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SOCIO-DEMOGRAPHIC AND ECONOMIC FACTORS OF THE PHARMACEUTICAL MARKET DEVELOPMENT IN RUSSIA

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ABSTRACT

The events of the past 25 years have had a significant impact on the Russian industry in general, and on the production of medicines in particular. The crisis of 2014, the COVID-19 pandemic, the sanctions of 2022, and the unstable position of Russia in the international political arena – all these events had a significant impact not only on the economic condition of Russians but also on the demographic composition of the country. The Russian population continues to age, and the dynamics of the birth rate are negative, despite the attempts of the state to change the situation. The mortality rate of the population (including young people) over the past two years has significantly exceeded the figures of recent years. In addition, the unstable economic and political situation forces hundreds of thousands of young educated people to emigrate from Russia. The development of social networks, mass media, and the increase in the retirement age - all these are social factors that significantly affect the behavior of citizens during a difficult time for them, including the choice and purchase of medicines. This scientific paper describes the economic events of recent years, which have most influenced both the policy of drug manufacturers and the preferences of buyers. It also provides statistics on the Russian population by various categories and analyzes the social factors that control consumer behavior.

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Introduction

The industrial complex is a complex economic system, which is influenced by many factors [1]. The identification of existing factors and their systematization makes it possible to determine the main directions of development and support of the industrial complex, as well as to systematize existing approaches and tools for regulating its activities. External factors concerning the industrial complex include those factors that are associated with the impact on the cluster formation process from the environment and society. The social factors of the development of the industrial complex include social tension, employment, demographic situation, purchasing power, and health of the population [2, 3].

The pharmaceutical market of Russia consists of two main segments: commercial and state. The consumption of medicines at the expense of the population's funds remains one of the main parts of the drug supply of the healthcare system [4]. It accounts for about 64% in monetary terms and almost 85% in packages. Therefore, the state of the pharmaceutical market in Russia today cannot be considered only from the point of view of big politics and the world economy in isolation from the mood and standards of behavior of the local consumer.

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The purpose of this work is to analyze various economic and socio-demographic factors affecting the behavior of consumers of medicines, and consequently, the development of the pharmaceutical industry market in Russia.

The Economic Situation Around the Pharmaceutical Market in Russia

The economy of the Russian Federation experienced difficult moments at various stages of its development. Each economic crisis was accompanied by a wave of growth in various sectors of industry, including pharmacy. The crisis of 1998 showed the insufficient development of the market of domestic medicines. At the same time, a significant increase in prices for foreign drugs has made them practically inaccessible to the majority of the population [5]. Thus, the need to create a Russian system of drug production independent of foreign countries has become obvious.

Since 2009, the state has been actively intervening in the development of the domestic pharmaceutical market: "Pharma 2020" is approved - a strategy for the development of the pharmaceutical industry until 2020. According to this strategy, by 2020 at least 50% of medicines should be provided at the expense of domestic manufacturers.

In 2014-2015, due to the decline in world oil prices, as well as difficult relations in the Russia-Ukraine political arena and the annexation of Crimea, there was a sharp drop in the ruble exchange rate against the dollar. So in July 2014, 1 US dollar cost 34.7 rubles, in December 2014, 1 US dollar cost 55.6 rubles, and in February 2015, the US dollar cost 70 rubles. According to the Bank for International Settlements (BIS), the real effective exchange rate of the ruble from December 2013 to September 2015 decreased by 30.4%, which is one and a half times higher than the crisis of 2008-2009. Such a strong weakening of the ruble has become one of the main reasons for the increase in inflation, and, as a result, a decrease in real incomes of the population, a decrease in purchasing power, and domestic demand in general [6].

In 2018, there was another crisis in the Russian pharmaceutical market - the real incomes of Russians, and, consequently, the purchasing power of the population, fell significantly [7]. All this harmed the growth of drug consumption, and all participants in the pharmaceutical production chain began to reconsider the relationship between themselves and the consumer to maintain profits at the level of previous years. For the first time since 2011, the growth of the Russian pharmaceutical market has stopped **(Figure 1)**.

Nevertheless, the federal target program "Pharma 2020" in 2019 was supplemented with new targets and extended until 2024. By 2024, a new goal was set - to produce 93% of the drugs included in the list of essential medicines on the territory of the Russian Federation.

In 2020, a new incentive in the form of COVID-19 coronavirus infection was added to the development of the global and Russian drug market. A huge number of cases, massive use of personal protective equipment, the development and sale of vaccines, and various methods of prevention and treatment of the disease – all made COVID-19 the main factor that influenced the development of the pharmaceutical market in 2020 [8-10]. The dynamics of the Russian market in relative terms amounted to 9.8% instead of the predicted 5% **(Figure 1)**.

Figure 1. Capacity of the Russian pharmaceutical market, billion rubles, from 2011 to 2021

Experts in the field of economics claim that the profit of the Russian pharmaceutical industry in 2020 increased almost 2 times – from 126.3 billion rubles to 244.4 billion rubles. Such a mad leap occurred due to the following reasons:

- Increase in drug prices;
- Shifting the focus of consumers to more expensive or cheaper medicines
- Consumer demand for more capacious packages;
- The panic caused by quarantine forced the mass consumer to make a reserve of medicines.

At the same time, more than 65% of the market in 2020 – 2021 in physical terms is occupied by Russian-made medicines. At the same time, in monetary terms, only 42-45% is accounted for by Russian-made drugs [11].

The events taking place in the international political arena since February 2022 have had an extremely negative impact on the state of the Russian market, including the pharmaceutical one. Even though the Russian pharmaceutical industry has not been directly sanctioned, it has suffered significantly from the side effect of sanctions in other sectors of the economy. For example,

there were huge difficulties with the production of various packages for medicines, as well as the logistics route of supplies was lengthened.

Nevertheless, a significant number of Western companies claim that they will continue to invest in research, release new drugs to the Russian market and work in the same mode, since for them the welfare and health of the population are in the first place. Thus, Sanofi, Novartis, PMS, Roche, and others declare their commitment to the Russian market. In addition, many international companies have rebuilt their production facilities on the territory of the Russian Federation, thus consolidating their position [12]. At the same time, the leading foreign pharmaceutical companies Fizer and Bayer, although they continue to supply medicines, however, refuse to conduct investment and research activities in Russia.

Nevertheless, there is no doubt that redistribution of shares and levels of influence between producers is expected in the Russian market. Since 2022, Russian and Asian pharmaceutical manufacturers have had real opportunities to expand drug markets.

Social and Demographic Factors Affecting the Pharmaceutical Industry in Russia

The demographic and social situation in Russia now definitely cannot be called simple and understandable. The difficult situation of the country in the world political arena, COVID-19, and numerous economic crises of the last 20 years have led to the following consequences today [13]:

- Massive outflow of the country's population abroad. It should be noted that the majority of people leaving the country are young people (the average age of emigrants is 30 years), with a good education (IT specialists and scientists often leave the country) and high ambitions [10]. According to unofficial data, almost 6 million people left the Russian Federation from February to November 2022.
- The influx of population from neighboring countries, main people without education, ready for hard physical labor. Most often, citizens of Tajikistan, Kazakhstan, Uzbekistan, China, and Georgia arrive in Russia;
- Low birth rate **(Figure 2)**. It should be noted that state stimulation of the birth rate (the introduction of maternity capital and other measures of material support) leads to a surge in the birth rate of children mainly in disadvantaged families;
- Population aging **(Figure 3)**;
- A relative increase in physical and mental load on representatives of the able-bodied population, deterioration of health, decrease in life expectancy;
- Decrease in the purchasing power of the population;
- Increasing the retirement age.

These socio-demographic reasons cannot but affect the state of the Russian market of medicines. Despite the massive outflow of the population and high mortality in recent years, the population's need for medicines is only growing.

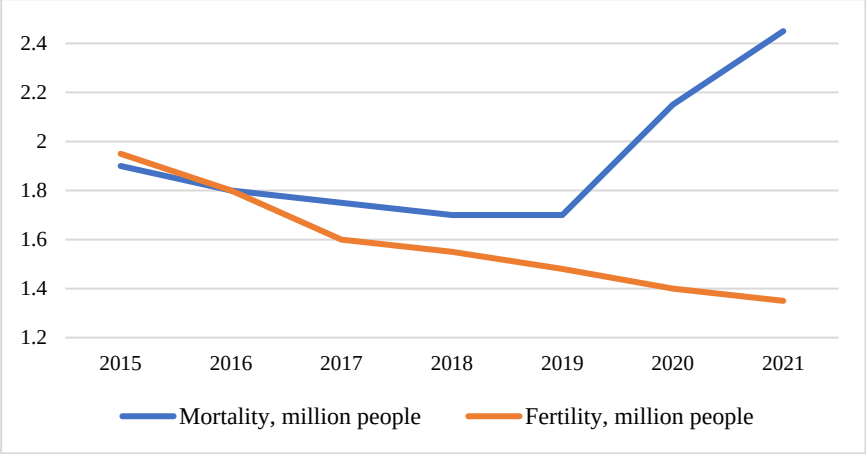

Figure 2. Birth and death statistics in Russia from 2015 to 2021

Men and women aged 55 to 65, who previously had the opportunity to retire, are now forced to continue working. In 2019, a pension reform was adopted in the Russian Federation, providing for an increase in the retirement age of women from 55 to 60 years and men from 60 to 65 years [12]. Thus, the adult population, due to the lack of rest and the need to be in working condition every day, is forced to buy medicines more often. For patients over 60 years of age, medication is prescribed for several purposes [14]:

- preservation, correction, and improvement of functional status: normal well-being, physical condition, and brain functions;
- ensuring independence so that a person needs outside help as little as possible;
- prevention of the appearance or intensification of geriatric syndromes: senile asthenia (weight loss, "fragility" of the skeleton, general weakness), hearing loss, vision, anxiety, depression, falls, fecal and urinary incontinence, malnutrition, and others;

- control, treatment, and prevention of relapses, and exacerbations of existing chronic diseases, and conditions.

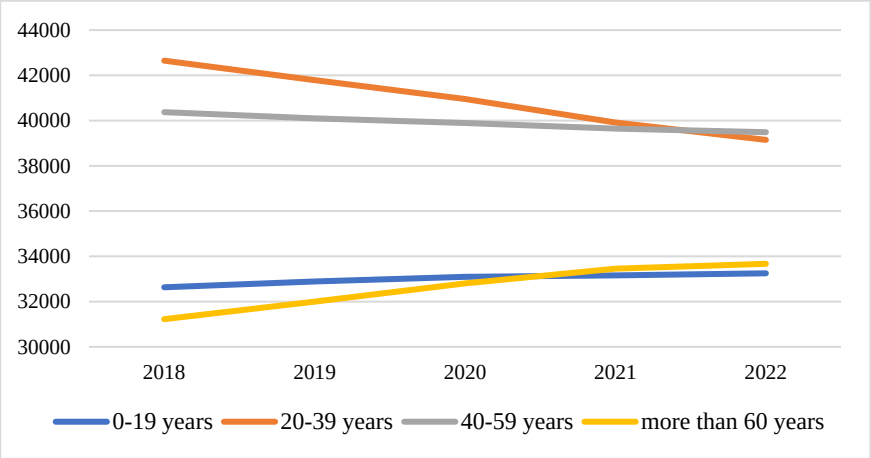

Figure 3. The number of representatives of various age groups in Russia from 2018 to 2022, million people

At the same time, a working person of pre-retirement age often does not have the opportunity and time to complain to the attending physician promptly, therefore self-medication is common among the adult population, in which medications are selected independently, guided by advertising, advice from acquaintances, information from the media.

The State of the Russian Pharmaceutical Market from the Point of View of Consumers

If the number of medicines used is growing, the cost of medicines is growing, and the purchasing power of Russian residents is falling, then it is logical to conclude that there is a tendency in the country to reduce the cost of one unit of production. In what ways is this settlement achieved?

The Russian consumer is gradually switching to medicines of domestic production. This is confirmed by the statistics of the largest manufacturers and suppliers of pharmaceuticals from the end of 2019 to the beginning of 2022 **(Table 1)** [11]. It should be noted that the cost of a foreign drug is generally about 30% more expensive than its Russian counterpart.

In addition, the Russian consumer increasingly prefers the use of generics. Generic is a medicinal product containing an active pharmaceutical ingredient identical to the patented one. Simply put, the generic contains the same active ingredient as the original drug. Unlike the generic, the original drug is a patented drug created based on a new pharmaceutical formula and has passed some preclinical and clinical studies. The pharmaceutical company that developed the drug has a patent for the sole production of the drug [15].

The use of generics began to actively gain momentum with the development of social networks. It was on the open channels that the main original medicines and their analogs began to be published for the first time. After some time, this information began to be advertised by mass newspapers, which are especially common among mature and elderly people **(Table 2)**.

Table 1. The largest manufacturers and suppliers of medicines in the Russian market

November 2019				January 2022			
№	**Name of the manufacturer**	**Cost volume, million rubles**	**Fraction, %**	**№**	**Name of the manufacturer**	**Cost volume, million rubles**	**Fraction, %**
1	Bayer	4136.3	4.6	**1**	Otisipharm	6177.7	5.3
2	Sanofi	3297.8	3.7	**2**	Bayer	4895.7	4.2
3	Novartis	3226.1	3.6	**3**	Novartis	3969.6	3.4
4	Otisipharm	3065.6	3.4	**4**	Stada	3862.1	3.3
5	Teva	2945.6	3.3	**5**	Sanofi	3619.8	3.1
6	Servier	2772.6	3.1	**6**	GlaxoSmithKline	3541.7	3.0
7	KRKA	2618.3	2.9	**7**	Teva	3409.7	2.9
8	GlaxoSmithKline	2599.8	2.9	**8**	Abbott	3269.9	2.8
9	Berlin-Chemie	2346.2	2.6	**9**	A.Menarini	3271.6	2.8
10	Gedeon Richter	2260.3	2.5	**10**	Servier	3037.5	2.6

Table 2. List of some popular original medicines and their cheap analogs

Original medicinal product (a)	**Generic (b)**	**Cost ratio (a/b)**	**Original medicinal product (a)**	**Generic (b)**	**Cost ratio (a/b)**
Voltaren	Diclofenac	7,9	Nurofen	Ibuprofen	10,7

Diflucan	Fluconazole	23,5	Penang	Asparkam	14,2
Zovirax	Acyclovir	19,5	Aspirin Upsa	Acetylsalicylic Acid	21
Immunol	Echinacea	5,24	Mezim-Forte	Pancreatin	2,5
Iodomarin	Potassium Iodide	3,45	Panadol	Paracetamol	2,6
Lazolvan	Ambroxol	12,9	Claritin	Clarotadine	2,2
Noshpa	Drotaverine	10,6	Fastum Gel	Orthophen	7,2

One of the most promising, simple, and economical directions of development of the domestic pharmaceutical industry market is the production of generic copies of original drugs that have already expired patents. From the point of view of the state, it is possible to solve the problem of import substitution of finished drugs [16, 17]. For pharmaceutical companies, this is a chance to increase profits and gain new market shares. From the point of view of medicine, generics have a similar composition, and while preserving the properties of the original drugs, their cost is significantly lower, which means that more patients will be able to receive the necessary treatment [18-20].

However, the problem is that generics are not so easy to produce [21]. Of all the substitution requirements, it is easiest to achieve substance equivalence, that is, to synthesize the same substance as in the original. However, chemically complex drugs may have different physical properties due to different processing methods, and this can lead to different degrees of exposure to the body [22].

Another difficulty lies in the creation of auxiliary substances – stabilizers [23, 24]. The patent mustn't contain all the necessary characteristics of these stabilizers, and although the composition can be obtained by laboratory tests, the conditions, stages, and sequence of the introduction of excipients have to be determined empirically. All this significantly affects the result.

Thus, the generic may not meet the requirements for bioequivalence or therapeutic equivalence. This is not critical when it comes to everyday "simple" medicines, but when it comes to complex drugs with a small difference between active and toxic concentrations or when it is necessary to maintain a specific level of a substance in the blood in a narrow range for a long time, such deviations are unacceptable and can lead to irreparable consequences [11, 25].

In practice, almost perfect generics are very rare. There are precedents with complaints from various communities about generics. The problem lies not in the variety of the drug, but in the absence of a clear verification scheme, the "gold standard" of testing such drugs, screening out ineffective drugs even before entering the market, before harming the patient. There is only one way to ensure the quality and safety of medicines – to complete the transition to GMP standards at absolutely all enterprises. The development of drugs with similar or improved properties, as well as meeting all the necessary criteria, is a longer and more difficult path [26, 27].

It is also interesting to note the behavior of Russians during the coronavirus epidemic. Real fears for life forced the residents of Russia to carefully monitor their health. **Table 3** shows the medications that began to rapidly gain popularity in the era of coronavirus in Russia.

Table 3. Drugs that occupy leading positions in 2021 relative to the beginning of 2020 [16].

Appointment	Title	Dynamics of demand and consumption
Antimicrobial drugs	Levofloxacin	+463,1%
	Ceftriaxone	+382,4%
	Arbidol	+404,7%
Immunomodulators	Ingaron	+225,4%
	Grippferon	+166,3%
	Bronchomunal	+57,5%
Drugs intended for the prevention and treatment of thrombosis and embolism	Eliquis	+79,2%
	Curantil	+65,9%
	Pradaxa	+37,6%

In 2020, due to the difficult economic situation, the real incomes of Russians have fallen significantly. However, despite the deterioration of the financial situation of citizens, their consumer basket in terms of medicines has not decreased and even increased in the most expensive segment. At the same time, medicines of the average price category, on the contrary, have become more actively replaced by cheap analogs. The demand for medicines could not be reduced, as the threats to public health became more than real. A natural question arises: why has the number of medicines purchased in the expensive segment increased significantly?

- *Pharmacy Policy*

Modern pharmacies are brightly lit showcases with neatly displayed drugs. As a rule, drugs of a predominantly expensive segment are put on display. Cheaper analogs are stored in the cabinets of pharmacists. At the same time, some unscrupulous pharmacists strongly recommend the use of goods of a more expensive segment, ignoring the buyer's requests to offer a budget analog.

- *Doctors' Policy*

Doctors prescribe medications, as a rule, regardless of the financial capabilities of the patient. It should be noted that science and medicine do not stand still, and often a new drug shows greater effectiveness with fewer side effects than its outdated counterpart. At the same time, a novelty in the field of the pharmaceutical industry is, as a rule, very expensive.

- *Placebo Effect and Treatment Standards*

Doctors identify groups of drugs with unproven efficacy **(Table 4)**, but continue to prescribe them to their patients, focusing on the so-called "placebo effect". A significant part of the population considers their treatment to be full-fledged only if their ailment is attacked by medicines from all sides. In addition, the standards of medical care oblige doctors to prescribe the same immunostimulants or immunomodulators for colds and respiratory diseases.

Table 4. Groups of drugs with unproven efficacy [27]

Groups of drugs with unproven efficacy	Some medications
Homeopathic remedies	Ocillococcinum, traumel C
Release-active drugs	Anaferon, ergoferon, impaza, tenoten, proproten-100
Immunomodulators and Immunostimulators	Kagocel, polyoxidonium, tactivin, thymalin, thymogen
Some antiviral drugs	Arbidol, amixin, kagocel
Some hepatoprotectors	Essentiale, carsil, artichoke extract, glycyrrhizin, pumpkin seed oil, preparations derived from cattle liver extract
Chondroprotectors	Chondroitin, glucosamine, hyaluronic acid
Nootropics	Piracetam, hopanthenic acid, phenibut, glycine, cerebrolysin, cortexin

- *Publicity in the Media*

Self-medication remains popular in Russia, primarily due to the inability to visit a doctor promptly or a high workload at work. At the same time, the most popular medicines are "promoted" by TV and radio advertisements, as well as social networks.

Conclusion

Summing up the above, we can say that 2022 is a year of difficulties and uncertainties in the Russian pharmaceutical market. There is a decrease in the participation of European companies: some manufacturers are leaving the Russian market, some continue to supply medicines, but stop investing in research, and only a small part of European pharmaceutical companies do not change their policies. However, due to the sanctions, the logistics route for such manufacturers is significantly lengthened, therefore, medicines are becoming more expensive.

Accordingly, Russian and Asian manufacturers have the opportunity to increase their spheres of influence in the market. However, many components of medicines produced in Russia are also supplied to the country from Europe. The same goes for tare. The population of Russia continues to age, and consumer capacity continues to fall. Accordingly, medicines of the middle price segment are replaced by cheap analogs (generics). At the same time, medicines from the expensive price category, on the contrary, are in high demand due to the policy of pharmacists, doctors, and the media. In addition, homeopathic and antiviral drugs are in high demand, which, are drugs with unproven efficacy.

Shortly, the problem of shortage of foreign-made medicines will be solved by the production of generics. However, experts emphasize that generics, although they have a similar active substance, nevertheless, may differ in manufacturing technology and the use of additional components.

Thus, the problem of import substitution in Russia is now the most acute. The competent policy of the state will allow to development of the domestic market of pharmaceutical preparations, without limiting the choice of consumers.

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References

1. Hidalgo CA. Economic complexity theory and applications. Nat Rev Phys. 2021;3(2):92-113. doi:10.1038/s42254-020-00275-1
2. Mareeva S. Socio-economic inequalities in modern Russia and their perception by the population. J Chin Sociol. 2020;7(1):1-9. doi:10.1186/s40711-020-00124-9

3. Siddiqui SA, Singh P, Khan S, Fernando I, Baklanov IS, Ambartsumov TG, et al. Cultural, Social and Psychological Factors of the Conservative Consumer towards Legal Cannabis Use—A Review since 2013. Sustainability. 2022;14(17):10993. doi:10.3390/su141710993
4. Kopteva L, Budagov A, Shabalina L. Russian pharmaceutical industry innovative development: present state and prospects. InE3S Web of Conferences 2021 (Vol. 284, p. 02017). EDP Sciences. doi:10.1051/e3sconf/202128402017
5. Pinto B, Ulatov S. Financial globalization and the Russian crisis of 1998. World Bank Policy Research Working Paper. 2010 May 1(5312).
6. Manushin DV. Economic crisis in the russian macroeconomy in 2014: Causes, Financial Consequences, Prospects. In & V. Mantulenko (Ed.), Global Challenges and Prospects of the Modern Economic Development, vol 57. European Proceedings of Social and Behavioural Sciences (pp. 1505-1512). Future Academy. Available from: doi:10.15405/epsbs.2019.03.153
7. Wolfe SD, Müller M. Crisis neopatrimonialism: Russia's new political economy and the 2018 World. Study of the effect of Baricitinib on the Course of COVID-19. J Pharm Res Int. 2021;33(35A):204-13. doi:10.9734/jpri/2021/v33i35a31890
8. Bergeron A, Décary-Hétu D, Giommoni L. Preliminary findings of the impact of COVID-19 on drugs crypto markets. Int J Drug Policy. 2020;83:102870. doi:10.1016/j.drugpo.2020.102870
9. Maslova AY, Tskaeva AA, Ashurova ZA, Abazova A, Ismailov MM, Ismailova MM, et al. Study of the effect of Baricitinib on the Course of COVID-19. J Pharm Res Int. 2021;33(35A):204-13.
10. Rauf A, Abu-Izneid T, Olatunde A, Ahmed Khalil A, Alhumaydhi FA, Tufail T, et al. COVID-19 pandemic: epidemiology, etiology, conventional and non-conventional therapies. Int J Environ Res Public Health. 2020;17(21):8155.
11. Lobuteva L, Lobuteva A, Zakharova O, Kartashova O, Kocheva N. The modern Russian pharmaceutical market: consumer attitudes towards distance retailing of medicines. BMC Health Servi Res. 2022;22(1):1-2. doi:10.1186/s12913-022-07991-7
12. Kostin KB, Shanava LA. Key trends in the development of the Russian pharmaceutical market amidst uncertainty. J Econ Entrep Law. 2022;12(5):1639-58. doi:10.18334/epp.12.5.114635
13. Matveenko VE, Rumyantseva NM, Rubtsova DN. Migration in the Russian federation today. Teor Praksa. 2017;54:969-89.
14. Terentieva IV. Reforming the pension system of the Russian Federation. InIOP Conference Series: Earth and Environmental Science 2019 Jun 1 (Vol. 272, No. 3, p. 032231). IOP Publishing. doi:10.1088/1755-1315/272/3/032231
15. Balamurugan J, Ramathirtham G. Health problems of aged people. Int J Res Soc Sci. 2012;2(3):139-50.
16. Siddiqui SA, Bahmid NA, Taha A, Khalifa I, Khan S, Rostamabadi H, et al. Recent advances in food applications of phenolic-loaded micro/nanodelivery systems. Cr Rev Food Sci Nutr. 2022:1-21. doi:10.1080/10408398.2022.2056870
17. Gutnova TS, Kompantsev DV, Gvozdenko AA, Kramarenko VN, Blinov AV. Vitamin D nanocapsulation. Izv Vyssh Uchebn Zaved Khim Khim Tekhnol. 2021;64(5):98-105.
18. Zyryanov SK, Fitilev SB, Shkrebneva II, Vozzhaev AV. Drug interchangeability: Clinical efficacy and safety. Neurol, Neuropsychiatry, Psychosom. 2017;9(1S):4-10. doi:10.14412/2074-2711-2017-1s-4-10
19. Kircik LH. Understanding generics. J Drugs Dermatol. 2014;13(7):s75-6.
20. Siddiqui SA, Khan S, Wani SA. Controlling diabetes with the aid of medicinal herbs: a critical compilation of a decade of research. Crit Rev Food Sci Nutr. 2022:1-5. doi:10.1080/10408398.2022.2103088
21. Scheckel CJ, Rajkumar SV. Generics and Biosimilars: Barriers and Opportunities. InMayo Clinic Proceedings 2021 Dec 1 (Vol. 96, No. 12, pp. 2947-2957). Elsevier. doi:10.1016/j.mayocp.2021.08.001
22. Rzhepakovsky IV, Areshidze DA, Avanesyan SS, Grimm WD, Filatova NV, Kalinin AV, et al. Phytochemical characterization, antioxidant activity, and cytotoxicity of methanolic leaf extract of Chlorophytum Comosum (green type)(Thunb.) Jacq. Molecules. 2022;27(3):762. doi:10.3390/molecules27030762
23. Blinov AV, Maglakelidze DG, Yasnaya MA, Gvozdenko AA, Blinova AA, Golik AB, et al. Synthesis of Selenium Nanoparticles Stabilized by Quaternary Ammonium Compounds. Russ J Gen Chem. 2022;92(3):424-9. doi:10.1134/S1070363222030094
24. Blinov AV, Gvozdenko AA, Kravtsov AA, Krandievsky SO, Blinova AA, Maglakelidze DG, et al. Synthesis of nanosized manganese methahydroxide stabilized by cystine. Mater Chem Phys. 2021;265:124510.
25. Siordia JA, Bernaba M, Yoshino K, Ulhaque A, Kumar S, Bernaba M, et al. Systematic and statistical review of coronavirus disease 19 treatment trials. SN Compr Clin Med. 2020;2(8):1120-31. doi:10.1007/s42399-020-00399-6
26. Sizonenko MN, Timchenko LD, Rzhepakovskiy IV, DA SP AV, Nagdalian AA, Simonov AN, et al. The New Efficiency of the «Srmp»–Listerias Growth-Promoting Factor during Factory Cultivation". Pharmacophore. 2019;10(2):85-8.
27. Khandia R, Ali Khan A, Alexiou A, Povetkin SN, Nikolaevna VM. Codon usage analysis of pro-apoptotic bim gene isoforms. J Alzheimers Dis. 2022(Preprint):1-6.