

Patterns of Antiallergic Drug Consumption in Kyrgyzstan: A Nationwide ATC/DDD-Based Analysis of Antihistamines and Glucocorticosteroids (2024-2025)

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Abstract Objectives: Antiallergic drugs, including antihistamines and glucocorticosteroids, are widely used in the allergic diseases and inflammatory conditions. Monitoring their consumption is essential for assessing rational use, accessibility and adherence to clinical guidelines. In Central Asian countries, including the Kyrgyz Republic, up-to-date nationwide data on antiallergic drug utilization remain limited. This study aimed to analyze consumption patterns of antihistamines and glucocorticosteroids in Kyrgyzstan during 2024-2025 using the WHO-recommended ATC/DDD methodology. **Methods:** A retrospective nationwide drug utilization study was conducted based on official pharmaceutical distribution and registry data. All systemic antihistamines (ATC code R06A) and glucocorticosteroids were included in the analysis. Drug consumption was assessed using Defined Daily Doses (DDD), DDDs per 1,000 inhabitants per year (DID) and Packages per Inhabitant per Year (PIY). Consumption structure by International Nonproprietary Names (INNs) and temporal trends were analyzed. **Results:** Between 2024 and 2025, antiallergic drug use showed divergent patterns depending on the indicator applied. Total antihistamine consumption increased from 34,350,864 DDDs to 41,271,951 DDDs (1.2-fold growth), while population-adjusted exposure declined from 9 DID to 7 DID. Loratadine, cetirizine and levocetirizine remained the most frequently used agents, with cetirizine showing a notable consumption increase from 4.36 to 6.85 million DDDs. Systemic glucocorticosteroids followed a downward trajectory, with total volume decreasing from 10,674,561 DDDs to 9,451,298 DDDs and population exposure falling sharply from 3.79 DID to 0.82 DID. This reflects a pronounced contraction driven primarily by a structural withdrawal from dexamethasone (from 7.02 million to 481,369 DDDs). **Conclusion:** National ATC/DDD data for 2024-2025 indicate measurable changes in the composition and intensity of antiallergic therapy in Kyrgyzstan. Second-generation antihistamines continue to dominate outpatient treatment, while systemic corticosteroid use has contracted. From a public health standpoint, these patterns demonstrate favorable shifts toward aligned guideline prescribing and post-pandemic clinical stabilization, but highlight the critical importance of continuous, integrated pharmacoepidemiological surveillance to prevent potential access limitations and to support clinical stewardship.

Key Words Antiallergic Drugs, Antihistamines, Glucocorticosteroids, Drug Utilization, ATC/DDD Methodology, Pharmacoepidemiology, Kyrgyzstan

INTRODUCTION

Over the last decade, the demand for antiallergic pharmacotherapy has grown, reflecting the increasing prevalence of allergic diseases and their impact on everyday functioning. Allergic rhinitis, chronic urticaria and atopic dermatitis are no longer regarded as minor seasonal inconveniences; in many populations, they require long-term or repeated pharmacological management [1,2].

In the Kyrgyz Republic, allergic morbidity has become more visible in clinical practice, particularly in urban settings where environmental and lifestyle factors may contribute to disease expression. In the Kyrgyz Republic, allergic morbidity has become more visible in clinical practice, particularly in urban settings where environmental and lifestyle factors may contribute to disease expression. This aligns with broader regional data across Central Asia, where the prevalence of allergic rhinitis and bronchial asthma has shown a steady

upward trajectory over the past decade, affecting between 5 and 15% of the general population in neighboring Kazakhstan and Uzbekistan, driven by unique environmental triggers such as arid climate, dust storms and localized industrial emissions. Antihistamines are widely available and frequently used, often beyond specialist supervision [3].

Drug Utilization Research (DUR) offers a practical framework for examining such trends. Rather than focusing solely on therapeutic efficacy, DUR evaluates real-world consumption through distribution data and standardized indicators, allowing assessment of both volume and structure of drug use. This approach is particularly relevant for medicines that are easily accessible and may be subject to empirical or prolonged use [4,5].

The World Health Organization recommends the Anatomical Therapeutic Chemical/Defined Daily Dose (ATC/DDD) system. The use of indicators such as total Defined Daily Doses (DDD), DDD per 1,000 inhabitants per year (DID) and Packages per Inhabitant per Year (PIY) enables longitudinal evaluation of utilization intensity and shifts between active substances [6]. Importantly, these metrics do not measure clinical appropriateness directly, but they provide a quantitative basis for identifying potential deviations from rational prescribing patterns.

Given recent regulatory adjustments and evolving prescribing practices in the post-pandemic period, updated national data are needed. To address this gap, the primary objective of this study was to conduct a comprehensive, nationwide evaluation of the consumption patterns of antihistamines and systemic glucocorticosteroids in the Kyrgyz Republic during the 2024-2025 period utilizing the standardized WHO ATC/DDD methodology. Specifically, the study aimed to: (1) determine the absolute and population-adjusted utilization volumes (expressed in DDD, DID and PIY); (2) analyze the internal consumption structure by International Nonproprietary Names (INNs); and (3) identify structural shifts and temporal trends in prescribing behavior within these therapeutic classes.

METHODS

Data Sources

Official data on medicine circulation were obtained from the national regulatory authority of the Kyrgyz Republic. Demographic and population statistics were retrieved from the National Statistical Committee of the Kyrgyz Republic. The pharmaceutical database utilized for this study provides comprehensive nationwide coverage, encompassing approximately 95% of all officially registered and legally imported pharmaceutical distributions in both retail pharmacy sectors and public procurement networks. To ensure completeness of reporting, data entry fields were cross-checked against mandatory customs declarations and official manufacturer distribution registries. Quality control and data validation procedures were systematically applied to eliminate potential inconsistencies. Specifically, automated filtering algorithms were executed to identify and exclude duplicate invoice numbers, missing active substance

values, or misclassified package sizes. Discrepancies identified during this screening process (estimated at less than 1.5% of the total dataset) were manually audited and verified against the national registry of registered medical products before final ATC/DDD calculation.

ATC/DDD Methodology

Drug utilization was evaluated using the Anatomical Therapeutic Chemical (ATC) classification and Defined Daily Dose (DDD) system recommended by the World Health Organization. This framework enables standardized comparison of drug consumption across time and settings.

Defined Daily Dose (DDD)

DDD represents the assumed average maintenance dose per day for a drug used for its principal indication in adults. Values are assigned by the WHO Collaborating Centre for Drug Statistics Methodology for each active substance. It should be noted that DDD does not necessarily correspond to the prescribed dose; rather, it serves as a technical unit for population-level analysis.

Indicators of Drug Consumption

The following indicators were used to quantify and compare antihistamine and glucocorticosteroid drug consumption:

- **Defined Daily Dose (DDD):** The absolute number of standardized daily doses used over a given period
- **DDD per 1,000 inhabitants per year (annualized DID):** A normalized indicator reflecting the number of Defined Daily Doses consumed per 1,000 inhabitants over one calendar year. For the purposes of this study, DID values were calculated on an annual basis to assess population-level exposure and allow year-to-year comparison of utilization intensity
- **Packages per Inhabitant per Year (PIY):** Reflects physical availability and patient-level frequency of drug distribution
- **Number of Registered INNs:** Captures the diversity and turnover of antihistamine agents on the national market

Consumption structure by International Nonproprietary Names (INNs) and temporal trends were analyzed. Given that the study utilized highly aggregated, nationwide macroeconomic distribution data covering two consecutive full calendar years (2024 and 2025), inferential statistical tests (such as p-value calculations or longitudinal trend regressions) were methodologically limited due to the absence of individual-level variances and a multi-year time series. Consequently, in strict accordance with the WHO guidelines for drug utilization research on macroeconomic datasets, the statistical approach focused on descriptive comparative analytics, quantifying absolute and relative year-to-year structural shifts, percentage share distributions and fold-change dynamics across the standardized indicators.

RESULTS

Availability and Diversity of Antihistamines

By the end of the study period, 45 trade names of antihistamines (13 INNs) were registered in Kyrgyzstan. Market distribution was: cetirizine (17%), levocetirizine (15%), diphenhydramine (13%) and loratadine (12%) [15].

Actual availability was lower than formal registration suggested - only 28 trade names (62%) and 10 INNs were present in retail circulation, while desloratadine, dimethindene, diphenhydramine, ketotifen, fexofenadine, olopatadine and ebastine showed full market presence, quifenadine was not available despite being registered, this discrepancy indicates that regulatory approval does not necessarily translate into effective patient access.

Total antihistamine consumption increased from 34,350,864 DDDs in 2024 to 41,271,951 DDDs in 2025 (1.2-fold growth), reflecting expanding population exposure. The PIY indicator rose from 0.359 to 0.366, suggesting stable but gradually intensifying outpatient use. Overall, the data indicate a moderate upward trend in prescribing behavior. Together, these indicators point to an overall intensification of antihistamine utilization in 2025.

Analysis of antihistamine consumption using the DID indicator demonstrated a downward trend - decreased from 9 in 2024 to 7 in 2025, corresponding to an approximately 1.2-fold reduction (Figure 1). Thus, despite the increase in total DDD volume, population-level exposure declined.

Analysis of antihistamine consumption using the DID indicator demonstrated a downward trend - decreased from 9 in 2024 to 7 in 2025, corresponding to an approximately 1.2-fold reduction (Figure 1). Thus, despite the increase in total DDD volume, population-level exposure declined. This apparent methodological paradox is primarily attributed to rapid demographic shifts within the Kyrgyz Republic, where annual population growth outpaced the proportional expansion of drug distribution volumes,

thereby diluting the per-capita metric when adjusted per 1,000 inhabitants. Additionally, this divergence reflects a compression of the average duration of treatment courses in the population, where more patients received shorter, episodic anti-allergic therapies rather than prolonged, continuous maintenance regimens.

A DDD-based subgroup analysis for 2024–2025 showed that loratadine (R06AX13) was the most widely used systemic antihistamine, accounting for 6,435,638 DDDs in 2024 and 5,960,572 DDDs in 2025, cetirizine (R06AE07) ranked second but exhibited a marked increase, rising from 4,367,274 to 6,856,698 DDDs over the study period, levocetirizine (R06AE09) also expanded substantially, from 2,405,835 to 4,411,380 DDDs. These shifts suggest a gradual redistribution within the antihistamine class, with growing use of cetirizine and levocetirizine alongside high loratadine consumption (Table 1).

Population-level exposure was evaluated using the DID indicator and loratadine showed the highest values throughout the study period: 5 DID in 2024, increasing to 7 DID in 2025, suggesting a broader share of treated individuals, cetirizine demonstrated a pronounced upward shift, with DID rising from 3.7 to 6 over the same period and levocetirizine decreased from 3 to 2.4 DID. These differences reflect evolving prescribing preferences rather than changes in overall therapeutic demand (Figure 2).

Table 1: Dynamics of Antihistamine Consumption by Defined Daily Dose (DDD) Indicators in 2024-2025

ATC	INN	DDD per 2024 y.	DDD per 2025 y.
R06AX13	Loratadine	6435638	5960572
R06AE07	Cetirizine	4367274	6856698
R06AE09	Levocetirizine	2405835	4411380
R06AX17	Ketotifen	2245862	2711373
R06AA02	Diphenhydramine	2214698	2589781
R06AX26	Fexofenadine	202175	232134
R06AX27	Desloratadine	3246	7458
R06AC03	Chlorpiramine	1356	9791

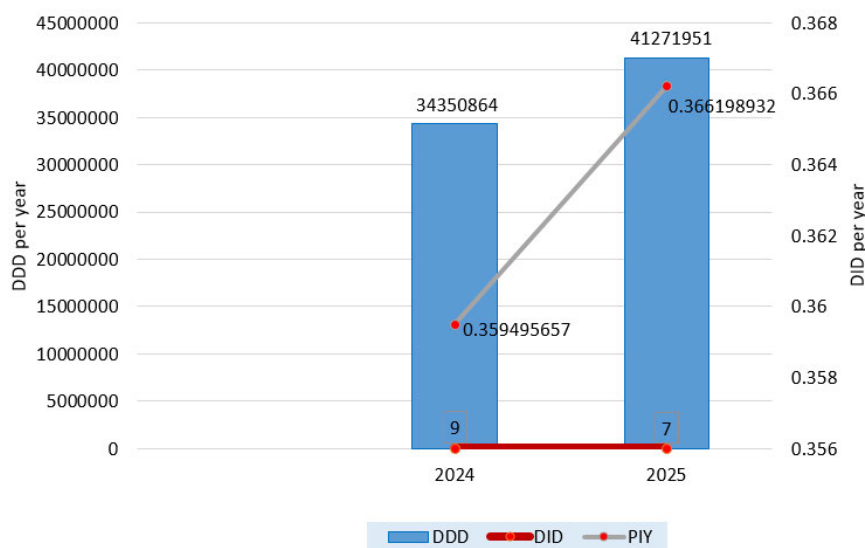


Figure 1: Trends in Total Antihistamine Consumption Volumes in the Kyrgyz Republic (2024-2025) Expressed in DDD and Population-Adjusted DID

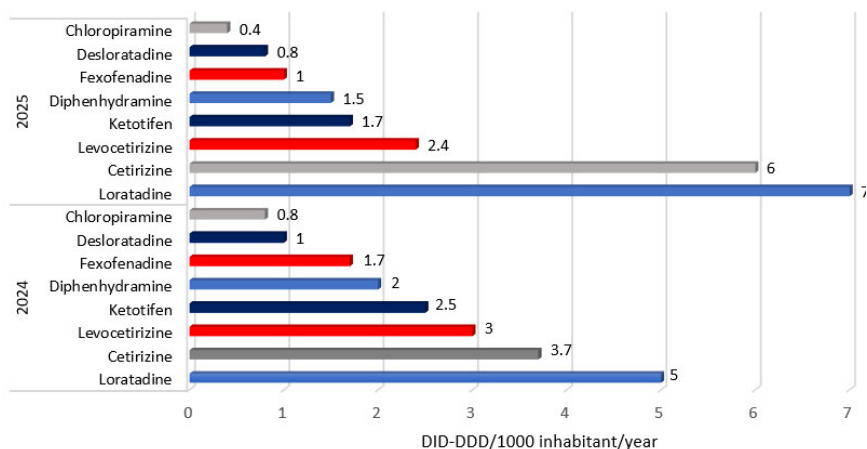


Figure 2: Dynamics of Antihistamine Consumption Expressed as DDDs per 1,000 Inhabitants per Year (DID) in 2024-2025

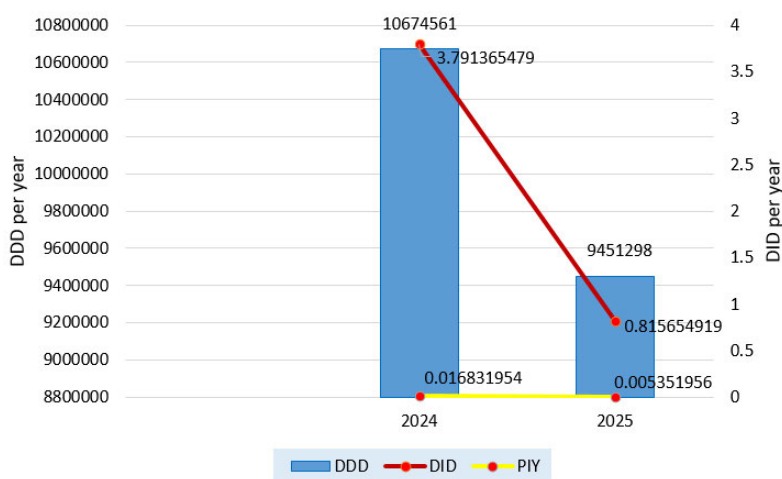


Figure 3: Trends in Population-Level Glucocorticosteroid Consumption in the Kyrgyz Republic during 2024-2025

In this context, the consumption structure observed in Kyrgyzstan appears aligned with broader regional prescribing tendencies rather than representing an isolated national pattern. The primary prescribing drivers pulling the market toward cetirizine and levocetirizine include their superior pharmacodynamic profiles-characterized by rapid onset of action, minimal sedative effects compared to first-generation agents and lack of hepatic cytochrome P450 metabolism, which minimizes drug-drug interactions. Furthermore, the expansion of these second-generation non-sedating agents is heavily driven by enhanced affordability through generic penetration and proactive embedding into localized clinical protocols for allergic rhinitis and urticaria management.

Trends in Glucocorticosteroids Consumption (DDD, DID, PIY)

Glucocorticosteroid (GCS) consumption was evaluated using the ATC/DDD framework-total annual volume decreased from 10,674,561 DDDs in 2024 to 9,451,298 DDDs in 2025, corresponding to an approximately 1.1-fold reduction. More pronounced differences emerged when population-adjusted indicators were examined. PIY declined

from 0.0168 to 0.0054, indicating a substantial drop in the number of packages dispensed per inhabitant. Similarly, DID values fell from 3.79 to 0.82, reflecting a marked decrease in per-capita exposure (Figure 3).

The parallel reduction across volume- and population-based measures suggests structural contraction in systemic corticosteroid use, which may be associated with post-pandemic normalization of prescribing patterns, increased caution regarding adverse effects, or gradual movement toward non-steroidal therapeutic alternatives.

Subgroup analysis revealed substantial internal shifts within the glucocorticosteroid class - dexamethasone (H02AB02) accounted for the largest volume in 2024 (7,023,231 DDDs), but its use dropped sharply in 2025 to 481,369 DDDs. This contraction represents the most pronounced change observed among systemic corticosteroids. Prednisolone (H02AB06) increased from 395,132 DDDs in 2024 to 836,264 DDDs in 2025. The divergence between these two medications suggests a redistribution within the class rather than uniform decline. Triamcinolone (H02AB08) remained comparatively stable, with minor variation between 316,851 and 301,629 DDDs.

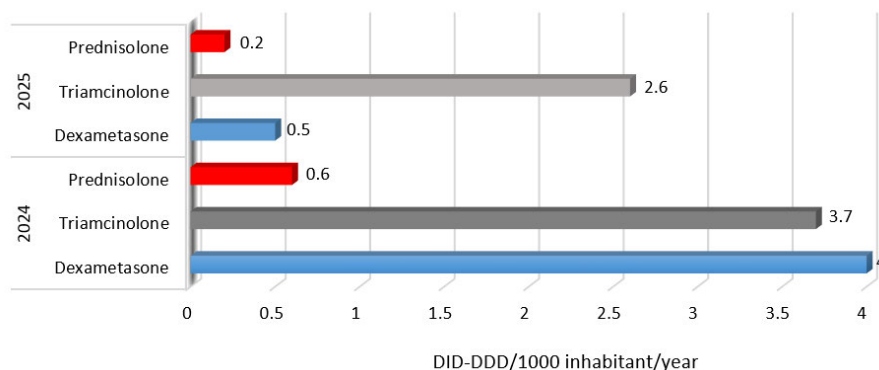


Figure 4: Dynamics of Glucocorticosteroid Consumption Expressed as DDDs per 1,000 Inhabitants per Year (DID) in 2024-2025

Population-adjusted indicators reinforce these dynamics - dexamethasone exposure fell from 4 to 0.5 DID, indicating a marked reduction in per-capita use and triamcinolone decreased more moderately (from 3.7 to 2.6 DID), while prednisolone remained at comparatively low levels (0.6 to 0.2 DID) (Figure 4). The data point to structural rebalancing within systemic corticosteroid prescribing, characterized by a substantial withdrawal from dexamethasone and selective shifts toward alternative.

DISCUSSION

Antihistamine Consumption Trends

Antihistamines continue to stay in a stable position in outpatient pharmacotherapy. Although total DDD and DID values showed a moderate decline in 2025, loratadine and cetirizine maintained dominance within the class, their sustained use is unsurprising, considering their established status as first-line second-generation agents, broad availability and comparatively favorable safety profiles.

Comparable patterns have been described in other CIS countries. Reports from Kazakhstan and Uzbekistan indicate that loratadine and cetirizine account for the largest share of outpatient antihistamine use [26-28]. Russian ATC/DDD-based analyses similarly note the predominance of second-generation antihistamines, with continued, though limited, presence of first-generation agents in routine practice [29]. In this context, the consumption structure observed in Kyrgyzstan appears aligned with broader regional prescribing tendencies rather than representing an isolated national pattern.

Glucocorticosteroid Consumption Dynamics

The most notable shift concerned systemic glucocorticosteroids - all consumption indicators moved downward between 2024 and 2025, while total DDD volume declined moderately (approximately 1.1-fold), population-adjusted exposure (DID) contracted much more sharply, nearly fourfold. The change was driven by dexamethasone, whose use fell substantially in both absolute and per-capita terms.

Similar information have been reported in neighboring countries. Analyses from Kazakhstan and the Russian Federation describe a decline in systemic corticosteroid prescribing after 2022, following the period of expanded use during COVID-19 waves [30-32]. In this regard, the

trajectory observed in Kyrgyzstan appears consistent with regional recalibration rather than an isolated fluctuation [33].

In this regard, the trajectory observed in Kyrgyzstan appears consistent with regional recalibration rather than an isolated fluctuation. Furthermore, this substantial contraction in dexamethasone utilization directly reflects recent structural changes in national healthcare policy and clinical guideline updates implemented by the Ministry of Health of the Kyrgyz Republic. Specifically, post-pandemic revisions of state clinical protocols for respiratory and inflammatory conditions enforced stricter, evidence-based criteria for systemic corticosteroid initiation in outpatient settings. These regulatory updates actively discouraged the empirical prescription of high-potency agents like dexamethasone for mild-to-moderate presentations, shifting clinical recommendations toward more controlled alternative regimens or non-steroidal options. Additionally, tighter enforcement of Prescription-Only Medicine (POM) regulations in retail pharmacies across the country restricted speculative over-the-counter access to injectable and high-dose oral corticosteroids, significantly reducing irrational community-level consumption.

Prednisolone and triamcinolone displayed comparatively steadier patterns, suggesting selective reduction within the class, this internal redistribution may reflect a shift toward agents perceived as more suitable for controlled or chronic indications. Comparable concerns have been discussed in other CIS settings where procurement limitations or cost constraints may indirectly influence therapeutic choices [34].

Regional Comparison and Methodological Considerations

Most published data from CIS countries refer to the 2020-2023 period; however, the use of the standardized ATC/DDD system permits meaningful comparison across time and settings. Utilization patterns for antihistamines and systemic corticosteroids generally evolve gradually rather than abruptly, allowing earlier regional observations to serve as a contextual framework for interpreting more recent national trends. The present analysis contributes updated figures for 2024-2025, a period for which regional data remain limited.

Implications for Pharmacopolicy and Clinical Practice

The continued predominance of second-generation antihistamines may reflect gradual alignment with evidence-based recommendations, at the same time, the persistence of older agents indicates that prescribing behavior remains heterogeneous.

The contraction in glucocorticosteroid use deserves careful interpretation, while reduced exposure may indicate improved prescribing discipline, it may also signal emerging access constraints. Distinguishing between these possibilities requires integration of utilization data with clinical and procurement information.

Methodological Considerations in Trend Interpretation

When evaluating the factors driving the observed structural shifts in both antihistamine and corticosteroid utilization, a key structural parameter of macroeconomic drug utilization research must be highlighted. Because the primary data stream analyzed in this study is derived from highly aggregated nationwide distribution registries rather than patient-level electronic health records or direct prescription auditing, the observed expansion of second-generation antihistamines reflects gross market consumption trends rather than verified, individualized clinical choices. While clinical guidelines and safety profiles serve as highly plausible external explanations for these shifts, any direct extrapolation to specific physician prescribing behavior or patient compliance remains speculative. Consequently, these documented patterns should be interpreted strictly as macroeconomic re-alignments of market availability and aggregate population exposure, while definitive cross-sectional audits of clinical rationale would require future patient-level prescription tracking studies.

Clinical and Policy Implications

Based on the documented drug utilization trends, several actionable recommendations can be formulated to support evidence-based pharmaceutical policies and optimize rational medicine use in the Kyrgyz Republic:

- **Optimizing Reimbursement Frameworks:** The continued high consumption of first-generation antihistamines and older corticosteroids suggests a need to re-evaluate state-subsidized drug packages. Integrating cost-effective second-generation agents (such as cetirizine or levocetirizine) into national insurance programs (e.g., the Additional Mandatory Health Insurance Program) could significantly enhance patient access to safer, non-sedating alternatives
- **Strengthening Prescription Control:** To prevent the potential overestimation or irrational use of potent systemic glucocorticosteroids like dexamethasone, regulatory authorities should strengthen enforcement of Prescription-Only Medicine (POM) status in retail pharmacies. Implementing electronic prescription tracking systems would drastically reduce self-medication and empirical over-the-counter sales

- **Updating Clinical Guidelines and Educational Audits:** The Ministry of Health should leverage these drug utilization data to initiate regular provider-level educational interventions. Developing standardized, simplified algorithms for allergic rhinitis and asthma management at the primary healthcare level will help transition clinical practices away from legacy, high-sedation therapies
- **Establishing Continuous Surveillance:** The divergence observed between macro-distribution indicators and population-adjusted metrics underscores the critical need for a permanent, digitalized national system for monitoring medicine consumption to flag irrational utilization spikes in real time

CONCLUSION

The 2024-2025 analysis of national ATC/DDD data reveals shifts in the structure and intensity of antiallergic drug use in Kyrgyzstan. Second-generation antihistamines particularly loratadine and cetirizine remain central to outpatient therapy, maintaining their dominant position within the class.

A marked reduction in dexamethasone use, accompanied by internal redistribution toward other agents, indicates a structural adjustment within corticosteroid prescribing. Whether this reflects improved rationality or evolving access constraints requires further evaluation beyond consumption metrics alone.

When interpreted in the context of available CIS data, the trends observed in Kyrgyzstan appear consistent with broader regional developments, especially in the post-pandemic period, continued surveillance of drug utilization, combined with clinical and procurement data, will be necessary to ensure that reductions in use correspond to optimized rather than restricted therapy.

Limitations

Several methodological constraints should be acknowledged. The analysis was based on aggregated national distribution data and did not differentiate between inpatient and outpatient settings. Furthermore, while the official regulatory database encompasses nationwide public procurement networks and major wholesale distribution channels supplying the retail market, it may not completely separate specific private-sector direct imports or fully reflect the nuances of Over-the-Counter (OTC) sales without formal tracking. Consequently, this creates a potential for both underestimation and overestimation of actual population exposure. On one hand, non-prescribed OTC acquisitions of antihistamines could lead to an underestimation of true community-level utilization. On the other hand, analyzing wholesale distribution data rather than patient-level dispensing registries can potentially overestimate active consumption, as it does not account for wasted, expired, or unused medications within household stocks. Additionally, macro-level drug utilization metrics are inherently vulnerable to non-clinical market anomalies that were outside the scope of this database. Specifically, temporal fluctuations in antihistamine and corticosteroid volumes

may partially reflect periodic wholesale stock shortages, temporary regional supply chain disruptions, or administrative delays in national procurement tenders rather than shifts in true epidemiological demand. For instance, a sudden drop in a specific molecule's DID could be structural-driven by a temporary market shortage of an affordable generic-forcing an artificial therapeutic substitution. Future studies incorporating localized facility-level inventory tracking and direct prescription audits are required to cross-reference distribution peaks with real-world clinical indications, drug adherence rates and clinical outcomes. Nevertheless, nationwide coverage and the application of standardized ATC/DDD metrics provide a reliable quantitative foundation for evaluating structural trends in antiallergic and corticosteroid drug use in the country.

Conflict of Interest

The Authors declares that they have no conflict of interest.

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Declaration on AI and AI-Assisted Technologies

During the preparation of this manuscript, the authors utilized the Gemini AI model (Google) solely for the purpose of English language editing, stylistic refinement and grammatical correction to improve the readability of the text. After using this tool, the authors reviewed, edited and thoroughly verified all content and take full responsibility for the scientific integrity, factual accuracy and final phrasing of the manuscript.

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