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N. M. U. Sultanbaeva[1], D. U. Saydalieva[1], Sh. Z. Umarova[1], A. A. Nozdrina[2]

[1] Institute of Pharmaceutical Education and Research, Tashkent, Republic of Uzbekistan
[2] National University of Pharmacy of the Ministry of Health of Ukraine, Kharkiv
E-mail: nargiz6985@gmail.com

A COMPARATIVE ANALYSIS OF REGISTERED AND IMPORTED NOOTROPIC DRUGS IN THE PHARMACEUTICAL MARKET IN THE REPUBLIC OF UZBEKISTAN

Nootropic drugs are widely used to treat cognitive impairments associated with attention deficit hyperactivity disorder, dementia, Alzheimer's disease, schizophrenia, and cerebrovascular disorders, including stroke. The growing prevalence of neurodegenerative diseases, aging population, and increased neuropsychological stress have led to a sustained rise in demand for nootropic therapy. Under these conditions, assessing the relationship between the drug registration and the actual market availability is essential for evaluating the effectiveness of pharmaceutical supply.

Aim. To conduct a comparative analysis of the range of nootropic drugs registered in the State Register of Medicines of the Republic of Uzbekistan and the actual volume of these drugs introduced into the national pharmaceutical market over the period of 2014–2024.

Materials and methods. Comparative, systematic, economic, and statistical methods, well as marketing research and content analysis were used in the study. Data were obtained from the State Register of Medicines, Drug Audit reports, and the reference database. The analysis covered the number of registered and marketed trade names, countries of origin, manufacturers, international nonproprietary names, dosage forms, and the physical market volume expressed in packages.

Results and discussion. The results showed an almost twofold increase in the number of the registered nootropic drugs during the study period. However, only 40–55 % of the drugs registered actually entered the market, indicating a steady gap between the regulatory approval and commercialization. Since 2021, the share of domestic nootropic drugs has increased significantly, reflecting the strengthening of national pharmaceutical production. Monocomponent drugs continued to dominate the range although the share of multicomponent drugs increased. Injectable solutions accounted for the largest share of both the registered drugs and the market volume, while oral dosage forms showed a gradual growth. Piracetam and Citicoline remain the leading names although recent years have been characterized by increasing diversification towards peptide complexes and combination drugs.

Conclusions. The study provides a comprehensive overview of the structure and dynamics of the nootropic drug market in Uzbekistan and can be useful for making evidence-based decisions in pharmaceutical regulation, production planning, and market strategy development.

Keywords: assortment analysis; nootropic drugs; pharmaceutical market volume; comparative analysis; natural indicator.

Н. М. У. Султанбаєва[1], Д. У. Сайдалієва[1], Ш. З. Умарова[1], А. А. Ноздріна[2]

[1] Інститут фармацевтичної освіти і досліджень, м. Ташкент, Республіка Узбекистан
[2] Національний фармацевтичний університет Міністерства охорони здоров'я України, м. Харків
E-mail: nargiz6985@gmail.com

ПОРІВНЯЛЬНИЙ АНАЛІЗ ЗАРЕЄСТРОВАНИХ ТА ІМПОРТОВАНИХ НООТРОПНИХ ПРЕПАРАТІВ НА ФАРМАЦЕВТИЧНОМУ РИНКУ РЕСПУБЛІКИ УЗБЕКИСТАН

Ноотропні препарати широко використовуються для лікування когнітивних порушень, пов'язаних із синдромом дефіциту уваги та гіперактивності, деменцією, хворобою Альцгеймера, шизофренією та цереброваскулярними розладами, включно з інсультом. Зростання поширеності нейродегенеративних захворювань, старіння населення та збільшення нейропсихологічного стресу викликали стійке зростання попиту на ноотропну терапію. За таких умов оцінка взаємозв'язку між реєстрацією лікарських засобів та їхньою фактичною доступністю на ринку є надзвичайно важливою для оцінки ефективності фармацевтичного забезпечення.

Мета – порівняльний аналіз асортименту ноотропних препаратів, зареєстрованих у Державному реєстрі лікарських засобів Республіки Узбекистан, та фактичного обсягу цих препаратів, що надходили на національний фармацевтичний ринок у період 2014–2024 рр.

Матеріали та методи. У дослідженні використано порівняльні, систематичні, економічні та статистичні методи, а також маркетингові дослідження і контент-аналіз. Дані були отримані з Державного реєстру лікарських засобів, звітів про аудит лікарських засобів та довідкової бази даних.

Аналіз охоплював кількість зареєстрованих та реалізованих торгових назв, країни походження, виробників, міжнародні непатентовані назви, лікарські форми та фізичний обсяг ринку, виражений в упакованнях.

Результати та їхнє обговорення. Результати показали майже двократне збільшення кількості зареєстрованих ноотропних препаратів протягом періоду дослідження. Однак лише 40–55 % зареєстрованих препаратів фактично вийшли на ринок, що вказує на стійкий розрив між регуляторним затвердженням та комерціалізацією. З 2021 року частка вітчизняних ноотропних препаратів значно зросла, що відображає зміцнення національного фармацевтичного виробництва. Однокомпонентні препарати продовжували домінувати в асортименті, хоча частка багатокомпонентних препаратів збільшилася. Ін'єкційні розчини становили найбільшу частку як зареєстрованих препаратів, так і обсягу ринку, пероральні лікарські форми демонстрували поступове зростання. Пірацетам і цитиколін залишалися провідними найменуваннями, хоча останнім часом характеризувалися зростаючою диверсифікацією у бік пептидних комплексів і комбінованих препаратів.

Висновки. Дослідження надає комплексний огляд структури та динаміки ринку ноотропних препаратів в Узбекистані і може бути корисним для ухвалення обґрунтованих рішень у сфері фармацевтичного регулювання, планування виробництва та розроблення ринкової стратегії.

Ключові слова: аналіз асортименту; ноотропні препарати; обсяг фармацевтичного ринку; порівняльний аналіз; натуральні показники.

Introduction. Nootropic drugs (NDs), or cognitive enhancers, are drugs used to treat cognitive impairments in patients with conditions, such as attention deficit hyperactivity disorder, dementia, Alzheimer's disease, schizophrenia, and stroke. These agents typically enhance glucose and oxygen supply to the brain, exert antihypoxic effects, and protect the neural tissue from neurotoxicity [1, 2]. Under severe stress, the production of neurotransmitters may be disrupted, leading to symptoms, such as impaired cognitive function, panic, frequent errors, apathy, and mental disorders. In addition to stress-related effects, the neurotransmitter function is influenced by the cerebral circulation, which, in turn, affects the ability of the central nervous system to receive essential nutrients, oxygen, trace elements, and eliminate metabolic byproducts [3, 4]. According to the World Health Organization, more than 50 million people worldwide suffer from clinically diagnosed dementia, with nearly 10 million new cases reported annually. The elderly are the most vulnerable population group, with 3–20 % of individuals over the age of 65 affected by neurodegenerative disorders [5, 6]. Neurodegenerative diseases are Alzheimer's disease (the most prevalent, accounting for 60–70 % of dementia cases), Parkinson's disease, Huntington's disease, and others. These disorders are often sporadic, with various stressors, including more than 150 environmental factors, and acting as potential triggers. One of the most common damaging factors affecting the neural tissue is hypoxia, which may result from external oxygen deficiency or internal physiological dysfunctions leading to global or localized oxygen deprivation in tissues [6-8].

Compared to global data, the mortality rate from neurological diseases in the Republic of Uzbekistan is mainly due to stroke. In particular, the mortality rate for stroke is 103.48 per 100,000 population, which places the country in the 67-th place in the world ranking. For Alzheimer's disease and dementia, this indicator is 8.36 per 100,000 population, which is the 157-th place in the world ranking, and for Parkinson's disease, it is 3.21 per 100,000 population, which is the 135-th place [9-10]. These figures indicate that neurodegenerative diseases still have a small share compared to stroke, but their medical and social importance is increasing in the context of demographic aging.

In 2024, the overall Alzheimer's disease incidence rate in the Republic of Uzbekistan was 1.0 per 100,000 population, with the disease occurring mainly among the population aged 18 years and older. The highest rates across regions were observed in the Surkhandarya, Fergana, Navoi, and Kashkadarya regions, with differences particularly evident among the elderly population. While the disease is almost completely absent among children and adolescents in many regions, the high rates observed in these age groups in the Fergana region indicate the need for additional epidemiological analysis. In general, the data indicate that Alzheimer's disease is unevenly distributed across regions and age groups, emphasizing the importance of strengthening early diagnosis and prevention measures [9-10].

Taking into account these considerations, it is essential to assess the saturation of the pharmaceutical market with NDs to evaluate the balance between their supply and actual demand.

The **aim** of the work was to conduct a comparative analysis between the range of NDs listed in the official register of drugs approved for medical use in the Republic of Uzbekistan and the actual volume of these drugs that entered the pharmaceutical market of Uzbekistan from 2014 to 2023.

Materials and methods. Comparative, systematic, economic, and statistical methods, well as marketing research and the content analysis were used in the study. Data sources included the drug audit reports, and the State Register of Medicines, Medical Devices, and Medical Equipment approved for medical use in the Republic of Uzbekistan (hereinafter referred to as the State Register). The analysis covered the period from 2014 to 2024 and was based on consolidated reports on the import and production of medicines [10-11].

The assortment analysis of NDs was conducted in accordance with the Anatomical Therapeutic Classification (ATC) system, with a focus on group N06BX – "Other psychostimulants and nootropic drugs". The study examined the pharmaceutical market of nootropic drugs in the Republic of Uzbekistan and included a comparative assessment of the breadth and depth of the assortment of NDs registered in the State Register and those actually imported and marketed within the national pharmaceutical market.

Results and Discussion. Pharmaceutical marketing investigates specific drug segments within the existing market, including the consumer behavior, supply chains, and distribution channels. This field encompasses the development of healthcare infrastructure, human resources, disease management strategies, and the degree to which the patient and provider needs are met when selecting specific pharmaceuticals. A comprehensive analysis also includes competitive dynamics – both among manufacturers and intermediaries.

At the first stage of the study, the analysis of the range of the registered NDs was conducted. The previous work by Sh. Z. Umarov, D. U. Saidaliev, and N. M. U. Sultanbaeva on the assortment of NDs demonstrated that, from 2018 to 2022, the total portfolio expanded by almost 1.5 times with domestic products prevailing in both periods. In 2022, liquid dosage forms accounted for 72.77 % of the market, of which injectable solutions constituted 56.81 %. Throughout the five-year interval, citicoline remained the leading active substance, reaching a 37.44 % share in 2022 [11-13].

According to the findings, the number of registered trade names (TNs) of NDs increased from 115 in 2014 to 194 in 2023, reaching 200 in 2024. Overall, the results demonstrate a generally stable upward trend in the number of nootropic drugs registered in the State Register.

However, two periods of particularly sharp growth were identified in the registration dynamics. The first surge occurred in 2016, when the number of registered TNs increased from 112 in 2015 to 143, representing an increase of 31 TNs. The second significant increase was observed in 2021, with 31 additional TNs registered compared to 2020. The peak in registration was recorded in 2022, when the number of registered TNs reached 206, followed by a slight decline in 2023 and stabilization in 2024.

Subsequently, a comparative analysis was conducted between the number of registered nootropic TNs and those that actually entered the pharmaceutical market. It was observed that, alongside the growth in registered trade names, the number of marketed NDs also increased. However, on average, less than half of the registered NDs (approximately 40–45 %) were actually introduced to the pharmaceutical market during the study period. For example, in 2014, out of 115 registered TNs, only 48 NDs were marketed. In 2022, 106 registered NDs became available in the market, while in 2023, only 91 out of 194 registered TNs were introduced to the market. In 2024, despite 200 registered TNs, the number of marketed NDs decreased to 74 (Fig. 1).

The next stage of the study included the analysis of the total volume of NDs available in the pharmaceutical market. The results showed that the physical volume of NDs increased substantially over the study period although the growth was not strictly linear. In 2014, a total of 5.14 million packages of NDs were introduced to the pharmaceutical market. After a temporary decline in 2015 (4.33 million packages), the market volume demonstrated a steady increase, reaching 7.25 million packages in 2018. A short-term decrease was observed in 2019 (6.45 million packages), followed by the renewed growth in subsequent years [11-14].

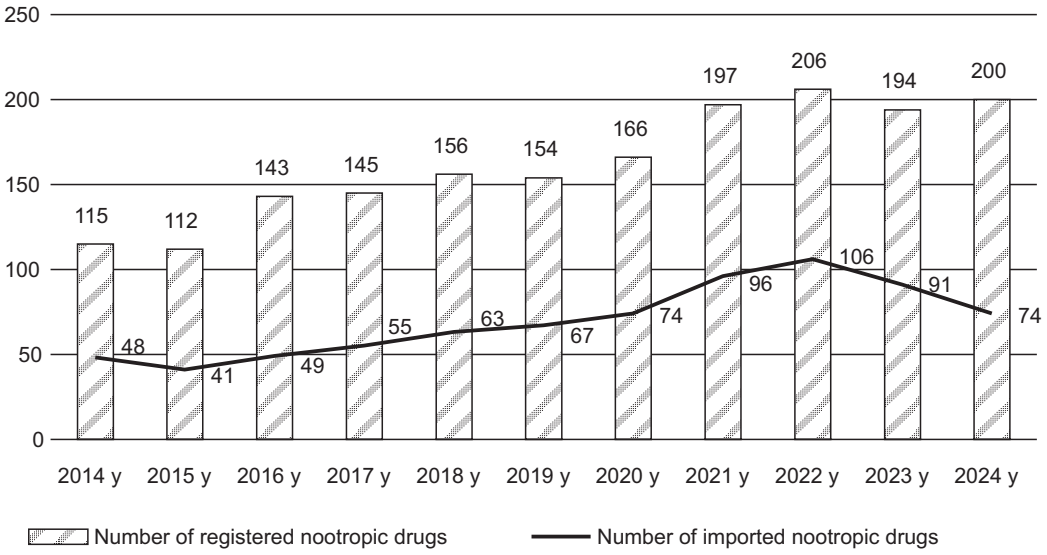

Fig. 1. Results of the comparative analysis of the total number of NDs from 2014 to 2024

The highest market volume was recorded in 2022, amounting to 9.47 million packages. In 2023, the volume remained high at 9.34 million packages, which was almost 1.8 times higher than in 2014. However, in 2024, a noticeable decline was observed, with the market volume decreasing to 7.94 million packages (Fig. 2).

Overall, despite periodic fluctuations, the dynamics of the physical volume of NDs generally mirror the expansion of the product range registered, indicating a long-term upward trend in both the market supply and the assortment.

At the next stage of the study, a comparative analysis of the registration of NDs and their actual entry into the pharmaceutical market was carried out depending on the country of manufacture. From 2014 to 2020, the structure of NDs registered in the Republic of Uzbekistan was dominated by foreign and CIS manufacturers, while the share of domestically produced drugs remained comparatively lower. During this period, the number of the registered domestic nootropic TNs increased gradually from 18 in 2014 to 53 in 2020, whereas the combined number of drugs registered from foreign countries and CIS states consistently exceeded domestic registrations.

Beginning in 2021, a marked shift in the registration structure was observed. It was characterized by a substantial increase in domestically

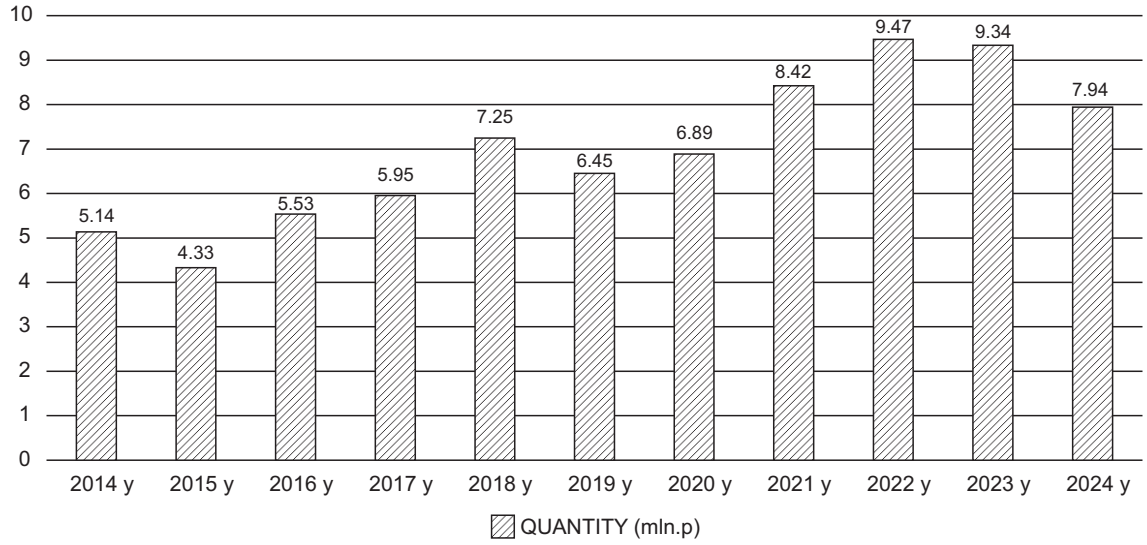

Fig. 2. The total number of the NDs in physical terms for the period from 2014 to 2023

produced NDs. The number of the registered domestic TNs rose sharply from 53 in 2020 to 76 in 2021, reaching 84 in 2022 and remaining high at 74 in 2023, before increasing again to 81 in 2024. This trend indicates a strengthening role of domestic manufacturers in the national pharmaceutical market.

In 2023, out of 74 registered domestic NDs, 43 were actually introduced to the market, corresponding to a market entry rate of 58.1 %. For comparison, in 2014, only 8 out of 18 registered domestic TNs entered the market (44.4 %). The growth in both absolute numbers and market entry rates reflects the progressive development of the domestic pharmaceutical industry, particularly since 2021. However, in 2024, despite an increase in the registered domestic TNs to 81, the number of marketed drugs decreased to 27, resulting in a lower entry rate (33.3 %).

Regarding NDs originating from CIS countries, 48 TNs were registered in 2014, of which 16 (33.3 %) entered the market. In 2023, 57 TNs were registered and 21 (36.8 %) were marketed. Over the entire study period, the market entry share of CIS-produced NDs remained relatively stable, generally ranging between 29.1 % and 44.4 %, indicating consistent but moderate commercialization activity.

For foreign (non-CIS) manufacturers, 49 TNs were registered in 2014, with 24 (49.0 %) entering the market. By 2023, the number of the registered foreign TNs increased to 63, while 27 (42.9 %) were introduced to the market. Although the absolute number of foreign NDs remained high throughout the study period, their relative market entry share showed a gradual decline compared with earlier years. In 2024, 74 foreign TNs were registered, with 33 (44.6 %) entering the market (Tab. 1).

Overall, the results demonstrate a significant increase in the role of domestic NDs since 2021, with domestic manufacturers leading in terms of registration volumes and, in several years, market entry rates. At the same time, the share of foreign drugs demonstrated a gradual decline, while the contribution of CIS countries remained comparatively stable. These trends indicate a gradual reduction in dependence on foreign manufacturers and an increasing capacity of the national pharmaceutical industry.

A detailed analysis of the volume of NDs packages by country of origin demonstrated pronounced differences in the supply dynamics over the study period.

The volume of NDs originating from CIS countries showed a notable increase beginning in 2018, when it reached 2.70 million packages. After a temporary decline in 2019 (2.19 million packages), a sustained upward trend was observed, with volumes rising to 3.32 million packages in 2021 and peaking at 3.93 million

Table 1

INDICATORS OF THE NUMBER OF NDS FORMS BY MANUFACTURING COUNTRIES IN THE COMPARATIVE ANALYSIS (2014-2023)

Years	Domestic		CIS				Foreign countries		
	Number of registered NDs	Number of imported NDs	%	Number of registered NDs	Number of imported NDs	%	Number of registered NDs	Number of imported NDs	%
2014	18	8	44.4	48	16	33.3	49	24	49.0
2015	20	7	35.0	49	15	30.6	43	23	53.5
2016	35	12	34.3	55	16	29.1	53	23	43.4
2017	42	15	35.7	50	18	36.0	53	25	47.2
2018	47	19	40.4	51	16	31.4	58	30	51.7
2019	47	21	44.7	51	18	35.3	56	30	53.6
2020	53	25	47.2	53	17	32.1	60	34	56.7
2021	76	38	50.0	57	23	40.4	64	38	59.4
2022	84	47	56.0	55	23	41.8	67	39	58.2
2023	74	43	58.1	57	21	36.8	63	27	42.9
2024	81	27	33,3	45	20	44,4	74,0	33,0	44,6

packages in 2022. In 2023, the supply from CIS countries remained high at 3.81 million packages, before declining to 3.22 million packages in 2024. Overall, CIS countries occupied a leading position in terms of the physical supply volume during the later years of the study.

The volume of NDs produced by domestic manufacturers (Uzbekistan) also demonstrated a steady growth, particularly after 2017. From 2.76 million packages in 2018, the domestic supply fluctuated within a relatively narrow range, reaching 3.02 million packages in 2021 and peaking at 3.07 million packages in 2022. In 2023, the volume slightly decreased to 3.08 million packages, followed by a more pronounced decline to 1.64 million packages in 2024, indicating a temporary reduction in the domestic market output.

Regarding foreign (non-CIS) countries, the volume of NDs packages exhibited a moderate growth after 2019. Following an increase from 2.01 million packages in 2019 to 2.31 million packages in 2020, the supply continued to rise, reaching 2.47 million packages in 2022. In 2023, the volume remained relatively stable at 2.45 million packages, before increasing further to 3.09 million packages in 2024, reflecting a renewed expansion of supplies from international markets.

Overall, the findings indicate that the total market volume of NDs was largely driven by increasing supplies from CIS countries, while domestic production maintained a substantial but more stable contribution until 2023. At the same time, foreign non-CIS suppliers demonstrated the renewed growth in recent years, particularly in 2024, highlighting the dynamic and diversified structure of the NDs market (Fig. 3).

The next stage of the study involved an analysis of the NDs market segmented by manufacturing countries. It was found that the NDs registered in the State Register were produced in more than 30 countries. Table 2 presents the TOP-10 leading countries in terms of the number of the registered NDs and their actual market entry over a three-year period (2022–2024).

The Republic of Uzbekistan consistently ranked first in all three years in terms of the number of registered NDs. In 2022, 84 TNs were registered, of which 47 entered the market, corresponding to a market entry rate of 55.95 %. In 2023, the number of registered TNs decreased to 74, while 43 were marketed (58.11 %). In 2024, despite an increase in registrations to 81 TNs, only 27 drugs entered the market, resulting in a substantially lower market entry rate of 33.3 %. These data indicate that although

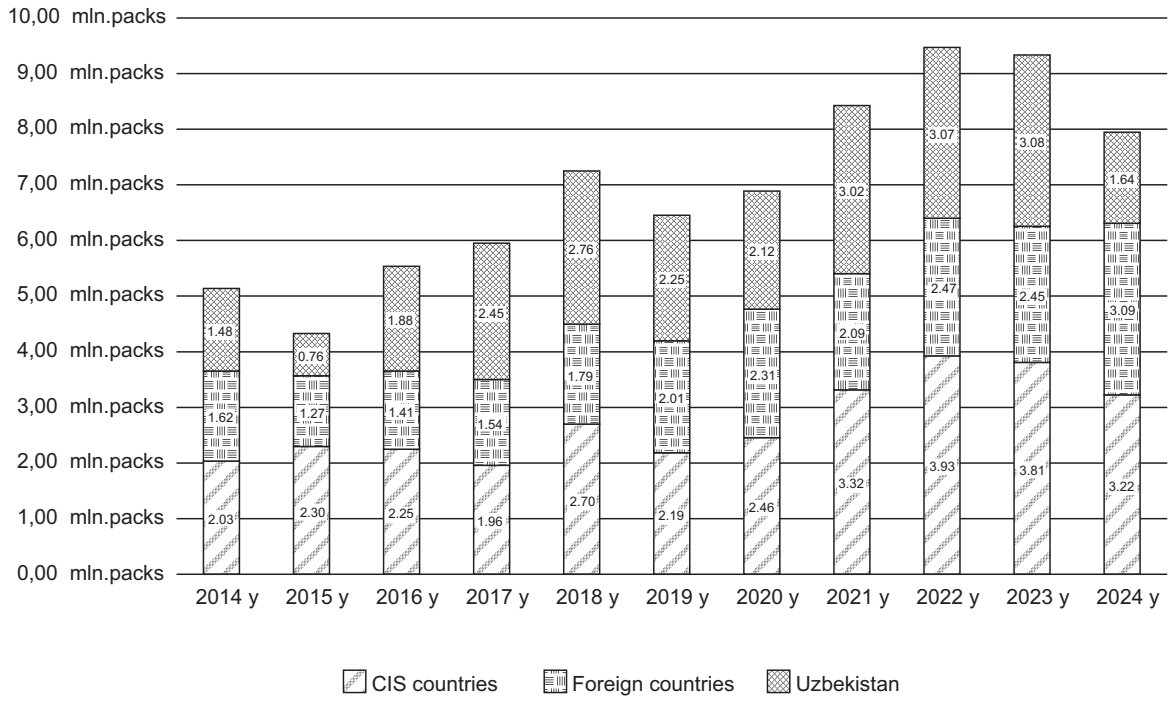

Fig. 3. Dynamics of the number of packages of NDs by manufacturing countries for the period from 2014 to 2023

Table 2

A COMPARATIVE TABLE OF THE TOP-10 COUNTRIES FROM 2022 TO 2024

No	Countries	2022 year			2023 year			2024 year		
		Number of registered NDs	Number of imported NDs	%	Number of registered NDs	Number of imported NDs	%	Number of registered NDs	Number of imported NDs	%
1	Republic of Uzbekistan	84	47	55.95	74	43	58.11	81	27	33.3
2	Russian Federation	27	13	48.15	30	13	43.33	22	12	54.5
3	India	30	16	53.33	26	11	42.31	32	12	37.5
4	Ukraine	18	4	22.22	18	4	22.22	15	5	33.3
5	Belarus	9	7	77.78	9	7	77.78	6	6	100.0
6	Spain	4	3	75.00	7	2	28.57	6	2	33.3
7	Turkey	7	3	42.86	5	2	40.00	8	2	25.0
8	Hungary	5	2	40.00	4	2	50.00	5	1	20.0
9	Italy	3		0.00	4	2	50.00	5	3	60.0
10	Latvia	4	1	25.00	4	1	25.00	3	1	33.3

domestic manufacturers maintain a leading position in the registration volume, the market entry efficiency declined in 2024. The Russian Federation consistently occupied the second place among foreign suppliers. In 2023, the number of the registered nootropic drugs reached 30 TNs, with 13 entering the market (43.33 %). In 2024, although registrations declined to 22 TNs, the market entry share increased to 54.5 %, indicating an improved commercialization efficiency. India remained among the top three countries throughout the period analyzed. In 2022, 30 TNs were registered, with 16 marketed (53.33 %). However, a decline in the market entry efficiency was observed in subsequent years, reaching 42.31 % in 2023 and 37.5 % in 2024, despite an increase in registrations to 32 TNs in 2024. Belarus demonstrated a relatively small but stable number of the registered NDs, accompanied by consistently high market entry rates. In both 2022 and 2023, 77.78 % of the registered drugs entered the market, while in 2024, all registered drugs (100 %) were marketed, indicating a highly effective market penetration.

Other countries, including Spain, Turkey, Hungary, Italy, and Latvia, showed lower and more variable levels of registration and market entry. Notably, Italy demonstrated an increase in the market entry efficiency in 2024 (60.0 %), while Latvia showed a gradual decline in both registrations and the absolute market presence.

Overall, the analysis confirms that Uzbekistan remains the dominant country in terms of the number of registered NDs, while several foreign countries – particularly India and the Russian Federation – retain strong positions in the market. On average, across the TOP-10 countries, approximately 45–50 % of the registered NDs entered the pharmaceutical market, highlighting persistent structural barriers between the registration and actual commercialization.

Table 3 presents the segmentation of the pharmaceutical market of NDs in quantitative terms by country, showing that the most dominant of the 29 countries import into the pharmaceutical market of the republic. In the market studied, domestic manufacturers, demonstrating a stable trend towards growth in the production of NDs (from 3.02 million packages in 2021 to 3.08 million packages in 2023). Next comes the Russian Federation, it consistently ranks second, with a moderate increase in volume (from 2.26 million packs to 2.28 million packages). Further, Belarus demonstrates the most pronounced positive dynamics, having increased market indicators more than twice over the period studied (0.90 million packages in 2023). Hungary recorded a significant decrease in market volumes from 0.41 million

Table 3

THE MARKET VOLUME OF THE TOP-10 COUNTRIES FROM 2021 TO 2024 (IN QUANTITATIVE TERMS)

No.	Countries	Million packages			
		2021	2022	2023	2024
1	Republic of Uzbekistan	3.02	3.07	3.08	1.63
2	Russian Federation	2.26	2.33	2.28	1.69
3	Belarus	0.38	0.86	0.90	0.91
4	Ukraine	0.68	0.73	0.63	0.72
5	Austria	0.41	0.33	0.51	0.49
6	Latvia	0.41	0.40	0.47	0.26
7	Pakistan	0.17	0.17	0.32	0.32
8	India	0.24	0.33	0.30	0.26
9	Hungary	0.34	0.41	0.25	0.91
10	Vietnam	0.10	0.12	0.13	0.14

packages in 2022 to 0.25 million packages in 2023. Ukraine reduced its market figures to 0.63 million units, possibly due to external factors.

Domestic manufacturers (Republic of Uzbekistan) occupied a leading position throughout the study period. The volume of domestically produced NDs demonstrated a stable upward trend from 2021 to 2023, increasing from 3.02 million packages in 2021 to 3.07 million packages in 2022 and 3.08 million packages in 2023. However, in 2024, a sharp decline was observed with volumes decreasing to 1.63 million packages, indicating a temporary reduction in domestic production or the market supply. The Russian Federation consistently ranked second in terms of the supply volume. From 2021 to 2023, the market volume remained relatively stable, fluctuating slightly between 2.26 million packages in 2021 and 2.28 million packages in 2023. In 2024, the volume decreased to 1.69 million packages, reflecting a contraction similar to that observed for domestic manufacturers. Belarus demonstrated the most pronounced positive dynamics among foreign suppliers. The volume of NDs increased more than twofold over the study period, from 0.38 million packages in 2021 to 0.86 million packages in 2022, reaching 0.90 million packages in 2023 and 0.91 million packages in 2024, indicating the stable growth and strengthening market positions.

In contrast, Hungary showed a decline in market volumes after 2022, while the volume reached 0.41 million packages in 2022, it decreased to 0.25 million packages in 2023. Nevertheless, in 2024, a substantial increase was recorded, with supply rising to 0.91 million packages, suggesting a recovery or expansion of the market activity.

Ukraine experienced a reduction in market volume from 0.73 million packages in 2022 to 0.63 million packages in 2023, likely influenced by external geopolitical and economic factors. In 2024, a partial recovery was observed, with volumes increasing to 0.72 million packages.

Other countries, including Austria, Latvia, Pakistan, India, and Vietnam, contributed smaller but stable volumes to the NDs market. Their supplies generally remained below 0.5 million packages per year, with moderate fluctuations and no pronounced long-term growth trends.

Overall, the quantitative analysis indicates that the NDs market is characterized by a high concentration of supply, with domestic manufacturers and a small number of foreign countries accounting for the majority of the market volume. While steady growth was observed up to 2023, the decline in 2024 suggests emerging market constraints that may require further investigation.

Based on the analysis of the assortment structure and import activity of NDs manufacturers, it has been found that domestic companies play a leading role in the formation of the pharmaceutical market.

Among the companies analyzed, Remedy Group (JV LLC) demonstrated a consistently high market entry activity. In 2022, 10 out of 12 registered NDs were marketed (83.3 %).

Table 4

A COMPARATIVE ANALYSIS BY MANUFACTURERS

Manufacturers	2022			2023			2024		
	Number of registered NDs	Number of imported NDs	%	Number of registered NDs	Number of imported NDs	%	Number of registered NDs	Number of imported NDs	%
Remedy Group	12	10	83.3	11	12	109.1	16	10	62.5
Temur Med Farm	7	13	185.7	7	11	157.14	8	2	25
Reka-Med Farm	6	3	50	5	0	0	6	1	16.67
Radiks	8	2	25	6	4	66.6	6	5	83.3
Bayan Medical	4	3	75	3	2	66.6	5	1	20
Merrymed Farm	6	4	66.6	7	4	57.1	5	3	60
Jurabek Laboratories	6	2	33.3	6	2	33.3	5	2	40
UZGERMED PHARM	5	1	20	3	1	33.3	5		
Aseptica	2	3	150		2		3	3	100
Integra DD	2			2			2		

In 2023, the number of marketed drugs (12) exceeded the number of registered trade names (11), indicating the continued circulation of products previously registered. In 2024, despite an increase in registrations to 16 TNs, only 10 drugs entered the market (62.5 %).

Temur Med Farm (LLC) showed exceptionally high market entry ratios in 2022 (185.7 %) and 2023 (157.1 %), reflecting the active marketing of products registered in earlier years. However, in 2024, the market entry rate declined sharply to 25 %, with only 2 out of 8 registered NDs entering the market.

Reka-Med Farm (JV LLC) demonstrated unstable commercialization dynamics. While 50 % of the registered drugs entered the market in 2022, no market entry was recorded in 2023, despite the presence of the registered TNs. In 2024, only 1 out of 6 registered NDs was marketed (16.7 %).

Radiks (LLC) showed a gradual increase in the market entry efficiency. The share of the marketed NDs increased from 25 % in 2022 to 66.6 % in 2023, reaching 83.3 % in 2024, indicating improved commercialization performance.

Bayan Medical (LLC) demonstrated a moderate but declining market entry activity. The market entry rate decreased from 75 % in 2022 to 66.6 % in 2023, followed by a further decline in 2024, when only 1 out of 5 registered NDs entered the market.

Other domestic manufacturers, including Merrymed Farm, Jurabek Laboratories, UZGERMED PHARM, Aseptica, and Integra DD, showed a limited and irregular market participation, characterized by small numbers of the registered TNs and significant fluctuations in market entry rates. Notably, Aseptica LLC demonstrated the market entry exceeding registrations in some years, while Integra DD LLC showed registrations without the confirmed market entry during the period analyzed.

Based on the results of the assortment analysis and import of companies-producers of NDs, it has been found that the market leaders are domestic manufacturers. It has been determined that in the market of the Republic of Uzbekistan, the largest segment in quantitative terms is occupied by 5 main domestic companies out of 144 manufacturers, such as Merrymed Farm – 0.997 million packages, Temur Med Farm – 0.63 million packages; Jurabek Laboratories – 0.45 million packages; Radiks – 0.34 million packages and Remedy Group – 0.33 million packages in 2024.

The content analysis of NDs has demonstrated that this pharmacological group is highly heterogeneous, encompassing both mono- and multicomponent formulations produced by domestic and foreign manufacturers.

Throughout the entire study period, monocomponent NDs dominated the assortment structure. In 2014, 101 monocomponent TNs

were registered, and their number increased steadily, reaching a maximum of 157 TNs in 2022. In 2023, a slight decline to 150 TNs was observed, followed by a further decrease to 148 TNs in 2024, which might indicate the partial market saturation or shifts in therapeutic preferences.

At the same time, the number of multicomponent NDs showed a pronounced upward trend. In 2014, only 14 multicomponent TNs were registered. This number increased consistently, reaching 30 TNs in 2018 and peaking at 49 TNs in 2022. In 2023, a moderate decrease to 44 TNs was recorded, followed by the renewed growth to 51 TNs in 2024, indicating sustained interest in combination therapies.

Import dynamics reflected similar trends. The number of imported multicomponent NDs increased steadily from 12 TNs in 2014 to 33 TNs in 2023, before declining to 25 TNs in 2024. In contrast, imports of monocomponent NDs rose from 34 TNs in 2014 to a peak of 75 TNs in 2022, followed by a notable reduction to 55 TNs in 2023 and 49 TNs in 2024 (Tab. 5).

Overall, the results indicate a gradual structural shift toward multicomponent NDs, both in terms of the registration and market entry. While monocomponent NDs continue to dominate the assortment, the growing share of multicomponent formulations suggests an increasing demand for combination products, potentially driven by their broader pharmacological effects and improved therapeutic convenience.

The analysis of INNs of NDs for the period 2022–2024 demonstrated substantial differences in both the registration volumes and the actual market entry among individual INNs. Over the three-year period analyzed, Citicoline consistently occupied a dominant position in terms of both registration and import. In 2022, 81 citicoline-based TNs were registered, of which 47 entered the market (58.02 %). In 2023, the number of registered TNs declined slightly to 73, while the number of imported products decreased to 33, resulting in a lower market entry rate of 45.21 %. In 2024, registrations returned to 81 TNs, but imports remained unchanged at 33 TNs, further reducing the market entry ratio to 40.74 %. These data indicate a sustained dominance of citicoline-based drugs, accompanied by a declining commercialization efficiency.

The second most represented INN was Piracetam although its market entry rates remained consistently low. In 2022, 27 piracetam-based TNs were registered, with only 6 imported (22.22 %). In 2023, registrations increased to 31 TNs, while imports remained at 6 TNs (19.35 %). In 2024, registrations declined to 23 TNs, and imports dropped to 3 TNs, corresponding to the lowest market entry rate (13.04 %) among the leading INNs.

Table 5

THE REGISTRATION AND IMPORT OF MONOCOMPONENT AND MULTICOMPONENT DRUGS IN THE PHARMACEUTICAL MARKET FOR THE PERIOD FROM 2014 TO 2024

Years	Multicomponent NDs		Monocomponent NDs	
	Number of registered NDs	Number of imported NDs	Number of registered NDs	Number of imported NDs
2014	14	12	101	34
2015	19	9	93	32
2016	25	8	118	41
2017	28	11	117	44
2018	30	14	126	49
2019	27	15	127	52
2020	34	17	132	57
2021	45	28	152	68
2022	49	31	157	75
2023	44	33	150	55
2024	51	25	148	49

Vinpocetine showed relatively stable registration figures with modest but gradually increasing market entry rates, rising from 25.00 % in 2022 to 26.67 % in 2023 and 28.57 % in 2024. Similarly, hopantenic acid demonstrated stable registration numbers (11–12 TNs) and a gradual increase in the import share from 41.67 % to 45.45 % by 2024.

The aminophenylbutyric acid group exhibited a pronounced decline in the market activity. While 9 TNs were registered in both 2022 and 2023, the number of imported NDs decreased from 3 TNs (33.33 %) in 2022 to 1 TN (11.11 %) in 2023. In 2024, although 7 TNs were registered, no imports were recorded, indicating a complete absence of the market entry.

Combination NDs demonstrated heterogeneous dynamics. Peptide complex-based combination drugs showed exceptionally high market entry activity. In 2022, 10 out of 11 TNs entered the market (90.91 %). In 2023, the number of imported drugs (11) exceeded the number of newly registered TNs (8), resulting in a market entry rate of 137.50 %, reflecting the continued circulation of products registered in previous years. In 2024, the market entry rate decreased but remained high at 71.43 %.

In contrast, combination drugs containing Piracetam and Cinnarizine demonstrated low and unstable market entry rates, fluctuating between 14.29 % and 40.00 %. Other combination formulations, including those based on Ginkgo biloba extracts or tiazotic acid with Piracetam, remained at consistently low levels, with minimal or no imports recorded, particularly in 2023–2024.

Overall, the findings indicate that while a limited number of INNs – primarily Citicoline and certain combination drugs – dominate the nootropic drug market, many other INNs exhibit a low commercialization efficiency. On average, only 40–50 % of the registered NDs by INN actually enter the pharmaceutical market, highlighting persistent disparities between the regulatory registration and the real market supply (Tab. 6).

Table 6

A COMPARATIVE ANALYSIS OF THE REGISTRATION AND IMPORT DYNAMICS BY INN FOR 2022-2024 TOP-10

INN	2022 year			2023 year			2024 year		
	Number of registered NDs	Number of imported NDs	%	Number of registered NDs	Number of imported NDs	%	Number of registered NDs	Number of imported NDs	%
Citicoline	81	47	58.02	73	33	45.21	81	33	40.74
Pyracetam	27	6	22.22	31	6	19.35	23	3	13.04
Vinpocetine	16	4	25.00	15	4	26.67	14	4	28.57
Hopantenic acid	12	5	41.67	12	5	41.67	11	5	45.45
Aminophenylbutyric acid	9	3	33.33	9	1	11.11	7		
Combination drug (Peptide complex)	11	10	90.91	8	11	137.50	14	10	71.43
Combination drug (Piracetam, Cinnarizine)	5	2	40.00	7	1	14.29	4	1	25
Combination drug (Extracts: Ginkgo biloba, *Centella asiatica*, Bacopa monnieri, *Coriandrum sativum*, *Amomum subulatum*, *Emblica officinalis*)	4	1	25.00	4		0.00	2		0.00
Combination drug (morpholine salt of tiazotic acid, piracetam)	4	1	25.00	3	1	33.33	4	1	25
Combination drug (tiazotic acid + Piracetam)	3		0.00	3		0.00	2		0.00

The analysis of the market structure of NDs by INN for the period 2022–2024 showed pronounced differences in market shares and dynamic shifts in consumer and supply preferences.

Piracetam maintained its leading position throughout the period analyzed. In 2022, its share in physical volume amounted to 35.78 %, followed by a decline to 32.38 % in 2023. In 2024, the share stabilized at 33.23 %, confirming the Piracetam continued dominance in the nootropic segment despite minor annual fluctuations.

A significant change in the market structure was observed with gamma-amino-beta-phenylbutyric acid (GABA derivative). This INN was absent from the market in 2022, but in 2023 it rapidly expanded, capturing 16.60 % of the total market volume. In 2024, its share decreased to 7.35 % although it remained one of the leading nootropic substances, indicating a sustained but less intensive demand.

Peptide complex-based drugs demonstrated a consistent growth. Their market share increased from 7.83 % in 2022 to 11.87 % in 2023, remaining almost unchanged in 2024 (11.90 %). This reflects a steady interest in multicomponent and biologically active formulations.

In contrast, Citicoline showed a downward trend. Its share declined from 13.86 % in 2022 to 10.28 % in 2023, followed by a partial recovery to 11.72 % in 2024, suggesting a gradual loss of its market leadership compared with earlier years.

Vinpocetine exhibited variable dynamics. After a decrease from 4.84 % in 2022 to 2.94 % in 2023, a sharp increase was recorded in 2024, when its share reached 11.58 %, indicating a renewed market interest or an increased supply.

Hopantenic acid remained relatively stable over the study period, with market shares of 5.37 % in 2022, 5.61 % in 2023, and 5.51 % in 2024, reflecting a steady demand.

Combination drugs containing Piracetam and tiotriazoline showed moderate fluctuations, increasing from 6.94 % in 2022 to 5.18 % in 2023, and then rising again to 7.02 % in 2024.

Preparations based on Ginkgo biloba and other plant extracts demonstrated a gradual growth, with shares increasing from 1.79 % in 2022 to 3.40 % in 2023 and 4.08 % in 2024, indicating growing interest in phytotherapeutic and natural-origin NDs.

Other INNs, including hypothalamic phospholipids and citicoline + arginine hydrochloride, occupied minor market niches although their shares increased slightly over time, remaining below 2 % for all the years analyzed.

Overall, the results indicate that Piracetam remains the dominant INN in the NDs market, despite moderate fluctuations in its share. The rapid emergence of gamma-amino-beta-phenylbutyric acid in 2023 significantly altered the competitive landscape, while peptide complexes and phytocomponent NDs demonstrated a sustained growth. At the same time, Citicoline and Vinpocetine exhibited mixed dynamics, reflecting changes in the market demand and supply conditions.

Table 7

THE TOP 10 INN OF MEDICINAL PRODUCTS BY IMPORT FOR THE PERIOD FROM 2022 TO 2024 IN PHYSICAL TERMS

INN	Year		
	2022	2023	2024
Piracetam	35.78 %	32.38 %	33.23 %
Peptide complex	7.83 %	11.87 %	11.90 %
Citicoline	13.86 %	10.28 %	11.72 %
Vinpocetine	4.84 %	2.94 %	11.58 %
Gamma-amino-beta-phenyloil acid hh	0.00 %	16.60 %	7.35 %
Piracetam, tiotriazoline	6.94 %	5.18 %	7.02 %
Hopantenic acid	5.37 %	5.61 %	5.51 %
Ginco biloba, *Centella asiatica*, *Bacopa monnieri*, *Coriandrum sativum*	1.79 %	3.40 %	4.08 %
Hypothalamic phospholipids	0.50 %	0.67 %	1.94 %
Citicoline, arginine hydrochloride	0.42 %	0.85 %	1.01 %

The range of NDs by dosage forms is highly diverse, with the majority being available as injectable solutions. From 2014 to 2023, there was a steady increase in the registration of various dosage forms, especially noticeable since 2019. The highest number of registrations was recorded in 2021 and 2022, with more than 140 TNs registered each year. A detailed analysis revealed that NDs were registered in 12 different dosage forms. In 2023, the most common form was injectable solutions, accounting for 99 TNs, followed by tablets (40 TNs), oral solutions (15 TNs), and capsules (19 TNs), among others (Fig. 4).

This trend reflects the continued clinical preference for parenteral administration in acute or hospital settings, also indicating a gradual diversification in dosage forms of NDs to meet outpatient and patient-friendly administration needs.

The analysis of the NDs market in terms of physical volume by dosage form demonstrated a high degree of diversification. Over the study period, 11 different dosage forms were represented in the market.

The dominant dosage form throughout the years analyzed was injectable solutions (solution–ampoule). Their market volume remained the highest among all forms, increasing from 4.08 million packages in 2017 to 5.63 million packages in 2022. In 2023, the volume remained high at 5.59 million packages, confirming the leading role of parenteral forms in clinical practice. In 2024, however, no volume was recorded for injectable solutions. This may reflect temporary supply interruptions, reporting limitations, or structural changes in market supply.

The tablet dosage form takes the second place by volume. The market size showed a generally upward trend, increasing from 1.23 million packages in 2017 to a peak of 1.78 million packages in 2022. In 2023, tablet volumes remained stable (1.76 million packages), followed by a decline to 1.33 million packages in 2024, indicating a possible shift in demand or substitution by alternative dosage forms of NDs.

A particularly pronounced growth was observed for powder formulations. The volume of powders increased steadily from 0.23 million packages in 2017 to 0.96 million packages in 2023, suggesting growing clinical and consumer interest, potentially due to dosing flexibility and ease of administration. In 2024, the volume declined to 0.47 million packages though it remained higher than in the initial years of observation.

Other oral dosage forms of NDs demonstrated comparatively smaller but notable contributions. Capsules increased from 0.26 million packages in 2017 to 0.91 million packages in 2022, before decreasing to 0.54 million packages in 2023 and 0.28 million packages in 2024. Syrups showed a moderate growth from 0.13 million packages in 2017 to 0.43 million packages in 2023, with a slight decrease observed in 2024 (0.34 million packages).

Several dosage forms exhibited the minimal or sporadic market presence. Powder sachets, lyophilisates, and granules were either absent or represented by negligible volumes

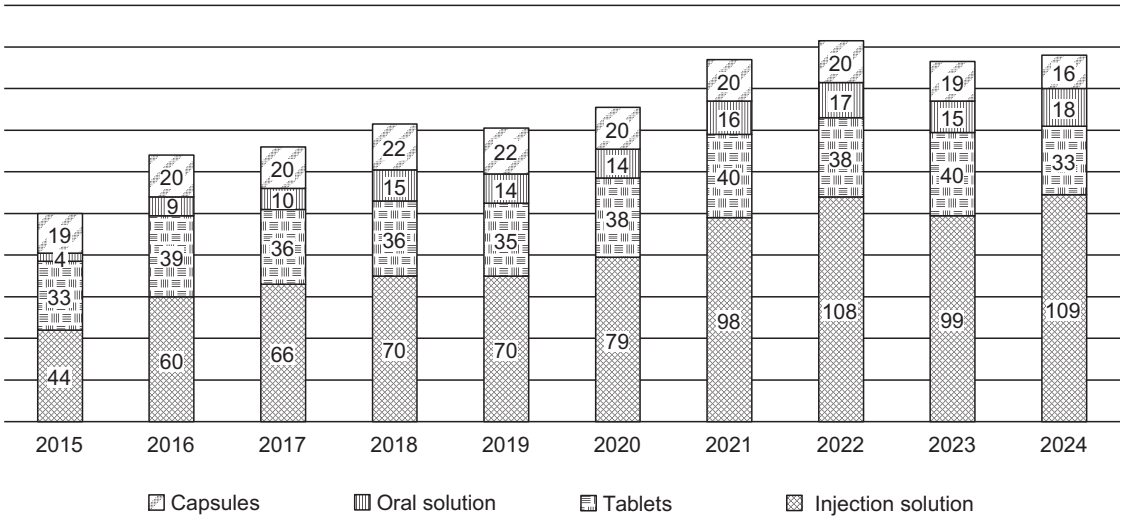

Fig. 4. The number of trade names registered by NDs dosage form for 2015-2024

until 2022–2023, with small quantities appearing only in 2024. Drops, concentrates and suspensions accounted for marginal volumes throughout the study period and did not demonstrate sustained growth.

Overall, the findings indicate that the nootropic drug market is strongly oriented toward injectable and solid oral dosage forms, while alternative formulations occupy niche positions. The absence or the minimal presence of certain dosage forms over extended periods suggests limited market demand, regulatory barriers, or technological constraints affecting their wider adoption.

In 2014, the assortment of NDs was predominantly formed by foreign manufacturers, which accounted for 49 TNs, or 42.6 % of the total registered range. Domestic manufacturers occupied a smaller share at that time. However, beginning in 2021, a structural shift was observed, with domestic manufacturers taking the leading position. By 2023, domestically produced nootropic drugs accounted for 74 TNs, or 38.1 % of the total assortment, indicating a strengthening role of the national pharmaceutical industry.

In 2014, drugs originating from the Russian Federation constituted a substantial share of the assortment (27 TNs, 23.5 %). In subsequent years, particularly from 2016 to 2023, the assortment structure became increasingly dominated by domestic manufacturers, while the relative contribution of individual foreign countries declined.

Throughout the study period, the assortment was clearly dominated by monocomponent NDs. In 2014, monocomponent preparations accounted for 101 TNs (87.8 %). Although their absolute number increased to 150 TNs in 2023, their relative share decreased to 77.3 %, reflecting a gradual expansion of multicomponent formulations.

The analysis by INN demonstrated a shift in leading active substances. In 2014, piracetam-containing NDs predominated, accounting for 34 TNs (29.6 %). By 2023, the leading position was occupied by citicoline-based drugs, with 73 TNs although their relative share of the total assortment was lower due to the overall expansion of products registered.

The evaluation by dosage form revealed a stable predominance of injectable solutions. Over the period from 2014 to 2023, injection solutions consistently represented the largest dosage-form category. In 2023, injectable NDs accounted for 99 TNs, or 51.0 % of the registered assortment, confirming the continued clinical importance of parenteral administration.

Overall, the macro-contour analysis indicates a transition from foreign-dominated to domestically driven assortment formation, preservation of monocomponent NDs as the core of the market, a shift in leading INNs from

Table 8

THE RESULTS OF THE MARKET ANALYSIS BY DOSAGE FORM IN PACKAGES

Dosage form	Million packages							
	2017	2018	2019	2020	2021	2022	2023	2024
Solution-ampoule	4.08	4.74	4.20	4.04	5.26	5.63	5.59	0.00
Tablets	1.23	1.50	1.13	1.72	1.86	1.78	1.76	1.33
Powder	0.23	0.31	0.43	0.43	0.63	0.78	0.96	0.47
Syrup	0.13	0.23	0.23	0.23	0.14	0.31	0.43	0.34
Capsule	0.26	0.44	0.44	0.45	0.50	0.91	0.54	0.28
Powder sachet	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
Drop	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01
Concentrate	0.00	0.02	0.01	0.01	0.02	0.02	0.03	0.01
Lyophilisate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Sachet	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Suspension	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Granule	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00

Piracetam to Citicoline, and the sustained dominance of injectable dosage forms, alongside a gradual diversification of the NDs assortment (Fig. 5).

Over the period analyzed, the role of the Republic of Uzbekistan in the NDs market strengthened markedly. In 2014, domestically produced drugs accounted for approximately 29 % of the total market volume (1.48 million packages). By 2024, the share of Uzbekistan increased to 33 %, reflecting the growing contribution of domestic manufacturers to the overall market supply, despite a temporary decline in absolute volumes observed in 2024.

Throughout the entire study period, CIS countries remained the dominant contributors in terms of the physical market volume. Their share increased slightly from 39.6 % in 2014 to 40.78 % in 2024, confirming their stable leading position in the structure of the NDs supply.

The analysis by INN showed that Piracetam retained its position as the leading substance in quantitative terms. In 2014, piracetam-based drugs accounted for approximately 51 % of the total market volume. Although its share declined to 32 % by 2024, Piracetam remained the most significant INN, indicating sustained clinical demand despite increasing diversification of the assortment.

The evaluation of dosage forms demonstrated the continued dominance of injectable solutions. In 2014, injection solutions accounted for about 70 % of the total market volume. By 2024, their share decreased to approximately 60 %, reflecting a gradual shift toward oral dosage forms, although parenteral preparations continued to play a central role in clinical practice.

At the manufacturer level, notable structural changes were observed. In 2014, Remedy Group was among the leading domestic manufacturers, accounting for approximately 25 % of the domestic market volume. By 2024, its share declined to around 11 %, while Merrymed Farm significantly strengthened its position, increasing its market share from 0 % in 2014 to approximately 32 % in 2024, thereby becoming the leading domestic manufacturer in terms of physical volume (Fig. 6).

Overall, the macro-contour analysis indicates a transition toward greater domestic involvement, sustained dominance of CIS suppliers, continued leadership of Piracetam despite declining relative share, and a gradual diversification of dosage forms. These changes reflect the maturation of the NDs market and evolving patterns of production, supply, and clinical use.

The comparative analysis of nootropic drugs in the Republic of Uzbekistan (2014–2023)

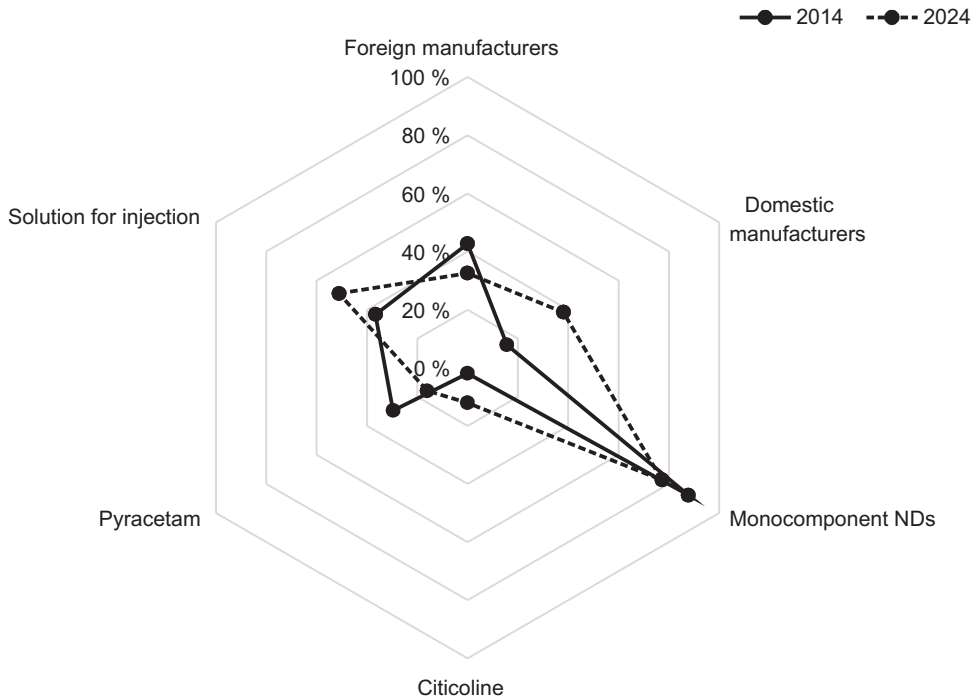

Fig. 5. The macro-contour assortment analysis for the period from 2014 to 2024

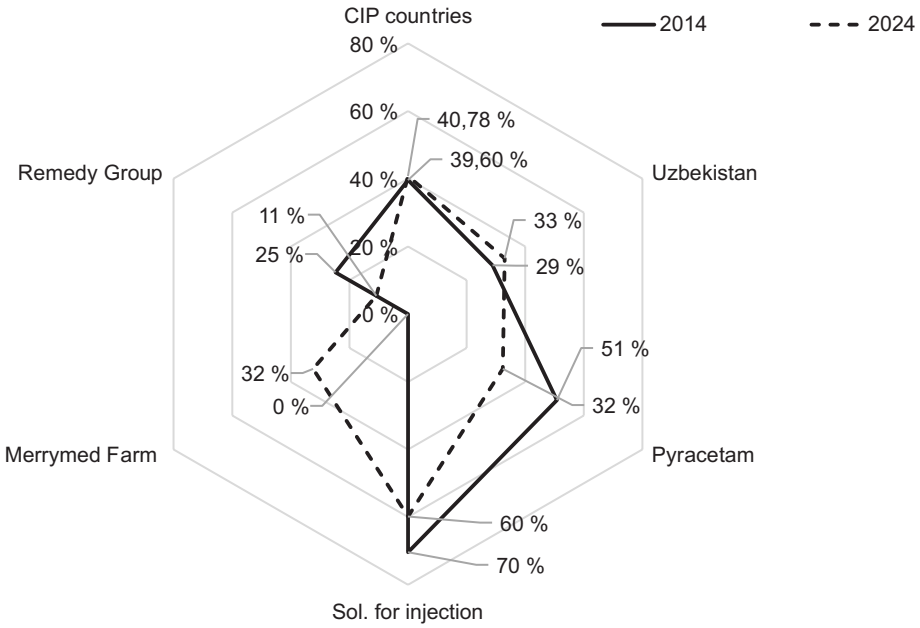

Fig. 6. The macro-contour analysis of the market volume from 2014-2024

shows a substantial expansion of the registered assortment, but a steady gap between registered and marketed products suggests continuing regulatory, logistical, or economic barriers to market entry. Over the decade, the marketed portfolio increasingly shifted toward domestic manufacturing, supporting import-substitution priorities and strengthening supply resilience. The therapeutic structure also evolved, with a notable rise in multicomponent products and a gradual shift in the INN demand from Piracetam toward newer agents, such as γ-aminobutyric acid and peptide complexes. Although injectable formulations remain predominant, growing interest in oral dosage forms indicates an increasing emphasis on convenience and outpatient treatment needs.

Conclusions

1. The comparative analysis of registered and marketed NDs conducted in the Republic of Uzbekistan for the period of 2014–2023 demonstrated significant structural and quantitative changes in the national pharmaceutical market. Over the period analyzed, the number of registered NDs increased almost twofold, accompanied by the substantial growth in the market volume expressed in physical units. At the same time, a persistent discrepancy between the registration and the actual market entry was identified as only 40–55 % of the registered trade names were introduced into commercial circulation. This indicates the presence of regulatory, economic, logistical, or marketing barriers affecting the effective commercialization of NDs.

2. A key finding of the study is the strengthening role of domestic manufacturers, particularly after 2021, reflecting the impact of the national pharmaceutical development policies and import substitution strategies. Despite the continued dominance of monocomponent drugs and injectable dosage forms, a gradual diversification of the assortment was observed, including the increased registration and use of multicomponent formulations and oral dosage forms. The analysis by INN revealed a sustained leadership of Piracetam and Citicoline, alongside emerging interest in peptide complexes and other combination products, indicating clinical and market preferences.

3. The results of this study provide an evidence-based foundation for optimizing the pharmaceutical market regulation, improving the drug availability, and supporting strategic planning for manufacturers and distributors. From a public health perspective, the findings emphasize the importance of aligning drug registration processes with a real market demand and therapeutic needs.

Prospects for further research include an in-depth analysis of the factors limiting the transition of registered NDs to the market, the

assessment of price accessibility and reimbursement mechanisms, and evaluation of prescribing patterns among healthcare professionals. Additionally, future studies should focus on pharmacoeconomic evaluations, patient adherence to different dosage forms, and the clinical effectiveness of mono- versus multicomponent nootropic therapies. Such research would contribute to a more rational and patient-oriented development of the NDs market in Uzbekistan.

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Authors' contribution:
N. M. U. Sultanbaeva: Conceptualization, Data analysis, Manuscript writing, Corresponding author.
D. U. Saydalieva: Data collection, Market analysis, Visualization, Draft revision.
Sh. Z. Umarova: Supervision, Methodological review, Final approval of the manuscript.
A. A. Nozdrina: Data curation, Validation, Visualization.

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Information about the authors:
N. M. U. Sultanbaeva, PhD, Head of the Master's Department, Institute of Pharmaceutical Education and Research, Tashkent, Republic of Uzbekistan (https://orcid.org/0000-0002-1658-7972). E-mail: nargiz6985@gmail.com
D. Saydalieva, teacher, Institute of Pharmaceutical Education and Research, Tashkent, Republic of Uzbekistan. E-mail: saydaliyevadildora98@gmail.com
Sh. Z. Umarova, PhD, Professor, I-Vice-Rector, Institute of Pharmaceutical Education and Research, Tashkent, Republic of Uzbekistan (https://orcid.org/0000-0003-4106-0395). E-mail: sh.umarova@ftti.uz
A. A. Nozdrina, PhD, Associate Professor of the Department of Social Pharmacy, National University of Pharmacy of the Ministry of Health of Ukraine (https://orcid.org/0000-0003-2472-4540). E-mail: almira.nozdrina@nuph.edu.ua
Відомості про авторів:
Н. М. У. Султанбаєва, кандидат наук, завідувачка кафедри магістратури, Інститут фармацевтичної освіти і досліджень, Ташкент, Республіка Узбекистан (https://orcid.org/0000-0002-1658-7972). E-mail: nargiz6985@gmail.com
Д. У. Сайдалієва, викладачка, Інститут фармацевтичної освіти і досліджень, Ташкент, Республіка Узбекистан. E-mail: saydaliyevadildora98@gmail.com
Ш. З. Умарова, кандидат наук, професор, перший проректор, Інститут фармацевтичної освіти і досліджень, Ташкент, Республіка Узбекистан (https://orcid.org/0000-0003-4106-0395). E-mail: sh.umarova@ftti.uz
А. А. Ноздріна, доктор філософії (PhD), доцент закладу вищої освіти кафедри соціальної фармації, Національний фармацевтичний університет Міністерства охорони здоров'я України (https://orcid.org/0000-0003-2472-4540). E-mail: almira.nozdrina@nuph.edu.ua

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