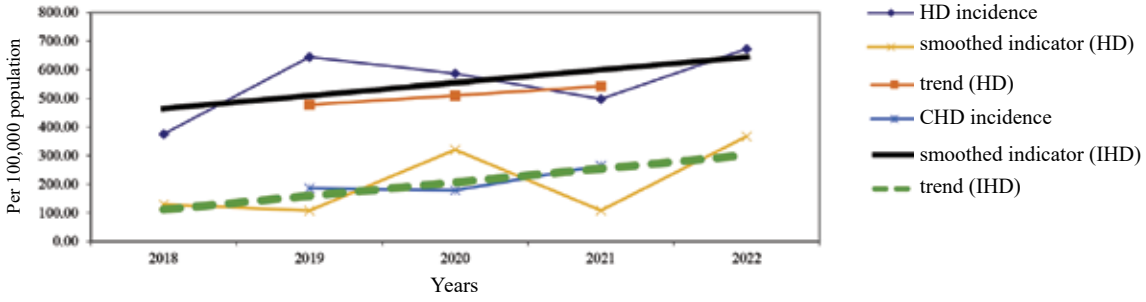

Fig. 3. Long-term changes in the incidence of HD and CHD in the WAP group in 2018–2022

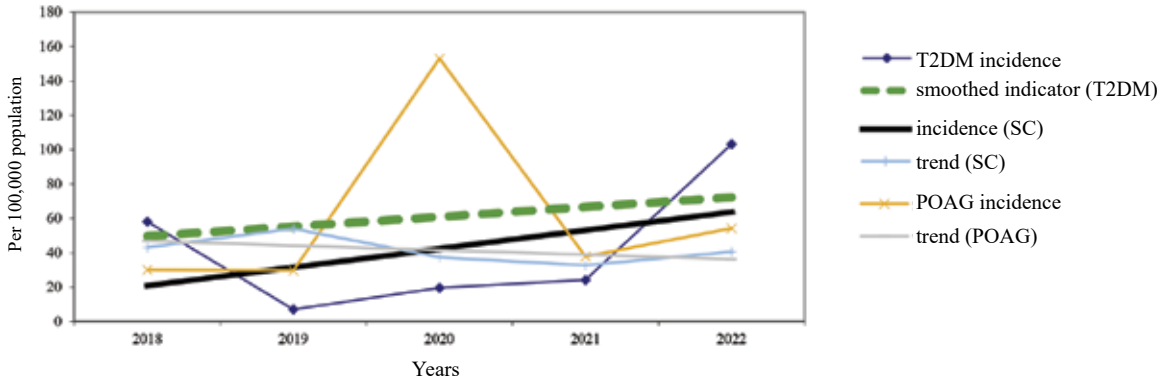

Fig. 4. Long-term changes in the incidence of T2DM, SC, and POAG in the WAP group in 2018–2022

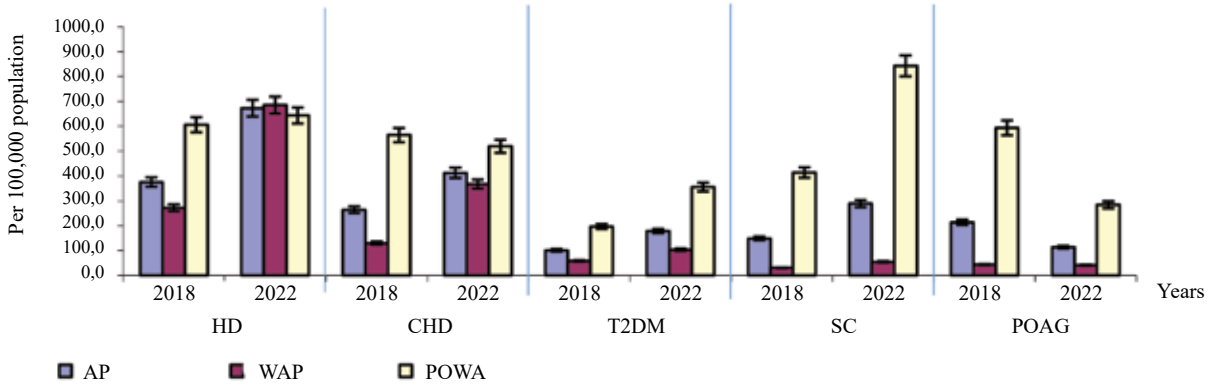

Fig. 5. Incidence rates of individual ARDs in 2018 and 2022

Table 2

Incidence rates of individual ARDs among different age groups in 2018–2022

Year	AP					WAP					Ratio Yi (AP):Yi (WAP)				
	Yi(HD)	Yi(IHD)	Yi(T2DM)	Yi(SC)	Yi(POAG)	Yi(HD)	Yi(IHD)	Yi(T2DM)	Yi(SC)	Yi(POAG)	HD	IHD	T2DM	SC	POAG
2018	375.4	264.1	101.0	148.9	213.6	271.9	129.4	58.1	30.0	43.1	1.4	2.0	1.7	5.0	5.0
2019	644.5	329.3	39.6	188.9	211.8	587	108.0	7	29.6	54.0	1.1	3.0	5.7	6.4	3.9
2020	586.7	377.8	37.3	637.6	149.2	574.9	320.4	19.6	153.1	37.4	1.0	1.2	1.9	4.2	4.0
2021	497.9	201.8	39.9	222.4	85.8	367.9	108.3	24.1	37.8	32.7	1.4	1.9	1.7	5.9	2.6
2022	672.8	412.5	178.3	288.9	112.9	685.3	367.2	103.2	54.1	40.6	1.0	1.1	1.7	5.3	2.8
Median	586.7	329.3	39.9	222.4	149.2	574.9	129.4	24.1	37.8	40.6	1.1	1.9	1.7	5.3	3.9
Rid	8.1	5.3	19.6	10.5	-1.37	12.2	23.0	25.3	9.3	–6.3	–	–	–	–	–

Figure 5 shows the incidence rate of HD, CHD, T2DM, SC, and POAG in persons of different age groups in the pre-COVID (2018) and post-COVID (2022) periods. It was established that the incidence rate of HD in the WAP group in the post-COVID period reached the incidence rate in the POWA group. A similar pattern was characteristic of CHD, T2DM, and SC. On the contrary, in the case of POAG, a decrease in the incidence rate was observed in all age groups considered.

DISCUSSION

The conducted comprehensive research demonstrated the relevance of studying a group of diseases associated with age-related processes. Early manifestation of ARDs from a clinical point of view is identical to the accelerated development of aging processes. Thus, the researchers found that a sharp increase in the incidence of T2DM begins in the age group of 50–54 years [7].

The analysis of the incidence (by uptake) of ARDs showed a moderate growth rate in the adult population on the whole and a pronounced increase in WAP. The revealed pattern corresponds to the trend when ARDs occur in younger people. A similar upward trend was found when assessing the changes in the prevalence of T2DM in the Krasnodar Krai in 2007–2012, with an average long-term level of total incidence of 3,093.7 cases per 100,000 population [8].

According to longitudinal observational studies, the incidence of arterial hypertension in Russia is on average 44% and continues to increase steadily [9]. The median level of incidence of arterial hypertension obtained in our study is slightly higher than its level in Russia (586.7 vs 547.7), which is consistent with the higher prevalence of this pathology in the Northwestern Federal District (8,129.5 cases per 100,000 population) compared to its prevalence in Russia [10].

The assessment of the sequence of pathology development according to the “age-specific morbidity index” (the ratio of the incidence rates in the POWA group to the same parameter in the AP group) clearly demonstrated an earlier manifestation of HD compared to T2DM. To assess the consistency of this index, a similar parameter was calculated for the incidence of certain ARDs in the Russian population according to the latest official statistics [10–12]. The calculation results fully confirmed the data obtained in this study

and corresponded to the following sequence of ARDs: HD – CHD – T2DM – POAG – SC (Table 3). In addition, it should be noted that the calculated index is directly proportional to the degree of association of pathology with older age: the higher the parameter value, the later the disease manifests. This index may be one of the important criteria for classifying pathology as ARD, given that there is debate whether some diseases should belong to this group [13].

Table 3

Ratio of incidence rates (Yi (POWA):Yi (AP)) by particular ARDs in the Russian Federation in 2018

Disease	Ratio
HD	1.32
CHD	1.73
T2DM	1.82
POAG	2.21
SC	2.27

According to the data obtained, among the considered ARDs at the population level, HD develops most early, followed by CHD, T2DM, POAG, and SC. In the future, this pattern will make it possible to develop a strategy for screening premature aging based on targeted early diagnosis of HD and CHD in younger people and T2DM, POAG, and SC in a more mature age. Such a step-by-step concept of secondary prevention of premature aging has a number of advantages: a more rational distribution of time, labor and financial resources; more targeted diagnostic screening increases the efficiency of detection due to optimal provision of the required diagnostic aid.

An increase in the incidence rate was found for the studied group of pathologies in the post-COVID period in all age groups. As noted above, this phenomenon may be associated both with the impact of the coronavirus infection on the accelerated aging and with the fact that the pandemic made people seek medical care in the hospital more often. For a more detailed and comprehensive study of this issue, it is necessary to consider the incidence rate (by uptake) in the post-COVID period over time, as well as to analyze the incidence rates based on the results of medical examinations in the pre- and post-COVID periods.

CONCLUSION

Thus, the incidence rate of age-related diseases is characterized by a continuing upward trend, especially characteristic of the WAP group. This pattern corresponds to the trend when ARDs occur in younger people. In addition, in the post-COVID period, a more accelerated development of such diseases was found. The identified patterns will make it possible to develop clearer approaches to the prevention, diagnosis, and treatment of age-related diseases as a separate group.

REFERENCES

1. Proschaev K.I., Ilnitsky A.N., Zhernakova N.I. The main geriatric syndromes: a textbook. Belgorod, 2012:228 (in Russ.).
2. Xia S., Zhang X., Zheng S., Khanabdali R., Kalionis B., Wu J. al. An update on inflamm-aging: mechanisms, prevention and treatment. *Journal of Immunology Research*. 2016;8:1–12. DOI: 10.1155/2016/8426874.
3. Dartigues J.F., Bourdonnec K. L., Tabue-Teguo M., Le Goff M., Helmer C., Avila-Funes J.A. et al. Co-occurrence of geriatric syndromes and diseases in the general population: assessment of the dimensions of aging. *The Journal of Nutrition, Health, Aging*. 2022;26(1):37–45. DOI: 10.1007/s12603-021-1722-3.
4. Samieri C., Perier M.C., Gaye B., Proust-Lima C., Helmer C., Dartigues J.F. et al. Association of cardiovascular health level in older age with cognitive decline and incident dementia. *JAMA*. 2018;320(7):657–664. DOI: 10.1001/jama.2018.11499.
5. Avila-Funes J.A., Pelletier A., Meillon C., Catheline G., Periot O., Trevino-Frenk I. et al. Vascular cerebral damage in frail older adults: the AMImage study. *The Journals of Gerontology*. 2017;72(7):971–977. DOI: 10.1093/gerona/glw347.
6. Guo X., Franco O.H., Laine J.E. Accelerated ageing in the COVID-19 pandemic: A dilemma for healthy ageing. *Maturitas*. 2022;157: 8–69. DOI: 10.1016/j.maturitas.2021.12.009.
7. Ivanenko A.A., Ushakova O.V. Epidemiology of type 2 diabetes mellitus in Komsomolsk-on-Amur. *Far East Medical Journal*. 2011;3:30–32. (In Russ.).
8. Basinskaya L.A., Komarovskikh E.N., Sakhnov S.N., Zabolotny A.G. The prevalence of diabetes mellitus of the first and second type in the Krasnodar region. *Bulletin Physiology and Pathology of Respiration*. 2013;50:126–129. (In Russ.).
9. Balanova Yu.A., Shalnova S.A., Imaeva A.E., Kapustina A.V., Muromtseva G.A. et al. Prevalence, awareness, treatment and control of arterial hypertension in the Russian Federation (data of the observational study ESSE-RF-2). *Rational Pharmacotherapy in Cardiology*. 2019;15(4):450–466. (In Russ.). DOI: 10.20996/1819-6446-2019-15-4-450-466.
10. Morbidity of the adult population of Russia in 2019. Statistical data. Moscow: Ministry of Health of Russia, 2020:160. (In Russ.).
11. Morbidity of the population over the working age in Russia in 2019. Statistical data. Moscow: Ministry of Health of Russia, 2020:183. (In Russ.).
12. Healthcare in Russia. 2019: Statistical collection. Moscow: Rosstat, 2019:170. (In Russ.).
13. Neudakhin E.V., Moreno I.G. Revisiting the pathogenesis of atherosclerosis and correction of atherogenic disorders in children. *RMJ. Pediatrics*. 2018;9:62–68. (In Russ.).

Authors' information

Saginbaev Ural R.h – Cand. Sci. (Biology), Senior Researcher, Laboratory for Age-related Clinical Pathology, St. Petersburg Institute of Bioregulation and Gerontology, Saint Petersburg, ural-spb-sag@mail.ru, https://orcid.org/0000-0001-9709-1882

Akhmedov Timur A. – Dr. Sci. (Biology), Associate Professor, Leading Researcher, Laboratory for Age-related Clinical Pathology, St. Petersburg Institute of Bioregulation and Gerontology, Saint Petersburg, timaxm@mail.ru, https://orcid.org/0000-0002-3105-4322 ; SPIN code: 5333-0721;

Rukavishnikova Svetlana A. – Dr. Sci. (Biology), Associate Professor, Leading Researcher, Laboratory for Age-related Clinical Pathology, St. Petersburg Institute of Bioregulation and Gerontology, Saint Petersburg, kdb2@yandex.ru, https://orcid.org/0000-0002-3105-4322

Davydova Elena P. – Researcher, Laboratory for Age-related Clinical Pathology, St. Petersburg Institute of Bioregulation and Gerontology, Saint Petersburg, kephala@mail.ru, https://orcid.org/0000-0002-2702-9394

(✉) **Saginbaev Ural R.,** ural-spb-sag@mail.ru

Received 27.10.2023;
approved after peer review 11.03.2024;
accepted 14.05.2024