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## MARKETING RESEARCH OF THE PHARMACEUTICAL MARKET OF UKRAINE IN THE SEGMENT OF ANTIVIRAL DRUGS FOR SYSTEMIC USE

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The present paper provides an overview of the domestic pharmaceutical market, in particular, of the J05 ATC group – antiviral drugs for systemic use.

**Objective** – conducting marketing research of the pharmaceutical market of Ukraine in the segment of antiviral drugs for systemic use: structuring data on their assortment, the ratio of imported to domestic drugs, the availability of the assortment, comparison of retail prices, and determination of social and economic affordability.

**Materials and methods:** data from the State Register of Medicines of Ukraine. Analytical techniques involved logical, mathematical, statistical, methodical, and comparative methods.

The analysis of Ukraine's domestic market for antiviral drugs, using the State Register of Medicines, brings forth significant insights. The dataset comprises 277 registered medicines within this category. Acyclovir stands out as the most prevalent. Beyond the domestic landscape, the study delves into the global presence of antiviral drugs, uncovering representation from 18 different countries. Indian-produced drugs dominate this scenario, comprising 44.2% of the total while Ukrainian-produced drugs constitute 19.9%. The study extends its focus to the socioeconomic accessibility within the Ukrainian pharmaceutical market. Noteworthy findings state that drugs from Ukrainian manufacturers are among the most readily available and economically accessible.

**Conclusion.** The conducted study encourages consideration of local drug development initiatives to enhance the affordability and accessibility of antiviral medications for the Ukrainian population.

**Key words:** antiviral drugs, pharmaceutical market, socio-economic accessibility, State Register of Medicines.

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### МАРКЕТИНГОВІ ДОСЛІДЖЕННЯ ФАРМАЦЕВТИЧНОГО РИНКУ УКРАЇНИ У СЕГМЕНТІ АНТИВІРУСНИХ ПРЕПАРАТІВ ДЛЯ СИСТЕМНОГО ЗАСТОСУВАННЯ

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У статті представлений розгорнутий аналіз вітчизняного фармацевтичного ринку України протівірусних препаратів групи J05 АТС. У дослідженні розглядається асортимент, співвідношення вітчизняних та іноземних препаратів, роздрібна цінова політика, соціально-економічна доступність. Станом на січень 2023 року в Україні зареєстровано 277 протівірусних препаратів. Аналіз країни походження показує, що на ринку домінують препарати індійського виробництва (44,2%), на другому місці – ліки українського виробництва (19,9%). Як показали дослідження, вартість вітчизняних ліків зазвичай є нижчою від імпортованих еквівалентів (виняток становили деякі індійські препарати), тому для підвищення соціально-економічної доступності протівірусних препаратів для громадян України доцільно розвивати їх внутрішнє виробництво, а також налагоджувати співпрацю з індійськими виробниками, наприклад у сфері закупівлі дешевших діючих субстанцій для виготовлення готових лікарських форм.

**Ключові слова:** протівірусні препарати, фармацевтичний ринок, соціально-економічна доступність, Державний реєстр лікарських засобів.

**Introduction.** The importance of antiviral drugs has become increasingly evident in the face of viral diseases, especially COVID-19 and influenza which have placed immense tension on healthcare systems globally. The virus known as SARS-CoV-2, which causes the COVID-19

pandemic, affected over 12.7 million individuals globally and resulted in more than 560.000 fatalities [1].

According to the public health center of the Ministry of Health of Ukraine, these diseases are among the ten leading diseases that caused the most deaths of Ukrainians in 2021 [2].

Antiviral medications play a crucial role in mitigating the severity and spread of these diseases, offering a vital tool for healthcare professionals to manage and treat viral

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Стаття поширюється на умовах ліцензії



infections. However, the demand for these drugs has strained healthcare systems, highlighting the need for adequate drug supply chains, distribution networks and affordability for population. As healthcare systems continue to grapple with the challenges posed by viral diseases, the significance of antiviral drugs in preventing and managing outbreaks cannot be overstated [3]. Antiviral drugs play a crucial role in the treatment of viral infections, and the development of new antiviral drugs continues in response to the growing threat of viral diseases [4].

Group J05 ATC is a subcategory of the Anatomical Therapeutic Chemicals (ATC) classification system that covers direct-acting antiviral agents used to treat viral infections. The ATC system is a widely recognized and standardized method of classifying drugs based on their anatomical, therapeutic and chemical characteristics [5]. The J05 group, in particular, includes drugs used to treat infections caused by viruses, such as hepatitis B and C, HIV/AIDS, and influenza.

The present paper provides an overview of the domestic pharmaceutical market, in particular, of the J05 ATC group – antiviral drugs for systemic use, including distribution by dosage form, the ratio of drugs of Ukrainian and foreign production, analysis of retail prices in the largest pharmacy chains, and the number of items produced by domestic manufacturers.

Modern conditions of socio-economic instability, deterioration of the economic situation and nutrition of a large part of the population, a sharp increase in migration, and an increase in the group of socially vulnerable persons contribute to the spread of viral diseases, because of the connection between anxiety and depression and viral infections, including herpes simplex virus, HIV/AIDS, influenza A (H1N1) and hepatitis C [6; 7; 8; 9]. The outlined

problem is especially relevant now for Ukraine, as in war conditions there is a decline in the population’s purchasing power, chronic stress, and consequently, weakened immune systems, which will impact on the frequency of viral diseases. In addition, an unstable and unpredictable domestic pharmaceutical market will affect the nation’s ability to have a proper treatment for those diseases. Thus, it is essential to be aware of the market section of antiviral drugs [10].

**Objective** – conducting marketing research of the pharmaceutical market of Ukraine in the segment of antiviral drugs for systemic use, in the aspect of structuring data on their assortment, the ratio of imported drugs to domestic ones, the availability of the assortment in the largest pharmacy chains, comparison of retail prices for analog drugs, and determination of social and economic affordability.

**Materials and methods.** Data from the State Register of Medicines of Ukraine were used to examine the selection of antiviral medications for systemic use [11]. Analytical techniques, namely, logical, mathematical, statistical, methodical, and comparative, were used in the work.

**Obtained results.** According to the ATC (Anatomical Therapeutic Chemical) classification, J05 antiviral agents for systemic use belong to the group of Antimicrobial agents for systemic use J. Analysis of the data of the State Register of Medicines of Ukraine as of January 2023 showed that the group of J05 antiviral agents for systemic use has 277 trade names [11]. The most common subgroup by the number of trade names is J05AB01 “Acyclovir”: 26 names. Compounds in this subgroup account for one tenth of the total number of names – 9.38%. The inosine subgroups of pranobex and oseltamivir contain 19 (6.86%) and 17 (6.13%) names, respectively. The distribution of all subgroups is presented in Table 1.

Table 1

Distribution of antiviral agents for systemic use by subgroups

Name of the subgroup of medicines	ATC code	The number of registered trade names of drugs		The number of trade names of drugs			
		absolute number, units	share in the total amount, %	Foreign production		Domestic production	
				absolute number, units	share in the total amount, %	absolute number, units	share in the total amount, %
1	2	3	4	5	6	7	8
Acyclovir	J05AB01	26	9.38	18	69.23	8	30.77
Ribavirin	J05AB04	5	1.8	4	80	1	20
Ganciclovir	J05AB06	3	1.08	0	0	3	100
Famciclovir	J05AB09	11	3.97	10	90.91	1	9.09
Valacyclovir	J05AB11	10	3.61	9	90	1	10
Valganciclovir	J05AB14	4	1.44	4	100	0	0
Rimantadine	J05AC02	4	1.44	4	100	0	0
Ritonavir	J05AE03	1	0.36	1	100	0	0
Atazanavir	J05AE08	6	2.16	2	33.33	4	66.67
Darunavir	J05AE10	8	2.88	7	87.5	1	12.5
Zidovudine	J05AF01	10	3.61	3	30	7	70
Lamivudine	J05AF05	7	2.52	7	100	0	0
Abacavir	J05AF06	4	1.44	4	100	0	0
Tenofovir disoproxil	J05AF07	6	2.16	5	83.33	1	16.67

1	2	3	4	5	6	7	8
Entecavir	J05AF10	2	0.72	2	100	0	0
Tenofovir alafenamide	J05AF13	2	0.72	1	50	1	50
Nevirapine	J05AG01	6	2.16	6	100	0	0
Efavirenz	J05AG03	6	2.16	6	100	0	0
Etravirine	J05AG04	2	0.72	1	50	1	50
Rilpivirine	J05AG05	1	0.36	1	100	0	0
Zanamivir	J05AH01	1	0,36	1	100	0	0
Oseltamivir	J05AH02	17	6.13	11	64.70	6	35.30
Raltegravir	J05AJ01	2	0.72	2	100	0	0
Ribavirin	J05AP01	1	0.36	0	0	1	100
Daklatasvir	J05AP07	3	1.08	2	66.67	1	33.33
Sofosbuvir	J05AP08	5	1,8	3	60	2	40
Dasabuvir	J05AP09	2	0.72	2	100	0	0
Sofosbuvir/ ledipasvir	J05AP51	6	2.16	4	66.67	2	33.33
Ombitasvir/ paritaprevir/ ritonavir	J05AP53	2	0.72	1	50	1	50
Sofosbuvir/ velpatasvir	J05AP55	4	1.44	4	100	0	0
Glecaprevir/ pibrentasvir	J05AP57	3	1.08	3	100	0	0
Combina drug	J05AR	4	1.44	2	50	2	50
Zidovudine/ lamivudine	J05AR01	9	3.24	7	77.78	2	22.22
Lamivudine/ abacavir	J05AR02	3	1.08	3	100	0	0
Tenofovir Disoproxil/ Emtricitabine	J05AR03	5	1.8	4	80	1	20
Lamivudine/ zidovudine/ nevirapine	J05AR05	1	0.36	1	100	0	0
Efavirenz/ emtricitabine/ tenofovir disoproxil	J05AR06	9	3.24	9	100	0	0
Rilpivirine/ emtricitabine/ tenofovir disoproxil	J05AR08	1	0.36	1	100	0	0
Lopinavir/ ritonavir	J05AR10	5	1.8	1	20	4	80
Efavirenz/ lamivudine/ tenofovir disoproxil	J05AR11	1	0.36	1	100	0	0
Lamivudine/ abacavir/ dolutegravir	J05AR13	2	0.72	0	0	2	100
Emtricitabine/ tenofovir/ elvitegravir/ cobicistat	J05AR18	1	0.36	1	100	0	0
Dolutegravir/ rilpivirine	J05AR21	1	0.36	1	100	0	0
Atazanavir/ ritonavir	J05AR23	1	0.36	1	100	0	0
Lamivudine/ tenofovir/ dolutegravir	J05AR27	1	0.36	1	100	0	0

1	2	3	4	5	6	7	8
Комбінований препарат	J05AX	8	2.88	6	75	2	25
Inosine pranobex	J05AX05	19	6.85	12	63,15	7	36,84
Raltegravir	J05AX08	1	0.36	1	100	0	0
Dolutegravir	J05AX12	10	3.61	10	100	0	0
Umifenavir	J05AX13	4	1.44	4	100	0	0
Daklatasvir	J05AX14	1	0.36	1	100	0	0
Sofosbuvir	J05AX15	1	0.36	1	100	0	0
Dasabuvir	J05AX16	2	0.72	2	100	0	0
Enisamium iodide	J05AX17	4	1.44	2	50	2	50
Letermovir	J05AX18	2	0.72	2	100	0	0
Baloxavir marboxil	J05AX25	2	0.72	2	100	0	0
Favipiravir	J05AX27	3	1.08	3	100	0	0
Sofosbuvir/ ledispavir	J05AX65	1	0.36	1	100	0	0
Ombitasvir/ paritaprevir/ ritonavir	J05AX67	2	0.72	2	100	0	0
Sofosbuvir/ velpatasvir	J05AX69	1	0.36	1	100	0	0
<b>Total</b>		<b>277</b>	<b>100.00</b>	<b>222</b>	<b>80.15</b>	<b>55</b>	<b>19.85</b>

From the J05AR group, which includes drugs for the treatment of HIV infection, there are 14 drugs represented by 44 names on the pharmaceutical market of Ukraine. Of these 14 medicinal products, Ukrainian plants produce 5 and are represented by 11 trade names.

The data in the table clearly shows the state of the domestic pharmaceutical market for antiviral drugs and the division of the product range into Ukrainian and foreign-made drugs. It was found that Ukrainian drugs occupy only a fifth of the market. The only domestic representative that occupies more than half of the market is Zidovudine (J05AF01). It is worth noting that Acyclovir (J05AB01), although occupying only a third of the market compared to imported drugs, is represented by 8 trade names.

Instead, drugs in the subgroups of Famciclovir (J05AB09) and Valacyclovir (J05AB11) are represented by only a single name. And Dolutegravir (J05AX12), even more so, does not have a single name from a domestic manufacturer.

Analyzing the results presented in Table 1, it is also essential to note that one-fifth of the drugs on the market are combined drugs (in particular, there are 59 such drugs out of 277 names, which make up 21.3% of the total number), as a result of which there is a significant expansion of the range of antiviral drugs. Thus, the combination of 3 active substances (J05AF01, J05AF05, J05AF07) in different ratios made it possible to bring 9 drugs to the pharmaceutical market. Such a situation only expands the assortment, but does not actually bring an original effective new drug to the market. Therefore, the search for new effective active substances with antiviral action is promising.

There are active substances that are presented both as separate medicinal products and as part of combined preparations. In particular, Lamivudine (J05AF05) is presented as a separate drug, but it is also part of 4 separate trade

names (J05AR01, J05AR02, J05AR05, J05AR27). Tenofovir disoproxil (J05AF07) is presented as a separate drug, but it is also part of 6 separate trade names (J05AR03, J05AR06, J05AR08, J05AR11, J05AR18, J05AR27).

Distribution of these drugs was also analyzed by the dosage form used in the State Register of Medicines of Ukraine. It was found that the lion's share of drugs are tablet forms – 202 names (72.9%), capsules – 35 names (15.5%), oral solutions – 12 names (4.3%), infusions – 10 names (3.6%), and other less common forms of release: syrups, suspensions, drops, suppositories and granules. Oral dosage forms of the antiviral drugs presented in this study are the most convenient to use and account for the vast majority of the total number of dosage forms (Fig. 1).

An analysis of the pharmaceutical market for antiviral drugs by country of origin showed that the largest market

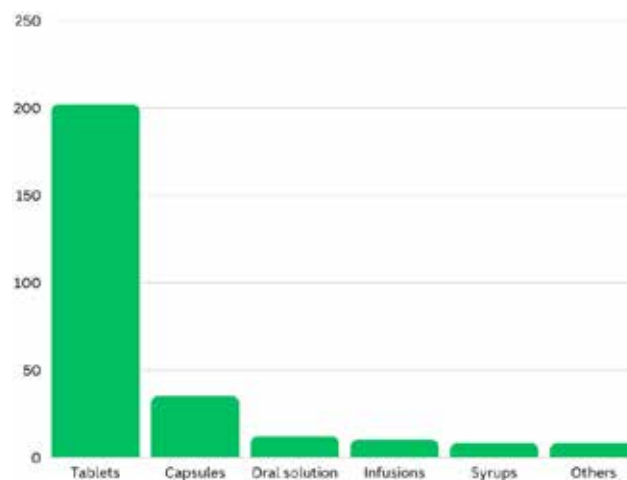


Fig. 1. Distribution of antiviral drugs by release form

share is held by drugs of Indian origin – 44.2%, which corresponds to 122 names. In contrast, Ukrainian-made drugs account for only 19.9% of the market and are represented by 55 names (Fig. 2).

The distribution of medicinal products in the studied segment among manufacturers of Indian origin by assortment items is as follows: Aspiro Pharma Limited – 1 position, Aurobindo Pharma Limited – 14 positions, Hetero Labs Limited – 31 positions, Glenmark Pharmaceuticals Ltd. – 1 position, Emcur Pharmaceuticals Ltd. – 9 positions, Laurus Labs Limited – 1 position, Lupin Limited – 1 position, Mylan Laboratories Limited – 18 positions, Macleods Pharmaceuticals Limited – 11 positions, Micro Labs Limited – 1 position, Milan Laboratories Limited – 5 positions, MSN Laboratories Private Limited – 3 positions, Natco Pharma Limited – 6 positions, Panacea Biotech Pharma Ltd. – 1 position, Sun Pharmaceutical Industries Limited – 3 positions, Strides Pharmaceutical Sciences Limited – 11 positions, Cipla Ltd – 5 positions.

The analysis of INN (international nonproprietary names) of antiviral drugs for systemic use J05 showed that 199 items, i.e., 71.84%, are mono drugs, and 78 items, i.e., 28.16% of the total number, are combined drugs.

After analyzing antiviral drugs for systemic use by the number of names manufactured by a particular domestic manufacturer, we obtained the results presented in Table 2. The results show that Farmak is the leader in terms of the number of names (Fig. 3), which, according to Proxima Research as of November 2022, remains the leader of the Ukrainian pharmaceutical market, just like in pre-war times [12].

We also analyzed prices in the largest pharmacy chains for the most popular products on the market. We analyzed the prices of the most popular antiviral drugs [13] on the market in the largest pharmacy chains of Ukraine, taking into account the number of outlets [14]. For comparison, the pharmacy chains Pozhorozhnyk, Bazhaemo zdorovya – Sirius-95 and ANC – Apteka Magnolia LLC in Kyiv, Lviv, and Kharkiv regions were taken.

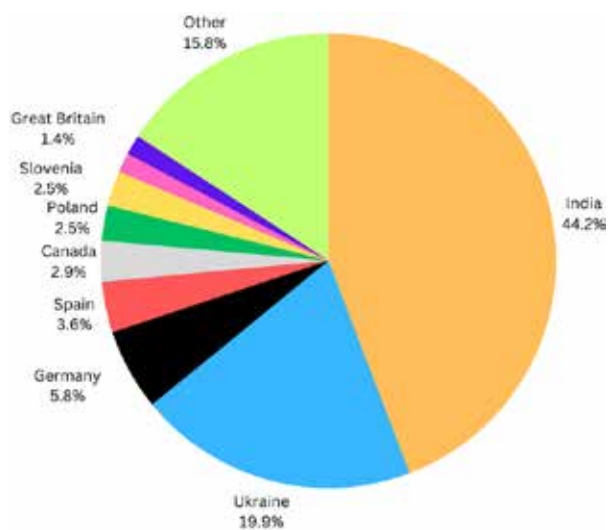


Fig. 2. Distribution of antiviral drugs by country of origin

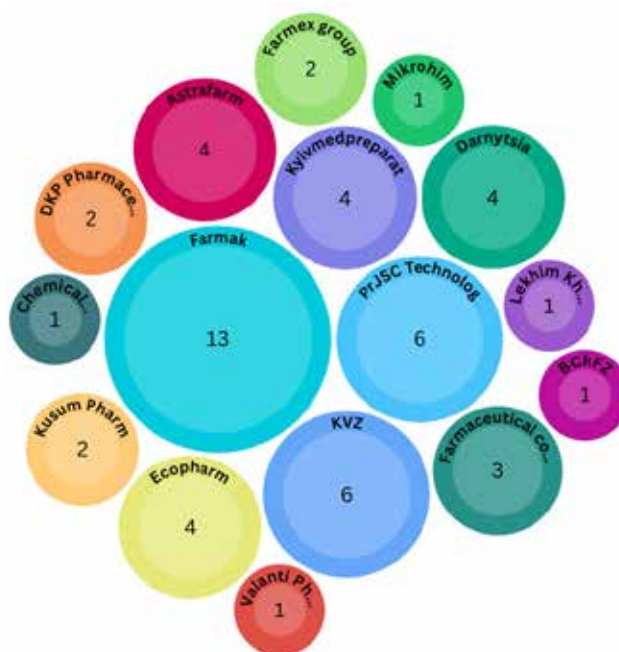


Fig. 3. Number of names of antiviral agents for systemic use by the manufacturer

It was found that representatives of the groups Acyclovir (J05AB01) – Acyclovir-Darnytsia, which has 9.38% of market share, Inosine Pranobex – Noviryin (J05AX05) – 6.85%, Oseltamivir – Seltavir (J05AH02) – 6.13%, Famciclovir – Virostat (J05AB09) – 3.97%, listed in the table, are available in the largest pharmacy chains in the country [14] in sufficient quantities [13]. Instead, the drugs of the Zidovudine (J05AF01) and Dolutegravir (J05AX12) group, which according to the Medicines Register have 10 trade names each, are not available in all pharmacies in the country.

In order to determine the socio-economic availability of antiviral drugs available on the Ukrainian market, we calculated some marketing indicators, in particular the price liquidity ratio,  $C_{liq}$ , the solvency adequacy ratio,  $C_{a.s.}$ , for acyclovir and oseltamivir drugs of domestic and foreign production, since these 2 medicinal substances occupy the largest shares of the Ukrainian market, respectively 9.38% and 6.13%. The cheapest offers on the market were chosen for imported drugs. Separately, we were also interested in comparing the prices of drugs of Ukrainian, Indian and European origin in terms of price per 1 tablet.

The coefficient of appropriate solvency (Ca.s.) and the socioeconomic affordability of drugs based on acyclovir and oseltamivir are inversely connected. The higher the Ca.s. coefficient value, the less affordable pharmaceuticals are in the eyes of the consumer. When the population's solvency is low, the Ca.s. indication reveals if a drug can still be sold. As a result, the analysis allowed us to identify the drugs that are most readily available to consumers while accounting for the economics. Acyclovir-Darnytsia tablets of 200 mg No. 20 of the Ukrainian firm Darnytsia (Ca.s. = 0.59) and Acyclovir-Lekhim tablets of 200 mg No. 20 of the Ukrainian producer Lekhim (Ca.s. = 0.53) are

Table 2

Prices of the most common names in the largest pharmacy chains of Ukraine

Drug name	Kyiv region			Lviv region			Kharkiv region		
	Podorozhnyk	Bazhayemo zdorov'ya	ANC	Podorozhnyk	Bazhayemo zdorov'ya	ANC	Podorozhnyk	Bazhayemo zdorov'ya	ANC
Acyclovir-Darnytsia 200 mg tablets No. 20 (10x2)	102.65	94.61	75.81	102.65	103.86	91.34	100.78	96.98	79.62
Virostat 500 mg tablets No. 21 (7x3)	851.25	794.70	799.97	851.25	833.69	841.61	900.50	833.79	863.40
Seltavir capsules of 75 mg No. 10	460.02	439.55	438.36	459.94	457.02	469.23	451.64	453.95	449.80
Noviryln 500 mg tablets No. 40 (10x4)	137.90	143.77	124.92	137.90	145.33	136.12	137.90	144.21	136.01

Table 3

Marketing indicators of socioeconomic affordability of antiviral drugs

Drug name	Drug release form	Producer, country	C <sub>liq</sub>	C <sub>a.s.</sub>	Price per pack (UAH) **	Price per tablet (UAH)
Acyclovir-Darnytsia	tablets of 200 mg No. 20 (10x2)	Ukraine	0.71	0.59	70.70	3.53
Acyclovir Lekhim	tablets of 200 mg No. 20 (10x2)	Ukraine	0.93	0.53	49.20	2.46
Acyclovir 200 Stada	tablets of 200 mg No. 25 (5x5)	Germany	0.82	1.15*	131.20*	6.56*
Tamiflu	capsules of 75 mg No. 10	Switzerland	1.1	5.07	524.11	52.41
Azelta	capsules of 75 mg No. 10	Ukraine	0.72	3.31	390	39
Flucap	capsules of 75 mg No. 10	India	1.67	2.15	188	18,8

•  $C_{liq} = \frac{P_{max} - P_{min}}{P_{min}}$  – liquidity ratio of the drug price;

$P_{max}$  – the maximum price of drugs on the market for a certain period of time, hryvnias;

$P_{min}$  – the minimum price of drugs on the market for a certain period of time, hryvnias;

$C_{a.s.} = \frac{P_{r.p.}}{W_{a.w.}} \cdot 100\%$  – solvency adequacy ratio;

$P_{r.p.}$  – the average retail price of drugs for the corresponding period of time;

$W_{a.w.}$  – average salary for the relevant period of time [15; 16]

\* – recalculated price per 20 tablets

\*\* – the price is selected from tabletki.ua [13] as the cheapest available offer on the Ukrainian market

the goods for the acyclovir group (J05AB01). These goods include Flucap 75 mg No. 10 capsules from the Indian company Hetero Labs Limited (Ca.s. = 2.15) and Azelta 75 mg No. 10 capsules from the Ukrainian company Biofarm Ltd (Ca.s. = 3.31) for the oseltamivir group (J05AH02).

Low indicator of socio-economic affordability was observed for foreign drugs. In particular, Acyclovir 200 Stada tablets of 200 mg No. 25 (Ca.s. = 1.15) and Tamiflu capsules of 75 mg No. 10 (Ca.s. = 5.07), which had the lowest socioeconomic affordability among acyclovir and oseltamivir products accordingly. Obtained results for socioeconomic affordability are shown in Table 3.

As can be seen from the analysis, the cost of domestic drugs and in some cases is lower than that of imported drugs with the same active ingredient (the exception was some Indian drugs), so the logical step to improve the socio-economic affordability of antiviral drugs for Ukrainian citizens is to develop domestic production of drugs of this class.

In today's conditions, the development of the domestic pharmaceutical industrial production of substances is

complicated by the challenges of wartime. Taking into account the relatively low price of Indian drugs to improve the social availability of antiviral agents for citizens of Ukraine, it is advisable to establish cooperation with Indian manufacturers, for example, in the field of purchasing cheaper active substances for manufacturing of ready-made dosage forms.

**Conclusion.** Having analyzed the domestic market of antiviral drugs using the State Register of Medicines, it was found that as of January 2023, 277 medicines of the relevant group were registered in Ukraine. The most common representative is acyclovir, which lays the groundwork for other 26 names, accounting for 9.38% of all antiviral drugs. However, there is no obvious leader among the drugs that would occupy the lion's share of the market.

It was also established that the only subgroup of drugs that contains a medicinal form convenient for children's prescription is J05AX05 – Inosine Pranobex (8 names). Of these, 3 names are represented by Ukrainian manufacturers: Ecopharm LLC and Pharmaceutical Company "Darnitsa" PrJSC.

It was determined that antiviral drugs are represented on the market by 18 countries. The most numerous are the drugs produced in India, the number of which is 122 items, i.e., 44.2% of the total number of drugs, and Ukraine – 55 items, which is 19.9%, respectively.

The results of the study on the socioeconomic accessibility of antiviral medications on the Ukrainian pharmaceutical market can be used as a factual justification for the potential for local drug development and range expansion.

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