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ANALYSIS OF INDICATORS OF SOCIO-ECONOMIC AVAILABILITY OF CHONDROPROTECTOR DRUGS ON THE UKRAINIAN PHARMACEUTICAL MARKET

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Abstract

The feature of the use of chondroprotective drugs is the presence of a delayed pharmacotherapeutic effect in patients, which necessitates their use for a long time. Against the background of low purchasing power of patients in Ukraine and the lack of effective mechanisms of reimbursement of the cost of treatment by the state, this fact calls into question the possibility of effective treatment of patients with osteoarthritis.

Aim: analysis of indicators of socio-economic accessibility of chondroprotective drugs presented on the pharmaceutical market of Ukraine.

Materials and methods. The information retrieval system "PharmXplorer"/"Pharmstandard" of the company "Proxima Research". Mathematical-statistical, marketing methods of analysis, as well as a set of general theoretical research methods were used (historical, logical, comparative, graphical, etc).

Results of the research. It is established that for different groups of chondroprotective drugs during 2017-2020 there is a different dynamics of changes in the data of Ca.s. and D. Thus, according to the group of imported drugs, the indicator of Ca.s. in 2020, compared to 2017, it decreased by 3.1 times. In contrast, according to the range of domestic drugs, the data of Ca.s have increased 2.0 times since 2017 compared to 2020. According to the data of 2020, the indicator of Ca.s. as a whole in terms of assortment increased by 2.4%, in terms of imported drugs by 3.6%, and in terms of domestic drugs by 2.2 times. During 2017-2019, there was a systematic decrease in the data of Ca.s., which indicates an increase in the availability of drugs for patients. It is proved that during 2017-2020 drugs were relatively available for chronic patients in Ukraine. Thus, the total range of drugs in the range of D ranged from a small range of values, namely from 1.29 to 1.38 (R = 0.09 or 6.98%). According to the results of the analysis of the dynamics of changes in indicators D for drugs of domestic and imported production, it was found that the group of Ukrainian drugs had a positive, from a socio-economic point of view, the trend towards systematic growth of these data (from 1.07 to 1.38). At the same time, it should be noted that imported drugs had a complex nature of changes in indicators D. Thus, this figure in 2017 was 1.08, and in 2019 it increased to 1.97 (+ 82.41%). It was proved that the most available for patients were combination drugs (D = 1.38).

Conclusions. Given the unstable nature of changes in indicators that characterize the availability of chondroprotective drugs, as well as the need for their long-term use by the state, it is necessary to develop and implement effective mechanisms of reimbursement of the cost of consumption of drugs from this group.

Keywords: chondroprotective drugs, chondroitin hydrochloride, glucosamine sulfate, osteoarthritis, pharmaceutical market.

Introduction

The global trend of aging is leading to increasing financial risks in national health systems. these risks are due to the inability to fully compensate for the cost of treatment of chronic patients at the expense of state or other public funds. In addition, the level of requirements in the society for the effectiveness of medical care for chronic patients who need long-term treatment at the expense of state and insurance funds is growing every year [1-3]. Among the groups of chronic patients who require the use of drugs for a long time, a special group is formed by patients with destructive and degenerative diseases of the musculoskeletal system. This is due to the action of a whole range of reasons, including a high level of disability, the presence of long-term pain and the need for comprehensive treatment using a wide range of drugs are a priority [4-7]. According to the WHO, in the structure of the causes of disability in old age, osteoarthritis II ranks after diseases of the cardiovascular system and one of the leaders in disability [8,9].

In Ukraine, the incidence and prevalence of osteoarthritis have been steadily increasing over the past ten years. In 2012, the incidence of osteoarthritis in Ukraine was 345 people per 100 thousand population, and according to 2015 - 254 people per 100 thousand population. Osteoarthritis is known to be one of the most common diseases of the human musculoskeletal system, affecting the hip, knee and shoulder joints [10-12]. For a long time, the pharmacotherapy of osteoarthritis was based on the use of drugs that helped eliminate pain and relieve inflammation in the joint [13-16]. The use of chondroprotective drugs in the pathogenetic and symptomatic treatment since the 60's of the last century has opened up new opportunities to improve the effectiveness of treatment of patients with osteoarthritis [17-19]. The group of chondroprotectors includes drugs that have a delayed action and help modify the structure of the joints, as well as high tropism to cartilage [20,21]. Chondroprotective drugs are characterized by the presence of delayed pharmacotherapeutic effect, which necessitates their use for a long time [22-25]. Despite the fact that discussions on the pharmacoeconomic feasibility of using chondroprotective drugs are still ongoing, the inclusion of chondroprotective drugs in the treatment of patients with osteoarthritis is relevant for many health care systems, including Ukraine [9,26,27].

The purpose of the study was to analyze the indicators that characterize the socio-economic availability of chondroprotective drugs on the domestic pharmaceutical market.

Methods

The object of our research were drugs with chondroprotective action, which in accordance with the recommendations of the European Anti-Rheumatic League (EULAR, 2003), the American College of Rheumatologists (ACR, 2012), the American Academy of Orthopedic Surgeons (AAOS, 2013), the International Society for Osteoarthritis (OARSI, 2014) can be used in the treatment of this pathology of the human musculoskeletal system [28,29]. It should be noted that in Ukraine there is currently no unified protocol for providing medical care to patients with osteoarthritis. In 2016, such a protocol was developed by domestic experts, but later was not approved in the appropriate manner.

According to the classification of anti-arthritic drugs, which was developed by the Joint Committee of the WHO and ILAR (International League of Associations for Rheumatology), chondroprotective drugs belong to the group of slow-acting anti-arthritic drugs (Symptomatic Slow Acting Drugs for Osteoarthritis – SYSADOA) [28-30]. In accordance with the unified Anatomical-Therapeutic and Chemical classification system ATC (Anatomical Therapeutically Chemical Classification System - ATC) chondroprotectors belong to subgroups:

- M – Medicines affecting the musculoskeletal system;
- M01AX – Other non-steroidal anti-inflammatory and anti-rheumatic drugs;
- M01AX05 – Glucosamine;

- M01AX25 – Chondroitin sulfate;
- M01AX21 – Diacerein;
- M01AX55 – Glucosamine and chondroitin sulfate).

Some names of chondroprotective drugs ATC classification system refers to the group:

- M01B – Combined anti-inflammatory (anti-rheumatic) drugs;
- M01BX – Other non-steroidal anti-inflammatory / anti-rheumatic drugs in combination with drugs of other groups;
- M09A – Other means used in pathologies of the musculoskeletal system;
- M09AX10 – Different drugs;
- M09AX01 – Hyaluronic acid.

Further, in accordance with the information retrieval system "PharmXplorer"/"Pharmstandard" of the company "Proxima Research" we analyzed all trade names of chondroprotective drugs in accordance with the release form. The data of average retail prices for chondroprotective drugs, which were offered to consumers in the domestic pharmaceutical market during 2017-2020, were analyzed. Subsequently, the values of average retail prices for all trade names of drugs were calculated, taking into account all forms of release in the dynamics of years.

In order to assess the level of availability of drugs with chondroprotective action, we used two indicators, namely:

- coefficient of adequate solvency (Ca.s.);
- availability (D).

Calculation of the indicator Ca.s. carried out according to the formula

$$C_{a.s.} = \frac{\overline{P}}{W_{a.w.}} \times 100\%$$

where: $C_{a.s.}$ – solvency adequacy ratio;

$\overline{P}$ – the average retail price of the drug for a certain period of time;

$W_{a.w.}$ – average salary for the relevant period of time [31].

The values of the arithmetic weighted average retail prices for chondroprotective drugs for all trade names that were presented on the domestic pharmaceutical market were used for the relevant calculations. Indicators of the average wage were calculated according to the official data of the State Statistics Committee of Ukraine for the relevant periods of time.

In order to assess the socio-economic affordability of drugs in addition to indicators of Ca.s. the indicator D according to the formula was calculated:

$$D = \frac{Ix \times Z\min}{Is \times Vk}$$

where: I_x – index of change in average wages for a certain period of time in Ukraine (2017-2020);

I_S – consolidated price index for medicines that are present in the National List of Essential Medicines, which is valid on the date of the relevant calculations;

Z_{min} – indicator of the minimum wage in the country for a certain period of time in Ukraine (2017-2020);

V_k – the value of the consumer basket in the period under study, i.e. during 2017-2020 [32]

All necessary macroeconomic indicators used for calculations D were obtained from the official website of the State Statistics Committee of Ukraine, which is an open source of information. Analysis of the dynamics of changes in indicators of Ca.s. and D was carried out by calculating the absolute increase in data on drugs, taking into account their international non-proprietary names. In addition, individual and group chain growth indices of Ca.s. and D. Fluctuations in Ca.s. and D was also performed using the variational scope (R) [33].

Analysis of changes in indicators of Ca.s. and D was performed for such groups of chondroprotective drugs as:

- domestic drugs;
- import drugs;
- drugs (glucosamine and chondroitin sulfate);
- combined drugs;
- total set of drugs with chondroprotective action.

In addition to mathematical-statistical, organizational-economic and marketing methods of analysis, general theoretical (historical, logical, comparative, graphical, hypothetical-deductive, etc. were used in research. All the necessary statistical data processing was performed by using the

modern licensed software (StatSoft. Inc., 2014; STATISTICA version 12.7, May 2015), also standardized tables of variation statistics. A value of $p < 0.05$ was considered statistically significant [33].

Results and discussion

The results of calculations of indicators Ca.s. and analysis of the dynamics of their changes are given in table 1. It should be noted the complex nature of changes in the values of this indicator for all groups of analysis. Thus, for the group of imported drugs, the indicator of Ca.s. in 2020 decreased by 3.1 times compared to 2017 data. In contrast, according to the range of domestic drugs, the data of Ca.s. have increased 2.0 times since 2017, compared to the data of 2017. At the same time, the tendency to decrease of values of indicators of Ca.s. in dynamics of years practically on all groups of chondroprotective drugs dominates. Thus, the highest decrease (-47.30) in the values of Ca.s. was observed for the group of chondroitin sulfate monopreparations, and the lowest decrease (-0.06) in the range of domestic drugs in 2018. A characteristic feature of the dynamics of changes in Ca.s. for all groups of chondroprotective drugs is the growth of these data in 2020 compared to the previous 2019. Thus, the increase in Ca.s. data ranged from 0.10 (combined chondroprotective drugs) to 3.43 (domestic drugs)).

Analyzing the general range of chondroprotective drugs, it can be argued that a significant decrease in these indicators of Ca.s. in 2018, compared to previous data, as well as the tendency to gradually increase in 2020.

This fact indicates an increase in their socio-economic accessibility for chronic patients with degenerative lesions of the musculoskeletal system.

Given the significant dependence of the domestic pharmaceutical market on imports and low purchasing power of the majority of the population, it is important to conduct a comparative analysis of the dynamics of changes in Ca.s for a group of drugs of domestic and foreign production [34,35]. The results of the analysis are presented in Figure 1. As you can see, the indicators of Ca.s. during 2017-2019 systematically decreased in the range of both domestic and imported drugs with chondroprotective action. It should be noted that the rate (%) of reduction of Ca.s. data for these groups of drugs differed significantly. Thus, in 2019 the average value of the indicator Ca.s. compared to the data of 2017, it decreased by 3.0 times in the range of imported drugs, and by 17.0% in the group of domestically produced drugs. Subsequently, as we indicated earlier, we observed an increase in Ca.s. on both groups of drugs of chondroprotective action. Thus, according to the group of domestic drugs, the indicator of Ca.s. in 2020 it increased 2.4 times compared to 2019, and in the range of imported drugs by only 3.6%. Thus, it can be argued that there is a significant difference in the nature of the decrease in Ca.s. by group of imported and domestic drugs during 2017-2019.

The next important stage of our research, which allows us to analyze the socio-economic accessibility of patients in the domestic pharmaceutical market was the analysis of the dynamics of changes in indicator D. The results of the research are shown in table 2.

According to the analysis of the special literature, it can be stated that in the presence of values of $D \geq 1.0$, it can be stated that the drugs were relatively available to the vast majority of the population [32]. However, it should be noted that this statement has certain limitations, because in the case of calculations D is the assessment of the availability of one package of drugs for chronic patients. It is clear that for the full treatment of patients with osteoarthritis requires the use of at least 2-4 packages. That is, the peculiarity of providing pharmaceutical care to patients with osteoarthritis is the use of drugs for a long time, and the presence of therapeutic effect is delayed in time [9,11,22-25]. As we can see from Table 2, the most available chondroprotective drugs in 2019 were glucosamine single drugs (D = 2.34). At the same time, we observed the lowest values of availability indicators in 2018 for the group of chondroitin sulfate drugs (D = 0.92). In general, for the entire range of chondroprotective drugs during 2017-2019 there was a gradual increase in their availability for chronic patients. In addition, in the set of drugs that we studied significantly dominated by drugs that had a value of $D \geq 1.0$, they were relatively available to patients. The decrease in these indicators of D in 2020 for all groups of chondroprotective drugs is negative, except for domestic drugs. Thus, in 2019,

domestic drugs had an average value of D = 1.24. In the next 2020, its value increased by 11.3% to 1.38.

Subsequently, we conducted a comparative analysis of the dynamics of changes in D indicators in the group of imported and domestic drugs with chondroprotective action. The results are shown in Figure 2. As we can see, during 2017-2020 the availability of domestically produced drugs gradually increased, namely from 1.07 to 1.38. Thus, the increase in availability in the dynamics of the years was equal to 28.97%. In turn, imported drugs had a complex dynamics of changes in availability. Thus, in 2017, the total range of chondroprotective drugs was 1.08, and in 2019 this figure increased to 1.97, i.e. 82.41%. Subsequently, the availability rate was 1.13, i.e. a decrease of 42.64%. Thus, it can be argued that imported and domestic drugs had not only different in nature the dynamics of changes in D, but also characterized by different values of the rate of change over time.

Next, we calculated the average values of D for groups of chondroprotective drugs (Fig. 3). Thus, the most available for consumers during 2017-2020 were combined drugs (1.38). In this case, the total range of chondroprotective drugs availability rate was equal to the value of 1.29.

Thus, it can be argued that despite the financial and economic crisis in society for patients with osteoarthritis, chondroprotective drugs were relatively available in the domestic pharmaceutical market. In general, the rate of availability by groups of chondroprotective drugs ranged from a small range of values, namely from 1.29 (in the whole range) to 1.38 (group of combined drugs). The value of the variational range was equal to 0.09 or 6.97%.

Organizations of effective pharmaceutical care for chronic patients, such as patients with musculoskeletal disorders, need not only sufficient resources. In recent years, much attention has also been paid to the provision of effective pharmaceutical services, advising patients on a wide range of issues related to trade names of drugs, new forms of drug production, the use of biologically active impurities and vitamins and more. Thus, it can be argued that the role of pharmacists in the treatment and lifelong support of such patients will increase every year, and the professional burden on pharmacies - to increase. Under these conditions, increasing the level of professional training and psychological adaptation of pharmaceutical workers is of great socio-economic importance.

Conclusions

1. According to the analysis of indicators of Ca.s. we found the presence of different in time data on the groups of chondroprotective drugs. Thus, according to the group of imported drugs, the indicator of Ca.s. in 2020, compared to 2017, it decreased by 3.1 times. In contrast, according to the range of domestic drugs, the data of Ca.s. have increased 2.0 times since 2017, compared to the data of 2017.
2. During 2017-2019, there was a systematic decrease in the data of Ca.s., which indicates an increase in the availability of drugs for patients. According to 2020, the indicator of Ca.s. as a whole in the range increased by 2.4%, in imported drugs by 3.6%, and in domestic drugs by 2.2 times.
3. Analyzing the general range of chondroprotective drugs, it can be argued that a significant decrease in these indicators of Ca.s. in 2018, compared to previous data, as well as the tendency to gradually increase in 2020.
4. It is proved that during 2017-2020 chondroprotective drugs in general in the range were relatively affordable for chronic patients. Thus, availability indicators ranged in a small range of values, namely from 1.29 to 1.38 (R=0,09 or 6,98%).
5. According to the results of the analysis of the dynamics of changes in the availability of drugs of domestic and imported production, it was found that for the group of Ukrainian drugs there was a tendency to a systematic increase in these indicators (from 1.07 to 1.38). In general, the range of domestic drugs availability indicators in 2020, compared to 2017 increased by 28.97%.
6. It is proved that imported drugs had a complex nature of changes in availability indicators during 2017-2020 Thus, this figure in 2017 was 1.08, and in 2019 it increased to 1.97 (data growth of 82.41%). In 2020, the availability rate for the range of imported drugs decreased to 1.13 (-42.64%). It is proved that the most accessible for patients were combined drugs (D=1,38).
7. It should be noted that the general conclusion about the availability of drugs used in the

treatment of osteoarthritis for a long time, but sometimes throughout life will need to be made according to the analysis of the cost of treatment. This statement determines the long-term direction of our research.

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The conflict of interests

There is no conflict of interest.

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Table 1

Analysis of the dynamics of indicators of Ca.s. for chondroprotective drugs presented on the Ukrainian pharmaceutical market

Groups of drugs	Years of research				Dynamics of change		
	2017	2018	2019	2020	△1*	△2**	△3***
Coefficient of adequate solvency (Ca.s.)							
Domestic drugs	2,98	3,04	2,53	5,96	0,06	-0,51	3,43
Imported drugs	24,10	16,54	7,41	7,68	-7,56	-9,13	0,27
Combined drugs	–	12,31	5,78	5,88	–	-6,53	0,10
Monopreparations of chondroprotective action, including:	54,10	19,07	8,31	8,65	-35,03	-10,76	0,34
- glucosamine	–	13,1	5,59	5,98	–	-7,51	0,39
- chondroitin sulfate	63,97	16,67	5,67	6,02	-47,30	-11,00	0,35
The total set of drugs with chondroprotective action	54,10	16,54	6,88	7,04	-37,56	-9,66	0,16

Note: - * the difference between the value of the indicator in 2018 compared to 2017;
- ** the difference between the value of the indicator in 2019 compared to 2020;
- *** the difference between the value of the indicator in 2020 compared to 2019.

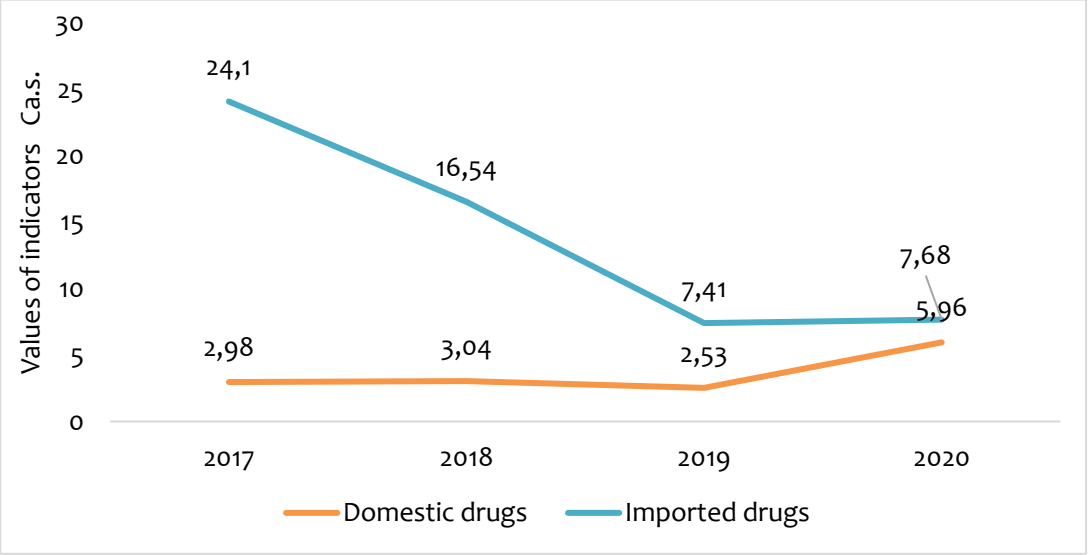

Figure 1 Analysis of changes in indicators of Ca.s. by group of chondroprotective drugs (imported and domestic names) for 2017-2020

Table 2

The results of the analysis of the dynamics of changes in D for the group of chondroprotective drugs in Ukraine

Groups of drugs	Years of research				Dynamics of changes		
	2017	2018	2019	2020	△1*	△2**	△ 3***
Availability (D) of drugs							
Domestic drugs	1,07	1,09	1,24	1,38	0,02	0,15	0,14
Imported drugs	1,08	1,15	1,97	1,13	0,07	0,82	-0,84
Combined drugs	1,23	1,20	1,88	1,21	-0,03	1,88	- 0,67
Monopreparations of chondroprotective action, including:	1,07	1,15	2,03	1,09	0,08	0,88	-0,94
- glucosamine	0,97	1,01	2,34	1,04	0,04	1,33	-1,30
- chondroitin sulfate	1,05	0,92	2,03	1,18	-0,13	1,11	-0,85
The general set of drugs of chondroprotective action	0,87	1,15	1,97	1,16	0,28	0,82	-0,81

Note: - * the difference between the value of the indicator in 2018 compared to 2017;
- ** the difference between the value of the indicator in 2019 compared to 2020;
- *** the difference between the value of the indicator in 2020 compared to 2019.

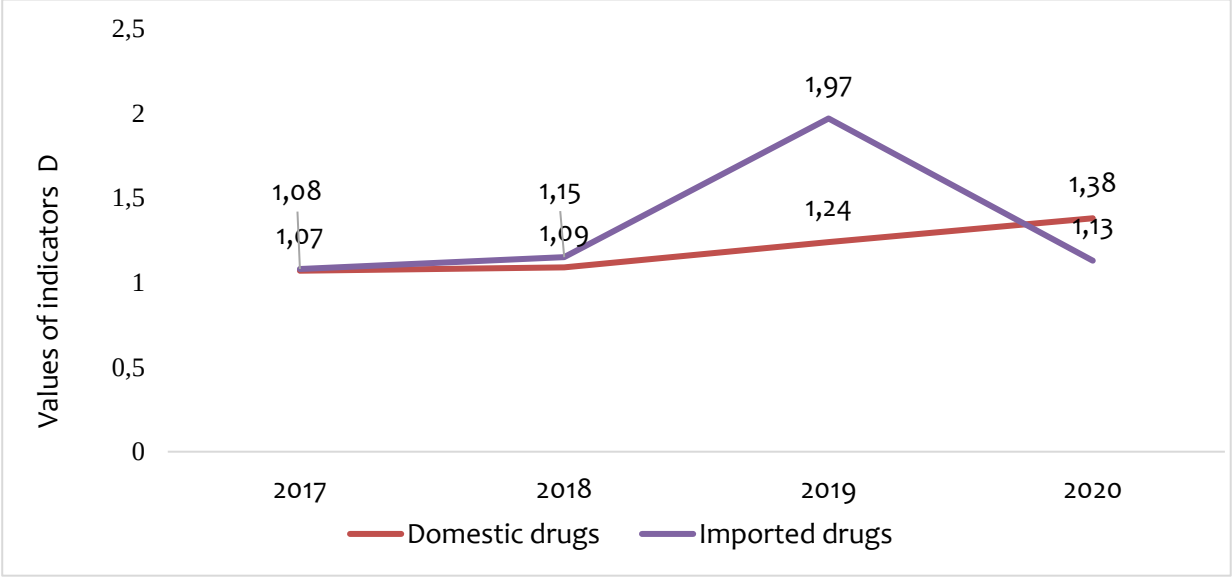

Figure 2. Study of the dynamics of changes in D by the group of chondroprotective drugs during 2017-2020

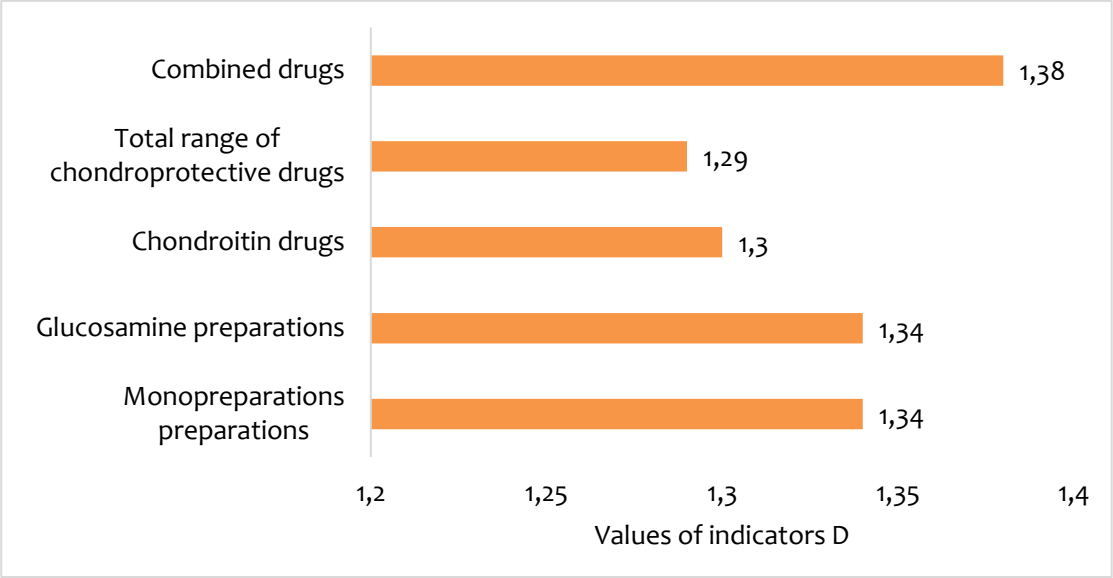

Figure 3. Results of comparative analysis of D indicators by groups of chondroprotective drugs in Ukraine