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Analysis of the Dynamics of Concentration in the Wholesale Segment of the Regional Pharmaceutical Market

Chloe Evans[1], James Green[1]*, Mia Hall[1]

[1]Department of Pharmacy Practice, College of Pharmacy, University of Georgia, Athens, USA.

***E-mail** ✉ james.green@outlook.com

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ABSTRACT

Analyzing the competitive landscape of the pharmaceutical market is a key aspect of assessing the drug supply system. This study aims to examine the changes in concentration levels within the wholesale segment of a regional pharmaceutical market. Data on the market shares of major distributors were collected and compiled from 461 contracts executed for the supply of pharmaceutical products in the selected region. The Herfindahl-Hirschman Index (HHIn) was employed to evaluate the competitiveness among pharmaceutical distributors. Additionally, an SV matrix was constructed, represented as a four-quadrant graph with market concentration ratios (CRSV) along the x-axis and Hall-Teidman indices (HTSV) along the y-axis.

The analysis of concentration metrics in the wholesale segment revealed the emergence of an oligopolistic market structure. The SV matrix illustrated how market concentration levels evolved in response to economic fluctuations. Based on these findings, recommendations were developed to enhance the competitiveness of regional pharmaceutical distributors. Assessing the dynamics of market concentration allowed for the evaluation of their current state, identification of trends, and formulation of strategies to optimize the wholesale distribution of pharmaceutical products.

Keywords: Wholesale segment, Pharmaceutical distributor, Market concentration, SV matrix, Pharmaceutical market

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Introduction

Examining the evolution of various commodity markets is crucial for understanding the mechanisms that shape market interactions amid constantly shifting economic, political, social, and demographic conditions [1, 2].

A key measure of a market's state is the concentration of its participants, which influences the competitive landscape. Market concentration reflects the dominance of a few major players, which can limit free economic activity, hinder the integration of markets, disrupt the movement of goods, reduce competition, and affect the overall efficiency of commodity markets [3, 4].

Interest in monitoring and evaluating competitive environments is evident from numerous studies, both theoretical [5–7] and applied, across sectors such as transportation [8], industrial manufacturing [9–11], entrepreneurship [12, 13], and arms and defense equipment sales [14].

The degree of market concentration directly impacts the behavior of market participants. Economic dominance theory suggests that as concentration rises, interdependence among players increases, influencing both the structure of the market and the outcomes of participants' economic activity [15, 16].

The pharmaceutical market is unique due to the dual nature of its core product—medicines. On one hand, medicines are commercial commodities intended to generate revenue for all components of the supply chain, including manufacturers, distributors, and pharmacies, enabling cost recovery, profit generation, and business development. On the other hand, they are socially critical products that directly affect healthcare quality, disease

prevention, and public health. This dual role often creates tension between the profit motives of the pharmaceutical sector and the population's or healthcare institutions' ability to maintain access to essential medicines [17–19].
Given this context, studying the evolution of the competitive environment in the pharmaceutical market—particularly in its wholesale segment—is of both practical and academic significance. Insights from such analyses support the evaluation of current market conditions and facilitate the forecasting of competitive dynamics, which directly affects the affordability of medicine for the population.
The objective of this study was to assess the changes in concentration levels within the wholesale segment of the regional pharmaceutical market and to identify its developmental trajectories using an SV matrix.

Materials and Methods

The study used the wholesale segment of the Karachay-Cherkessia Republic (KCR) pharmaceutical market as a model, selected due to an initiative-based investigation of drug accessibility and quality in the North Caucasus region. The competitive environment analysis followed established methodological guidelines [20, 21] through the following steps:

1. Selection of the study timeframe;
2. Definition of the geographic boundaries of the market;
3. Identification of the product scope, highlighting key pharmaceutical product groups that drive supply and demand;
4. Identification of principal market participants, including leading Russian and regional distributors;
5. Collection and aggregation of data on market shares of major players from executed contracts for the supply of drugs, medical devices, and related pharmaceutical products, using the PharmAnalyst database [https://marketmed.ru/]. A total of 461 contracts were reviewed and analyzed for the study period;
6. Estimation of the total market volume using aggregated statistical information on pharmaceutical supplies to KCR healthcare institutions;
7. Calculation of market concentration metrics via the Herfindahl-Hirschman Index (HHI n) using Eq. 1 [https://vakpro.ru/indexes-herfindalya-i-hirshmana-herfindahl-hirshman-index-hhi]:

$$HHI_n = MS_1^2 + MS_2^2 + MS_n^2 \quad (1)$$

where: MS_n^2– square of the market share (Market Share) *n* - new large wholesale supplier (in %) present in the regional pharmaceutical market;

8. Construction of the SV Matrix [https://svmatrix.online/ru/Matrix-SV/]. The SV matrix is represented as a graph plotted for the study period, with a coordinate system where the x-axis corresponds to the market concentration coefficient (CRSV) and the y-axis corresponds to the Hall-Tideman index (HTSV). The CRSV is calculated by summing the market shares of the dominant pharmaceutical distributors in the regional market using the formula:

$$CRSV = \sum_{i=1}^{n} MS_i \quad (2)$$

where MSi represents the market share (in %) of the i-th major wholesale supplier operating in the regional pharmaceutical market.
The y-axis represents the HTSV, which measures the differentiation among the dominant distributors by comparing their ranks and market shares, calculated as:

$$HTSV = \frac{1}{2} \sum R_n MS_n - 1 \quad (3)$$

where RnMSn is the product of the rank Rn (numerical) and the market share MSn (in decimal form) of the n-th leading wholesale supplier.
The resulting SV matrix is divided into four quadrants, each reflecting different market structures:

- Upper right quadrant G (Gazprom): The dominant core holds a large portion of the market and shows high differentiation among core companies. This indicates the presence of "super companies" that occupy key market positions and create barriers to the growth of smaller competitors. Boundaries: CRSV>65% and HTSV>0.1.

- Lower right quadrant B4 (Big Four): The dominant core also holds a large market share, but with low differentiation, reflecting several similarly strong alpha companies. Market dynamics in this quadrant aim to block new entrants from joining the dominant group. Boundaries: CRSV>65% and HTSV<0.1.
- Lower left quadrant RO (Red Ocean): Dominant companies hold a relatively small market share and exhibit low differentiation, resulting in strong competition among alpha companies as well as beta and gamma players. Boundaries: 30% <CRSV<65% and HTSV<0.1.
- Upper left quadrant I (IKEA): Dominant companies have low total market shares but are highly differentiated, characteristic of markets with low entry barriers yet the presence of distinct leading players. Boundaries: 30% <CRSV<65% and HTSV>0.1 [22–24].

Graphically, the quadrant boundaries are defined by CRSV = 65% (vertical line) and HTSV = 0.1 (horizontal line). The plotted movement of the total concentration and dominance indicators of the key wholesale distributors reflects both their relative position and influence in the market, as well as the overall state, dynamics, and directional trends of the market. This information is critical for forecasting market development and formulating strategies to enhance competitiveness among all players in the wholesale segment.

To assess the concentration levels of the wholesale segment in the regional pharmaceutical market during the study period, the calculated HHIn indices were compared with established benchmarks [25] [https://base.garant.ru/12148673/]:

- High concentration: 2000 < HHI < 10000
- Moderate concentration: 1000 < HHI < 2000
- Low concentration: HHI < 1000

At the final stage, the primary players in the wholesale segment of the Karachay-Cherkessia Republic (KCR) pharmaceutical market were stratified. This was based on an economic modeling approach [26], which posits that in commodity markets, economic actors undergo a natural stratification depending on their financial capabilities, social factors, regulatory environment, and other conditions. Stratification was performed across three levels: Alpha, Beta, and Gamma. Higher-level market participants often block access to certain market segments for other companies, creating conditions of "imperfect" competition [27–29].

Alpha players represent the most influential companies with significant economic power, capable of shaping market rules, advocating regulatory changes, and establishing affiliated commercial structures aligned with their strategic interests. These entities generally have access to substantial financial and product resources.

Beta players consist of companies capable of industrial-scale production, typically leading industry firms or groups. With extensive commodity resources and managed assets, they can control significant market shares.

Gamma players include all remaining business entities operating in the market space not dominated by Alpha and Beta players. They maintain commodity-money relations with higher-level companies while fulfilling market demand and supply [30, 31].

Results and Discussion

Following the outlined methodology for evaluating wholesale segment concentration, the study period was defined from January 2018 to June 2023. This timeframe encompassed the pre-pandemic period (2018) and the phases of the COVID-19 pandemic, including its onset (2019), peak (2020–2021), and decline (2022–2023), providing insights into the regional pharmaceutical market's response to challenging conditions.

The geographic scope was set as the territory of the KCR. To determine the product range of the market, medicines, medical devices, and parapharmaceuticals available in pharmacies were identified as the main goods driving supply and demand.

Suppliers were classified as major Russian and regional pharmaceutical distributors based on a threshold of 5% or more of the total supply volume. Seven distributors were identified: federal-level distributors Protek, Katren, and R-Pharm; regional distributors Organika Company, Pulse Krasnodar, and Magnit Pharma; and the local distributor Medsnab KCR. To avoid potential conflicts of interest, these entities are referred to as: Protek-FFD-1 (federal pharmaceutical distributor No. 1), Katren-FFD-2, R-Pharm-FFD-3, Organika-RFD-1 (regional pharmaceutical distributor No. 1), Pulse Krasnodar-RFD-2, Magnit Pharma-RFD-3, and Medsnab KCR-MFD (local pharmaceutical distributor).

The total value of the wholesale segment was calculated using aggregated statistical data on pharmaceutical supplies to healthcare organizations in the KCR for each year of the study. Using these data, the market shares (MS) of major suppliers and their rankings (R), determined by comparing shares, were established, as summarized in **Table 1**.

Table 1. Indicators of supply volumes of large distributors, HHIn index values.

Year	Key players in the regional pharmaceutical market: *MS* share in % (Rating *R*)							HHI_n, units _
	FFD-1	FFD-2	FFD-3	RFD-1	RFD-2	RFD-3	MFD	
2018	16.0 (1)	11.0 (4)	13.4 (2)	11.4 (3)	8.3 (6)	-	9.5 (5)	8 45 .66
2019	17.0 (2)	21.1 (1)	-	-	16.4 (3)	-	-	1003.17
2020	32.5 (1)	-	28.6 (2)	-	-	-	-	1874.21
2021	-	16.0 (2)	11.3 (4)	16.8 (1)	12.1 (3)	-	-	812.34
2022	12.0 (4)	14.3 (3)	-	16.5 (1)	15.6 (2)	-	8.1 (5)	929.71
2023	15.7 (2)	16.3 (1)	-	14.0 (4)	14.2 (3)	6.2 (6)	9.0 (5)	1029.26

Next, the Herfindahl-Hirschman indices (HHIn) were computed using Eq. 1. For instance, the calculation for 2018 is as follows:

$$HHI_{2018} = 16.0^2 + 11.0^2 + 13.4^2 + 11.4^2 + 8.3^2 + 9.5^2 = 845.66 \quad (4)$$

An SV matrix representing the wholesale segment of the pharmaceutical market in the Karachay-Cherkessia Republic was then constructed. Using Eq. 2, the market concentration coefficients (CRSV) were calculated based on the market share (MS) data presented in **Table 1** for each year. For example, the CRSV for 2018 was calculated as:

$$CRSV_{2018} = 16.0+11.0+13.4+11.4+8.3+9.5 = 69.6 \quad (5)$$

Subsequently, the Hall-Tideman indices (HTSV), which also serve as measures of market concentration, were determined using Eq. 3 along with the MS and ranking (R) data from **Table 1**. The calculation of the HTSV index for 2018 is shown below:

$$HTSV_{2018} = \frac{2}{2\times(1\times0{,}16+2\times0{,}134+3\times0{,}114+4\times0{,}11+5\times0{,}095+6\times0{,}083)-1=0.297} \quad (6)$$

The summary data required for constructing the SV matrix—including the number of major players in the wholesale segment of the regional pharmaceutical market, the calculated CRSV and HTSV values, and the respective quadrant occupied—are presented in **Table 2**.

Table 2. Main components for forming the SV matrix. Wholesale segment of the pharmaceutical market in the Karachay-Cherkessia Republic.

Year	Key players in the wholesale segment of the regional market (in descending order of *MS* value)	Number of players	*CRSV* %	*HTSV* units	SV Matrix Quadrant
2018	FFD-1, FFD-3, RFD-1, FFD-2, MFD, RFD-2	6	69.6	0.297	G
2019	FFD-2, FFD-1, RFD-2	3	54.4	0.926	I
2020	FFD-1, FFD-3	2	61.1	1.259	I
2021	RFD-1, FFD-2, RFD-2, FFD-3	4	56.2	0.623	I
2022	RFD-1, RFD-2, FFD-2, FFD-1, MFD	5	66.5	0.387	G
2023	FFD-2, FFD-1, RFD-2, RFD-1, MFD, RFD-3	6	75.4	0.280	G

In graphical representation, the SV matrix—divided into four quadrants—is shown in **Figure 1**.

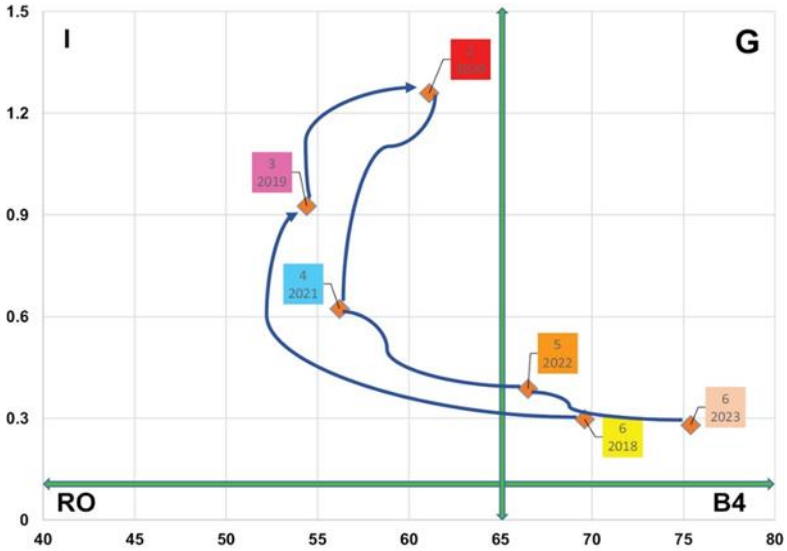

Figure 1. SV Matrix of the wholesale segment of the pharmaceutical market in the Karachay-Cherkessia Republic.
Note: The labels for market concentration indicators for each year show the number of key pharmaceutical distributors.

The outcomes of the stratification of the primary players in the KCR regional pharmaceutical wholesale market as of January 1, 2024, are illustrated in **Figure 2**.

Figure 2. Stratification of the primary pharmaceutical distributors in the wholesale segment of the regional pharmaceutical market.

Federal pharmaceutical distributors FFD-2 and FFD-1 firmly occupy the alpha player category. It is noteworthy that FFD-3, a federal distributor, has not shown interest in re-entering the regional pharmaceutical market following the end of the COVID-19 pandemic. Regional distributors RFD-2 and RFD-1 comprised the beta player group. The gamma player category included the local distributor MFD and regional distributor RFD-3, with RFD-3 being classified as a gamma player because it entered the KCR pharmaceutical market only in 2023.
Analysis of the annual Herfindahl-Hirschman (HHIn) indices **(Table 1)** shows that in 2018, before the onset of the COVID-19 pandemic, the wholesale segment of the regional pharmaceutical market exhibited a low concentration level (HHI2018 = 845.66), indicative of a competitive market environment. Between 2019 and 2020, the market transitioned to moderate concentration (HHI2019= 1003.17; HHI2020= 1874.21) due to the initial and peak stages of the pandemic, which caused widespread disruptions across economic sectors [32]. During this period, many medium-sized pharmaceutical businesses were forced to scale down or suspend operations, leaving large distributors as the dominant market players who adapted to the challenging conditions.
Following the easing of pandemic restrictions, the wholesale segment experienced a partial recovery, returning to a low concentration level in 2021 (HHI2021= 812.34) but trending toward moderate concentration in 2022 (HHI2022= 929.71). Data from the first half of 2023 indicate a return to moderate concentration at levels exceeding those of 2019 (HHI2023= 1029.26). These trends suggest the emergence of an oligopoly, in which a few large distributors occupy leading market positions, weakening the competitive capacity of other market participants and creating tension that negatively affects free-market dynamics.
Currently, global economic relations are increasingly influenced by intensified competition among economic actors for financial and technological dominance, as well as rising tensions between business structures and the

state, which can pose risks where business interests outweigh public welfare [33]. The pharmaceutical market, which has a critical social component, is also susceptible to such risks. Nonetheless, in our country, efforts are being made to enhance the influence of social considerations on the operations of pharmaceutical companies [34].
According to the theory of economic dominance, commodity markets naturally stratify economic entities based on their financial capacity, social position, regulatory environment, and other factors, with stratification occurring at three levels: alpha, beta, and gamma. Higher-level market entities limit access for other participants in certain market segments, leading to "imperfect" competition [27–29].
The SV matrix constructed in this study **(Figure 1)** allows observation of changes in market concentration in the wholesale segment over the five-year study period. In 2018, prior to the pandemic, the wholesale segment was located in quadrant G, reflecting the dominance of six large suppliers. Among them, MFD was not a market leader in terms of supply volume to the KCR but, with a 9.5% market share **(Table 1)**, ranked as one of the largest suppliers.
From 2019 to 2021, encompassing the onset, peak, and decline of the pandemic, market concentration shifted to quadrant I, accompanied by a reduction in the number of the largest suppliers—first to three, then to two in 2020. From the perspective of economic dominance theory, this trend temporarily reduced barriers for new entrants, but pandemic-related disruptions significantly constrained market access. The easing of restrictions in 2021 facilitated a revival of competition, increasing the number of main players to four.
However, due to the socio-demographic characteristics of the KCR—such as a relatively small pharmaceutical consumption volume and the absence of a local distributor network—the wholesale segment's concentration indicators returned to quadrant G in 2022. This ultimately resulted in the establishment of a stable oligopoly by 2023, consisting of six major pharmaceutical distributors.
The stratification of the primary wholesale suppliers, as shown in **Figure 2**, confirms the predominance of large business entities in the pharmaceutical goods market of the Karachay-Cherkessia Republic. At the same time, it highlights opportunities for regional wholesalers to develop further, leveraging advantages such as lower logistics costs and the ability to rapidly respond to the evolving needs of healthcare organizations [35].
To comparatively assess the observed trends in wholesale market concentration against similar metrics in Russia and the Eurasian Economic Union (EAEU) countries, a patent search and subsequent content analysis of relevant scientific literature [3, 36–38] addressing competition issues were conducted. Among these, only Markov and Yakimova (2022) partially examined market concentration in Russia's pharmaceutical market, including a limited analysis of the wholesale segment [3]. Livanskii (2017) and Evstratov *et al*. (2024) focused on concentration in pharmacy retail, while Toregozhina *et al*. (2019) analyzed concentration in pharmaceutical manufacturing [36–38].
The analysis revealed that trends in market concentration within the regional wholesale market generally reflect those observed in retail and industrial segments. Across the pharmaceutical industry, competition has intensified, leading to the marginalization or acquisition of smaller firms by larger companies, forming oligopolies encompassing both distributors and pharmacy chains. For Russia and EAEU countries, this economic structure is considered optimal under current conditions, as it ensures economic stability, facilitates medicine supply through widespread branches of major pharmaceutical associations, optimizes logistics, diversifies supply chains, accounts for regional socio-economic, climatic, medical, and demographic characteristics, and improves the eco-efficiency of distribution.
In the European Union, supranational regulation of production and capital concentration in the pharmaceutical sector is particularly notable [39]. Analyses based on perfect competition theory suggest that large markets cannot function independently, and maintaining product quality and fair pricing requires regulatory oversight. Strengthened supranational control of the pharmaceutical market is therefore anticipated.
In developing countries, small pharmaceutical firms face significant challenges related to digitalization and the adoption of continuous management and production technologies, which further intensify industry competition [40]. Brexit has also reshaped EU supply chains since early 2021, reducing the UK's competitiveness.
For MFD, a gamma-level distributor without a leading market position, strategic development options include: expanding economic partnerships with alpha and beta players, leveraging logistical advantages; retaining and growing the client base through attractive financial policies; and integrating with other gamma players to increase market share and economic capabilities.
Conceptual approaches to enhance competitiveness for regional pharmaceutical wholesalers such as MFD involve increasing functional complexity through diversification of activities [41]. Proposed strategies include:

- Continuous monitoring of the structure and composition of the product portfolio;
- Active participation in state and regional preferential drug programs;
- Expanding an affiliated pharmacy network to boost retail sales and pharmaceutical service provision;
- Developing small-scale pharmaceutical manufacturing;
- Conducting targeted advertising campaigns for wholesale and retail consumers;
- Implementing mechanisms to attract and retain clients by offering social and economic incentives.

Conclusion

Analyzing market concentration dynamics in the wholesale segment of the Karachay-Cherkessia Republic's pharmaceutical market via the SV matrix enabled assessment of the market's current state and trajectory under prevailing socio-economic conditions. The study also identified several conceptual strategies to optimize wholesale pharmaceutical operations. While these proposals involve significant economic (capital investments, costs, expenses) and administrative (licensing of specific pharmaceutical activities) barriers, their implementation could substantially enhance the competitiveness of MFD within the regional market.

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