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Analysis of the availability of bronchodilators and anti-inflammatory drugs for patients with chronic obstructive pulmonary disease

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SUMMARY

Background. The study of drug availability for patients with chronic obstructive pulmonary disease (COPD) represents one of the priority tasks in the organization of effective counteraction to COPD in the Russian Federation.

Objective: to assess drug prices, affordability, and availability for COPD patients.

Material and methods. The analysis of drug availability for COPD patients was carried out according to the methodology of the World Health Organization and Health Action International (WHO/HAI). Bronchodilator and anti-inflammatory therapy of originator brands and lowest-priced generics was evaluated. The consumption volume of the studied drugs was also analyzed using the ATC/DDD (Anatomical Therapeutic Chemical classification / defined daily dose) pharmacoepidemiologic methodology over a three-year period (from 2020 to 2022), taking into account their share of total DDD (drug utilization analysis, DU90%).

Results. According to the results of DU90% analysis, the most purchased drugs for bronchodilator and anti-inflammatory therapy for all the years under study were drugs from the groups of short-acting bronchodilators (salbutamol, fenoterol, ipratropium bromide + fenoterol) and inhaled glucocorticoids (budesonide, beclomethasone). The obtained data were confirmed by the results of the physical availability study. Thus, the highest percentage of physical availability was for short-acting inhaled beta-2-agonists (SABA) (salbutamol). Analysis of drug affordability also revealed a tendential superiority of SABA and short-acting anticholinergics over baseline bronchodilators and anti-inflammatory drugs.

Conclusion. Low affordability of the main drugs of baseline therapy contributes to the burden of COPD and necessitates improvement of drug supply mechanisms for individuals, especially those with low material income, which in the long term will significantly reduce the costs of the healthcare system for the treatment of these patients by decreasing the severity and frequency of exacerbations.

KEYWORDS

Chronic obstructive pulmonary disease, COPD, drug prices, drug affordability, drug availability, ATC/DDD analysis.

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Authors' contribution
Orlova E.A. – study concept and design, data collection and processing, text writing;
Petrov V.I., Shatalova O.V., Orlov M.A. – text editing;
Dorfman I.P. – statistical data processing

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Анализ доступности бронхолитических и противовоспалительных препаратов для пациентов с хронической обструктивной болезнью легких

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РЕЗЮМЕ

Актуальность. Исследование доступности лекарственных препаратов (ЛП) для пациентов с хронической обструктивной болезнью легких (ХОБЛ) представляет собой одну из приоритетных задач в организации эффективного противодействия ХОБЛ в Российской Федерации.

Цель: оценка ценовой, экономической и физической доступности ЛП для больных ХОБЛ.

Материал и методы. Анализ доступности ЛП для пациентов с ХОБЛ проводили по методике Всемирной организации здравоохранения и Международной неправительственной организации «Программа действий за здоровье и здравоохранение» (англ. Health Action International, HAI). Оценивали бронхолитическую и противовоспалительную терапию оригинальных и воспроизведенных ЛП. Также выполнен анализ объема потребления исследуемых ЛП с использованием фармакоэпидемиологической методологии ATC/DDD (англ. Anatomical Therapeutic Chemical classification – анатомо-терапевтическо-химическая классификация, defined daily dose – установленная суточная доза) за 3-летний период (с 2020 по 2022 гг.) с учетом их доли в общей структуре DDD (англ. drug utilization 90%, DU90%).

Результаты. Наиболее приобретаемыми ЛП для проведения бронхолитической и противовоспалительной терапии по результатам анализа DU90% за все исследуемые годы были препараты из групп короткодействующих бронхолитиков (сальбутамол, фенотерол, ипратропия бромид + фенотерол) и ингаляционных глюкокортикостероидов (будесонид, беклометазон). Полученные данные подтверждены результатами изучения физической доступности. Так, самый высокий процент физической доступности установлен для короткодействующих бета-2-агонистов (КДБА) (сальбутамол). Анализ экономической доступности ЛП также выявил тенденцию превосходства КДБА и короткодействующих антихолинергетиков над препаратами базисной бронхолитической и противовоспалительной терапии.

Заключение. Низкая экономическая доступность основных ЛП базисной терапии способствует увеличению бремени ХОБЛ и диктует необходимость совершенствования механизмов лекарственного обеспечения пациентов, особенно лиц с низким материальным доходом, что в долгосрочной перспективе позволит существенно сократить расходы системы здравоохранения на лечение таких больных за счет снижения тяжести и частоты обострений.

КЛЮЧЕВЫЕ СЛОВА

Хроническая обструктивная болезнь легких, ХОБЛ, ценовая доступность препарата, экономическая доступность препарата, физическая доступность препарата, ATC/DDD-анализ.

ИНФОРМАЦИЯ О СТАТЬЕ

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Highlights

What is already known about the subject?

- A significant proportion of patients with chronic obstructive pulmonary disease (COPD), regardless of their region of residence in Russia, needs medication provision, but does not belong to the preferential categories
- The lack of adequate benefits for many COPD patients raise the likelihood of frequent hospitalization, premature death and leads to increased economic losses for the state
- There is a known method for assessing the drug price, affordability and physical availability

What are the new findings?

- For the first time, the drug price, affordability and physical availability for COPD patients was analyzed
- An analysis of the consumption volume of bronchodilators and anti-inflammatory drugs in the pharmacy segment was carried out using the ATC/DDD pharmacoepidemiological methodology for COPD patients

How might it impact the clinical practice in the foreseeable future?

- The obtained results will help to improve the mechanisms of drug provision for COPD patients, especially those with low material income
- In the long term, it will significantly reduce the costs of healthcare system for the treatment of COPD patients by decreasing the severity and frequency of exacerbations

Основные моменты

Что уже известно об этой теме?

- Значительная часть пациентов с хронической обструктивной болезнью легких (ХОБЛ), независимо от региона проживания на территории России, нуждается в лекарственном обеспечении (ЛО), но не относится к льготным категориям
- Отсутствие должного льготного ЛО для многих больных ХОБЛ повышает вероятность частой госпитализации, преждевременной смерти и приводит к увеличению экономических потерь государства
- Известна методика оценки ценовой, экономической и физической доступности лекарственных препаратов (ЛП)

Что нового дает статья?

- Впервые проанализирована физическая, экономическая и ценовая доступность ЛП для пациентов с ХОБЛ
- Проведен анализ объема потребления бронхолитических и противовоспалительных ЛП в аптечном сегменте с использованием фармакоэпидемиологической методологии ATC/DDD у пациентов с ХОБЛ

Как это может повлиять на клиническую практику в обозримом будущем?

- Полученные результаты будут способствовать совершенствованию механизмов ЛО пациентов с ХОБЛ, особенно с низким материальным доходом
- В долгосрочной перспективе это позволит существенно сократить расходы системы здравоохранения на лечение больных ХОБЛ за счет снижения тяжести и частоты обострений

INTRODUCTION / ВВЕДЕНИЕ

Chronic obstructive pulmonary disease (COPD) is an increasingly important cause of morbidity, disability and mortality worldwide [1]. More than 80% of COPD-related deaths occur in low- and middle-income countries In these countries, where tobacco smoking, air pollution were identified as major risk factors of COPD [2]. Despite recent advances in pharmacotherapy for COPD, it remains inaccessible to many patients. Coupled with the high prevalence of the disease, it results in a high clinical and economic burden.

Ensuring the availability of medicines for patients is also an urgent problem for domestic healthcare system. Measures to improve it are one of the main directions of reforming the healthcare system in the Russian Federation (RF). For this purpose, a federal program for additional drug provision has been developed [3, 4]. However, a medical and sociological study on the provision of pulmonological care for patients with COPD in the RF, conducted by O.A. Rizakhanova et al., showed that 40.1% of patients, require medication provision, but are not classified as preferential categories of citizens [5]. The lack of adequate benefits for a significant proportion of COPD patients the frequency of hospital admissions, premature death and leads to increased economic losses for the state. A survey of COPD patients in the Astrakhan Region revealed that only 72.3% of respondents received basic therapy, and this also indicates its insufficiency [6].

So in most cases, the cost of purchasing drugs is passed on to patients, resulting in a significant financial burden for them. This burden is the most frequent among low- and middle-income individuals, and costs may increase if a patient has multiple chronic conditions [7]. According O.A. Rizakhanova et al., 41.58% of COPD patients had a monthly income below the average level, and 50.2% – within the average level [5]. High drug costs result in to non-compliance with the treatment regimen (taking smaller doses, skipping and delaying medications), the choice of drugs that provide only symptom relief in order to save money, which worsens health and leads to hospitalization [7, 8]. Ultimately, the transfer of drug expenses from the state to patients lead to high healthcare cost by increasing the use of medical services in hospitals [7]. Because access to medicines is an important component of the management of chronic noncommunicable diseases, both research and regular data collection are needed to monitor the availability and affordability of medicines. They should include all medications, and not be limited only to short-acting bronchodilators, as presented in many studies [9].

Thus, studying the availability of medications for patients with COPD seems to be one of the priority tasks in organizing effective COPD management in the RF.

Objective: to assess drug prices, affordability, and availability for COPD patients.

MATERIAL AND METHODS / МАТЕРИАЛ И МЕТОДЫ

A pharmacoepidemiological analysis of the availability of various pharmacological drug classes used to achieve the main goals of COPD therapy (symptoms control and reducing risk of exacerbations) was performed. The assessment was carried out on both original and generic medications with the minimal price. The study was one-stage. Data collection was carried out on the basis of information on the availability of study drugs in 357 pharmacies in Astrakhan.

Drug classes / Классы препаратов

In the clinical guidelines on COPD developed in 2021 by the Russian Respiratory Society [10], and in the report of the working group of the Global Initiative for Chronic Obstructive Lung Disease (GOLD) in 2023 [11], therapy was presented with different drug classes: short-acting beta-2-agonists (SABA), long-acting beta-2-agonists (LABA), short-acting muscarinic antagonists (SAMA), long-acting muscarinic antagonists (LAMA), inhaled glucocorticoids (IGC), as well as fixed combinations of LAMA + LABA, IGC + LABA, LAMA + LABA + IGC.

WHO/HAI methodology // Методика ВОЗ/HAI

An analysis of the price, affordability and physical availability of drugs for patients with COPD was carried out according to the

methods of the World Health Organization (WHO) and the international non-governmental organization Health Action International (HAI) [12].

Price availability assessment

The price availability of each drug was evaluated using the median price ratio (MPR) determined by the formula [12]:

$$MPR = P_{reg} / P_{ref},$$

where P_{reg} – regional median price; P_{ref} – international reference price.

Median prices from the 2015 International Drug Price Guide prepared by the Management Sciences for Health (MSH) organization were used as a reference price [12]. The MPR shows the correspondence or the multiple of the excess of regional prices over the reference ones. The regional price is considered equivalent to the reference price when the MPR=1. The MPI=2 means that the regional price exceeds the reference price by 2 times [13]. According to WHO recommendations, the price of a drug is considered acceptable for patients if the MPR≤1.5 and MPR≤2.5 in the public and private sectors, respectively [14].

Affordability assessment

Affordability is considered to be the possibility of purchasing drugs for the money of citizens who do not belong to preferential categories at acceptable prices [4, 15]. The affordability ratios (AR) was calculated as the number of one-day wages of the lowest paid unskilled government sector worker needed to pay for drugs in the amount of monthly requirements, prescribed at a standard dosage [12]. The minimum wage used in the analysis for the Astrakhan Region in 2023 amounted to 546 rubles per day [16]. According to the WHO/HAI methodology, a drug can be considered affordable if its monthly treatment course only costs one day's wage or less [12].

Availability assessment

The physical availability of drugs was calculated as the proportion of pharmacies, in which a drug was available at the time of data collection, out of the total number of pharmacies. Data were collected on the availability of the original drug and the corresponding generic drugs in the same dosage forms. The following ranges were used to interpret availability: very low (<30%), low (30–49%), high enough (50–80%), and high (>80%) [14].

ATC/DDD analysis // Анализ ATC/DDD

Additionally, we were interested in the demand for medications of COPD basic therapy in the region. For this purpose, an analysis of the volume of consumption of bronchodilators and anti-inflammatory drugs was carried out using the pharmacoepidemiological ATC/DDD methodology (Anatomical Therapeutic Chemical classification, defined daily dose) over a three year period (from 2020 to 2022) [17, 18].

We analyzed sales volume using data of two large pharmacy chains in Astrakhan, including a total of 53 pharmacies. Medications were categorized according to ATC classification. For each international nonproprietary name, taking into account all trade names, the number of DDDs used per 1000 inhabitants per day was calculated. The number of residents was estimated based on data from the marketing agency DSM Group on the population per pharmacy (1932 people). DDDs were calculated based on the WHO DDD, including for combination drugs (**Table 1**) [17]. The information obtained was adjusted in accordance with the instructions for use in case of discrepancy between the DDD and the daily dose of a drug.

DU90% analysis / DU90%-анализ

The methodology of drug utilization 90% (DU90%) was used to analyze the consumption of bronchodilators and anti-inflammatory drugs, considering their proportion in the total DDD structure. This analysis allowed us to identify the number of drugs making up 90% of drug prescriptions [18].

For each purchased medicationsin pharmacies, the calculated DDDs per 1000 inhabitants per day were sorted from largest to smallest, followed by determination of the proportion of each drug in the total quantity of all calculated DDDs taken as 100%. As a result, the DU90% group was identified, comprising 90% of DDDs consumed in pharmacies.

Statistical analysis / Статистический анализ

Statistical processing of obtained data was performed by MS Excel 2010 (Microsoft, USA) and the statistical analysis package StatPlus 7.0 (StatSoft Inc., USA). Qualitative indicators are presented as relative frequencies (%). Student's t-test was used to compare two independent samples. Pearson's χ^2 test was used for comparing qualitative variable. The strength of association between qualitative characteristics was calculated using Cramer's V test (interpretation of values according to Rea and Parker recommendations). Significance of differences was determined at $p<0.05$.

RESULTS / РЕЗУЛЬТАТЫ

Physical availability / Физическая доступность препаратов

The analysis demonstrated a specific picture of the physical availability of bronchodilators and anti-inflammatory drugs for patients with COPD in Astrakhan pharmacies (**Table 2**).

Table 1 (beginning). Characteristics of drugs for the treatment of chronic obstructive pulmonary disease

Таблица 1 (начало). Характеристика лекарственных препаратов для лечения хронической обструктивной болезни легких

ATC code / Код АТС	INN / МНН	TN / ТН	Drug form / Лекарственная форма	ID / ИД	DDD
R03BB01	Ipratropium bromide / Ипратропия бромид	Atrovent®, Ipratropium®-nativ / Атровент®, Ипратропиум®-натив	Solution for inhalation / Раствор для ингаляций	0.25 mg/ml // 0,25 мг/мл	0.3 mg / 0,3 мг
		Atrovent®, Ipratropium®-aeronativ / Атровент®, Ипратропиум®-аэронатив	Aerosol for inhalation dosed / Аэрозоль для ингаляций дозированный	0.2 mg / 0,2 мг	0.12 mg / 0,12 мг
R03BB04	Tiotropium bromide / Тиотропия бромид	Spiriva®, Tiotropium®-nativ / Спирива®, Тиотропиум®-натив	Capsules with powder for inhalation / Капсулы с порошком для ингаляций	18 mcg / 18 мкг	1 ID / 1 ИД
		Spiriva® Respimat / Спирива® Респимат	Solution for inhalation / Раствор для ингаляций	2.5 mcg/dose // 2,5 мкг/доза	2 ID / 2 ИД

Table 1 (continuation). Characteristics of drugs for the treatment of chronic obstructive pulmonary disease

Таблица 1 (продолжение). Характеристика лекарственных препаратов для лечения хронической обструктивной болезни легких

ATC code / Код АТС	INN / МНН	TN / ТН	Drug form / Лекарственная форма	ID / ИД	DDD
R03BB06	Glycopyrronium bromide / Гликопиррония бромид бромид	Seebri® Breezhaler / Сибри® Бризхалер	Capsules for inhalation / Капсулы для ингаляций	50 mcg / 50 мкг	1 ID / 1 ИД
R03AC02	Salbutamol / Сальбутамол	Ventolin®, Salbutamol®-Teva, Novatron® neo, Salbutamol®-MCFP, Salbutamol®-Pharmstandard / Вентолин®, Сальбутамол®-Тева, Новатрон® нео, Сальбутамол®-МХФП, Сальбутамол®-Фармстандарт	Aerosol for inhalation dosed / Аэрозоль для ингаляций дозированный	100 mcg/dose // 100 мкг/доза	0.8 mg / 0,8 мг
		Ventolin®, Salbutamol®-Teva, Novatron® / Вентолин®, Сальбутамол®-Тева, Новатрон®	Solution for inhalation / Раствор для ингаляций	1 mg/ml // 1 мг/мл	10 mg / 10 мг
R03AC04	Fenoterol / Фенотерол	Berotec® / Беротек®	Aerosol for inhalation dosed / Аэрозоль для ингаляций дозированный	100 mcg/dose // 100 мкг/доза	0.6 mg / 0,6 мг
		Berotec® / Беротек®	Solution for inhalation / Раствор для ингаляций	1 mg/ml // 1 мг/мл	4 mg /4 мг
R03AC13	Formoterol / Формотерол	Formoterol®-nativ, Foradil® / Формотерол®-натив, Форадил®	Capsules with powder for inhalation / Капсулы с порошком для ингаляций	12 mcg / 12 мкг	24 mcg / 24 мкг
		Atimos® / Атимос®	Aerosol for inhalation dosed / Аэрозоль для ингаляций дозированный	12 mcg / 12 мкг	24 mcg / 24 мкг
R03AC18	Indacaterol / Индакатерол	Onbres® Breezhaler / Онбрез® Бризхалер	Capsules for inhalation / Капсулы для ингаляций	150 mcg / 150 мкг	150 mcg / 150 мкг
R03AL01	Ipratropium bromide + fenoterol / Ипратропия бромид + фенотерол	Berodual®, Ipraterol®-nativ, Astmasol®-SOLOpharm / Беродуал®, Ипратерол®-натив, Астмасол®-СОЛОфарм	Solution for inhalation / Раствор для ингаляций	0.25 mg + 0.5 mg/ml // 0,25 мг + 0,5 мг/мл	6 ID / 6 ИД
		Berodual® N, Ipraterol®-aeronativ, Phenipra®, Astmasol® neo / Беродуал® Н, Ипратерол®-аэронатив, Фенипра®, Астмасол® нео	Aerosol for inhalation dosed / Аэрозоль для ингаляций дозированный	20 mcg + 50 mcg/dose // 20 мкг + 50 мкг/доза	6 ID / 6 ИД
R03BA01	Beclomethasone / Беклометазон	Beclospir®, Beclometasone®, Beclometasone®-aeronativ / Беклоспир®, Беклометазон®, Беклометазон®-аэронатив	Aerosol for inhalation dosed / Аэрозоль для ингаляций дозированный	200 mcg/dose // 250 мкг/доза	0.8 mg / 0,8 мг
R03BA02	Budesonide / Будесонид	Pulmicort® Turbuhaler / Пульмикорт® Турбухалер	Powder for inhalation / Порошок для ингаляций	200 mcg/dose // 200 мкг/доза	0.8 mg / 0,8 мг
R03BA02	Budesonide / Будесонид	Budenit® Steri-Neb, Pulmibud® / Буденит® Стери-Неб, Пульмибуд®	Suspension for inhalation / Суспензия для ингаляций	0.25 mg/ml // 0,25 мг/мл	1,5 мг / 1.5 mg
R03BA05	Fluticasone / Флутиказон	Flixotide® / Фликсотид®	Aerosol for inhalation dosed / Аэрозоль для ингаляций дозированный	125 mcg/dose // 125 мкг/доза	0.6 mg / 0,6 мг
R03AK07	Budesonide + formoterol / Будесонид + формотерол	Symbicort® Turbuhaler, DuoResp Spiromax®, Formisonid®-nativ / Симбикорт® Турбухалер, ДуоРесп Спиромакс®, Формисонид®-натив	Powder for inhalation dosed / Порошок для ингаляций дозированный	160 mcg + 4.5 mcg/dose // 160 мкг + 4,5 мкг/доза	4 ID / 4 ИД
		Symbicort® Rapichaler / Симбикорт® Рапихалер	Aerosol for inhalation dosed / Аэрозоль для ингаляций дозированный	160 mcg + 4.5 mcg/dose // 160 мкг + 4,5 мкг/доза	4 ID / 4 ИД
R03AK07	Budesonide + formoterol (set) / Будесонид + формотерол (набор)	Foradil® Combi, Respiforb® Combi / Форадил® Комби, Респифорб® Комби	Capsules with powder for inhalation, set / Капсулы с порошком для ингаляций, набор	400 mcg / 12 mcg // 400 мкг / 12 мкг	4 ID / 4 ИД

Table 1 (end). Characteristics of drugs for the treatment of chronic obstructive pulmonary disease

Таблица 1 (окончание). Характеристика лекарственных препаратов для лечения хронической обструктивной болезни легких

ATC code / Код АТС	INN / МНН	TN / ТН	Drug form / Лекарственная форма	ID / ИД	DDD
R03AK08	Beclometasone + formoterol / Беклометазон + формотерол	Foster® / Фостер®	Aerosol for inhalation dosed / Аэрозоль для ингаляций дозированный	100 mcg + 6 mcg/dose // 100 мкг + 6 мкг/доза	4 ID / 4 ИД
R03AK06	Salmeterol + fluticasone / Салметерол + флутиказон	Seretide® Multidisk / Серетид® Мультидиск	Powder for inhalation dosed / Порошок для ингаляций дозированный	50 mcg + 500 mcg/dose // 50 мкг + 500 мкг/доза	2 ID / 2 ИД
R03AK06	Salmeterol + fluticasone / Салметерол + флутиказон	Seretide®, Salmecort® / Серетид®, Сальмекорт®	Aerosol for inhalation dosed / Аэрозоль для ингаляций дозированный	25 mcg + 250 mcg/dose // 25 мкг + 250 мкг/доза	4 ID / 4 ИД
R03AK10	Fluticasone furoate + vilanterol / Флутиказона фуроат + вилантерол	Relvar® Ellipta / Релвар® Эллипта	Powder for inhalation / Порошок для ингаляций	22 + 92 mcg/dose // 22 + 92 мкг/доза	1 ID / 1 ИД
R03AL06	Olodaterol + tiotropium bromide / Олодатерол + тиотропия бромид	Spiolto® Respimat / Спиолто® Респимат	Solution for inhalation dosed / Раствор для ингаляций дозированный	2.5 mcg + 2.5 mcg/dose // 2,5 мкг + 2,5 мкг/доза	2 ID / 2 ИД
R03AL03	Vilanterol + umeclidinium bromide / Вилантерол + умеклидиния бромид	Anoro® Ellipta / Аноро® Эллипта	Powder for inhalation dosed / Порошок для ингаляций дозированный	22 mcg + 55 mcg/dose // 22 мкг + 55 мкг/доза	1 ID / 1 ИД
R03AL04	Glycopyrronium bromide + indacaterol / Гликопиррония бромид + индакатерол	Ultibro® Breezhaler / Ультибро® Бризхалер Бризхалер	Capsules with powder for inhalation / Капсулы с порошком для ингаляций	50 + 110 mcg / 50 + 110 мкг	1 ID / 1 ИД
R03AL08	Vilanterol + umeclidinium bromide + fluticasone furoate / Вилантерол + умеклидиния бромид + флутиказона фуроат	Trelegy® Ellipta / Треледжи® Эллипта	Powder for inhalation dosed / Порошок для ингаляций дозированный	22 mcg + 55 mcg + 92 mcg/dose // 22 мкг + 55 мкг + 92 мкг/доза	1 ID / 1 ИД

Note. *ATC – Anatomical Therapeutic Chemical classification; INN – international nonproprietary name; TN – trade name; ID – inhalation dose; DDD – defined daily dose. Atrovent®, Spiriva®, Spiriva® Respimat, Berotec®, Berodual®, Berodual® N, Spiolto® Respimat – Boehringer Ingelheim International GmbH, Germany; Ventolin®, Flixotide®, Seretid® Multidisk, Seretid®, Relvar® Ellipta, Anoro® Ellipta, Trelegy® Ellipta – GlaxoSmithKlein Trading JSC, Russia; Pulmicort® Turbuhaler, Symbicort® Turbuhaler, Symbicort® Rapihaler – AstraZeneca AB, Sweden; Seebri® Breezhaler, Foradil®, Onbrez® Breezhaler, Foradil® Combi, Ultibro® Breezhaler – Novartis Pharma AG, Switzerland; Atimos®, Foster® – Chiesi Pharmaceuticali S. p.a., Italy; Ipratropium®-nativ, Ipratropium®-aeronativ, Tiotropium®-nativ, Salbutamol®-Pharmstandard, Formoterol®-nativ, Ipraterol®-nativ, Ipraterol®-aeronativ, Beclometasone®-aeronativ, Formisonid®-nativ – Nativa LLC / Farmstandard-Leksredstva OJSC, Russia; Novatron® neo, Novatron®, Astmasol®-SOLOpharm, Astmasol® neo – Groteks LLC, Russia; Salbutamol®-Teva, DuoResp Spiromax® – Teva Pharmaceutical Enterprises Ltd., Israel; Pulmibud® – Akrikhin JSC HFC, Russia; Respiforb® Combi – PSK Farma LLC, Russia; Salmecort® – Glenmark Pharmaceuticals Limited, India; Fenipra®, Beclospir® – Farmatsevticheskaya fabrika Sankt-Peterburga JSC, Russia; Budenit® Steri-Neb – Norton Healthcare Limited-IVAX Pharmaceuticals UK, United Kingdom; Salbutamol®-MHFP, Beclometasone® – Moskhimpharmpreparaty im. N.A. Semashko OJSC, Russia.*

Примечание. *АТС (англ. Anatomical Therapeutic Chemical classification) – анатомо-терапевтическо-химическая классификация; МНН – международное непатентованное наименование; ТН – торговое наименование; ИД – ингаляционная доза; DDD (англ. defined daily dose) – установленная суточная доза. Атровент®, Спирива®, Спирива® Респимат, Беротек®, Бередуал®, Бередуал® Н, Спиолто® Респимат – Берингер Ингельхайм Интернешнл ГмбХ, Германия; Вентолин®, Фликсотид®, Серетид® Мультидиск, Серетид®, Релвар® Эллипта, Аноро® Эллипта, Треледжи® Эллипта – АО «ГлаксоСмитКляйн Трейдинг», Россия; Пульмикорт® Турбухалер, Симбикорт® Турбухалер, Симбикорт® Рапихалер – АстраЗенека АБ, Швеция; Сибри® Бризхалер, Форадил®, Онбрез® Бризхалер, Форадил® Комби, Ультибро® Бризхалер – Новартис Фарма АГ, Швейцария; Атимос®, Фостер® – Кьези Фармацевтичи С.п.А., Италия; Ипратропиум®-натив, Ипратропиум®-аэронатив, Тиотропиум®-натив, Сальбутамол®-Фармстандарт, Формотерол®-натив, Ипратерол®-натив, Ипратерол®-аэронатив, Беклометазон®-аэронатив, Формисонид®-натив – ООО Натива / ОАО Фармстандарт-Лекредства, Россия; Новатрон® нео, Новатрон®, Астмасол®-СОЛОфарм, Астмасол® нео – ООО «Гротекс», Россия; Сальбутамол®-Тева, ДуоРесп Спиромакс® – Тева Фармацевтические Предприятия Лтд., Израиль; Пульмибуд® – АО «Акрихин» ХФК, Россия; Респифорб® Комби – ООО «ПСК Фарма», Россия; Сальмекорт®- Гленмарк Фармасьютикалз Лимитед, Индия; Фенипра®, Беклоспир® – ОАО «Фармацевтическая фабрика Санкт-Петербурга», Россия; Буденит® Стери-Неб – Нортон Хэлскэа Лимитед-АйВЭКС Фармасьютикалс ЮКей, Великобритания; Сальбутамол®-МХФП, Беклометазон® – ОАО «Мосхимфармпрепараты им.Н.А.Семашко», Россия.*

The group of drugs with high availability (>80%) was represented by the generic form of salbutamol (96.4%) in a metered-dose aerosol inhaler (MDAI), while the original drug was available only in 9.8% of cases. The group of drugs with fairly high availability (50–80%) included budesonide (74.8%), "ipratropium bromide + fenoterol" combination (63.6%), fenoterol (51%), presented in the original form. The group of drugs with low availability (30–49%) included drugs from the IGC group. Thus, beclomethasone in the original MDAI form was in demand only in 40.6% of cases, and in 18.8% of cases in the generics form. The "budesonide + formaterol" fixed combination under the trade name Symbicort® Turbuhaller (AstraZeneca, Sweden) had an availability of 32.8%.

It should be noted that the majority of basic therapy drugs were in the group of very low availability (<30%). All representatives of this group were original drugs, except for the "fluticasone + salmeterol" combination, which are generic drugs in MDAI form and a metered-dose powder inhaler (MDPI) form with low availability of 0.3%. The "beclomethasone + formoterol", "fluticasone + formoterol" combinations and tiotropium bromide had the greatest availability in this group (19.6%, 14%, 17%, respectively), and more often were used in regional healthcare practice. Among fixed combinations of bronchodilators, the availability of "tiotropium bromide + olodaterol" combination predominated (12%). The remaining medications in this group had a very low level of physical accessibility. Notably, there was a statistically significant predominance of physical accessibility of original drugs, except salbutamol (p<0.005).

Economic affordability / Экономическая доступность препаратов

Analysis of the economic affordability of drugs revealed higher rates (AR≤1) for SABA and SAMA compared to drugs of basic bronchodilator and anti-inflammatory therapy (**Table 3**).

Table 2 (beginning). Physical availability of drugs for the treatment of chronic obstructive pulmonary disease

Таблица 2 (начало). Физическая доступность лекарственных препаратов для лечения хронической обструктивной болезни легких

МНН / INN	Form (dosage) / Форма выпуска (дозировка)	Physical availability, % / Физическая доступность, %		p**
		Original / Оригинальные	Generic* / Воспроизведенные*	
High (>80%) / Высокая (>80%)				
Salbutamol / Сальбутамол	Aerosol for inhalation dosed (100 mcg/dose, 200 doses) // Аэрозоль для ингаляций дозированный (100 мкг/доза, 200 доз)	9,8	96,4	<0,001
	Solution for inhalation (1mg/ml, 2.5 ml, N10) // Раствор для ингаляций (1мг/мл, 2,5 мл, № 10)	–	8,4	–
High enough (50-80%) / Достаточно высокая (50-80%)				
Budesonide / Будесонид	Suspension for inhalation dosed (0.5 mg/ml, 2 ml, N20) // Суспензия для ингаляций дозированная (0,5 мг/мл, 2 мл, № 20)	74,8	28	<0,001
	Powder for inhalation dosed (0.2 mg/dose, 100 doses) // Порошок для ингаляций дозированный (0,2 мг/доза, 100 доз)	4,8	–	–
Ipratropium bromide + fenoterol / Ипратропия бромид + фенотерол	Solution for inhalation (0.25 mg + 0.5 mg/ml, 20 ml) // Раствор для ингаляций (0,25 мг + 0,5 мг/мл, 20 мл)	63,6	47,6	0,002
	Aerosol for inhalation dosed (20 mcg + 50 mcg/dose, 200 doses 10 ml) // Аэрозоль для ингаляций дозированный (20 мкг + 50 мкг/доза, 200 доз 10 мл)	55,2	46,2	0,021
Fenoterol / Фенотерол	Aerosol for inhalation dosed (100 mcg/dose, 200 doses 10 ml) // Аэрозоль для ингаляций дозированный (100 мкг/доза, 200 доз 10 мл)	51,0	–	–
	Solution for inhalation (1mg/ml, 20 ml vial) // Раствор для ингаляций (1мг/мл, флакон 20 мл)	–	7,0	–
Low (30–49%) / Низкая (30–49%)				
Beclomethasone / Беклометазон	Aerosol for inhalation dosed (250 mcg/dose, 200 doses) // Аэрозоль для ингаляций дозированный (250 мкг/доза, 200 доз)	40,6	18,8	<0,001
Budesonide + formoterol / Будесонид + формотерол	Powder for inhalation dosed + inhaler (160 mcg + 4.5 mcg/dose, 120 doses) // Порошок для ингаляций дозированный + ингалятор (160 мкг + 4,5 мкг/доза, 120 доз)	32,8	10,9	<0,001
	Capsules with powder for inhalation, set (400 mcg + 12 mcg, 120 doses) // Капсулы с порошком для ингаляций, набор (400 мкг + 12 мкг, 120 доз)	–	11,2	–
	Aerosol for inhalation dosed (160 mcg + 4.5 mcg/dose, 120 doses) // Аэрозоль для ингаляций дозированный (160 мкг + 4,5 мкг/доза, 120 доз)	6,7	–	–

Table 2 (end). Physical availability of drugs for the treatment of chronic obstructive pulmonary disease

Таблица 2 (окончание). Физическая доступность лекарственных препаратов для лечения хронической обструктивной болезни легких

МНН / INN	Form (dosage) / Форма выпуска (дозировка)	Physical availability, % / Физическая доступность, %		p**
		Original / Оригинальные	Generic* / Воспроизведенные*	
Very low (<30%) / Очень низкая (<30%)				
Beclomethasone + formoterol / Беклометазон + формотерол	Aerosol for inhalation dosed (100 mcg + 6 mcg, 120 doses) // Аэрозоль для ингаляций дозированный (100 мкг + 6 мкг, 120 доз)	19,6	–	–
Ipratropium bromide / Ипратропия бромид	Solution for inhalation (0.25 mg/ml, 20 ml) // Раствор для ингаляций (0,25 мг/мл, 20 мл)	16,0	–	–
	Aerosol for inhalation dosed (20 mcg/dose, 200 doses 10 ml) // Аэрозоль для ингаляций дозированный (20 мкг/доза, 200 доз 10 мл)	9,0	–	–
Fluticasone + salmeterol / Флутиказон + сальметерол	Aerosol for inhalation dosed (25 mcg + 250 mcg/dose, 120 doses) // Аэрозоль для ингаляций дозированный (25 мкг + 250 мкг/доза, 120 доз)	14,3	0,3	<0,001
	Powder for inhalation dosed (50 mcg + 250 mcg, 60 doses) // Порошок для ингаляций дозированный (50 мкг + 250 мкг, 60 доз)	4,2	0,3	<0,001
Tiotropium bromide / Тиотропия бромид	Solution for inhalation, cartridge (2.5 mcg/dose, 60 doses 4 ml) // Раствор для ингаляций, картридж (2,5 мкг/доза, 60 доз 4 мл)	17,0	–	–
Tiotropium bromide + olodaterol / Тиотропия бромид + олодатерол	Solution for inhalation dosed (2.5 mcg + 2.5 mcg/dose, 4 ml) // Раствор для ингаляций дозированный (2,5 мкг + 2,5 мкг/доза, 4 мл)	12,0	–	–
Umeclidinium bromide + vilanterol / Умеклидиния бромид + вилантерол	Powder for inhalation (22 + 55 mcg/dose, 30 pcs.) // Порошок для ингаляций (22 + 55 мкг/доза, 30 шт.)	0,8	–	–
Glycopyrronium bromide + indacaterol / Гликопиррония бромид + индакатерол	Capsules for inhalation with breezhaler device (50 mcg + 110 mcg, N30) // Капсулы для ингаляций с устройством бризхалер (50 мкг + 110 мкг, № 30)	3,1	–	–
Fluticasone furoate + vilanterol + umeclidinium bromide / Флутиказона фуроат + вилантерол + умеклидиния бромид	Powder for inhalation dosed (22 mcg + 55 mcg + 92 mcg/dose, 30 doses) // Порошок для ингаляций дозированный (22 мкг + 55 мкг + 92 мкг/доза, 30 доз)	3,1	–	–
Fluticasone furoate + vilanterol / Флутиказона фуроат + вилантерол	Powder for inhalation dosed (22 mcg + 92 mcg/dose, 30 doses) // Порошок для ингаляций дозированный (22 мкг + 92 мкг/доза, 30 доз)	1,7	–	–
Fluticasone / Флутиказон	Aerosol for inhalation dosed (250 mcg/dose, 60 doses) // Аэрозоль для ингаляций дозированный (250 мкг/доза, 60 доз)	0,8	–	–
Aclidinium bromide + formoterol / Аклидиния бромид + формотерол	Powder for inhalation dosed (340 mcg + 11.8 mcg/dose, 60 doses) // Порошок для ингаляций дозированный (340 мкг + 11,8 мкг/доза, 60 доз)	0,3	–	–

Note. *INN – international nonproprietary name. * With a minimum price. ** The significant differences (p<0.05).*

Примечание. *МНН – международное непатентованное наименование. * С минимальной ценой. ** Различия статистически значимы (p<0,05).*

Thus, the lowest AR was recorded for salbutamol and amounted to 0.25 for Ventolin® (GlaxoSmithKlein Trading JSC, Russia), and for generic form for MDAI and solution for inhalation – 0.26 and 0.21, respectively. For the rest of short-acting bronchodilators, the AR was also less than 1. Similar indicators of economic affordability were found for IGC. In the case of pulmicort, AR was 0.84 for MDPI. For beclomethasone, it did not exceed one-day wages, both for the original drug (0.84) and for generics (0.88). The cost of IGC + LABA fixed combinations significantly exceeded one-day wages of the lowest paid unskilled government sector worker in Astrakhan.

However, the extremely low availability of drugs used for basic COPD therapy is cause for concern. Thus, tiotropium bromide (Spiriva® Respimat – Boehringer Ingelheim Pharma GmbH and Co.KG, Germany) and "tiatropium bromide + olodaterol" combination (Spiolto® Respimat – Boehringer Ingelheim Pharma GmbH and Co.KG, Germany) had AR of 3.58 and 5.31, respectively. LAMA + LABA combinations represented by "umeclidinium bromide + vilanterol", "glycoperonium bromide + indacaterol", "fluticasone furoate + vilanterol", and "aclidinium bromide + formaterol", had AR ranging from 4.28 to 5.37. The "fluticasone furoate + vilanterol + umeclidinium bromide" fixed combination, used as a triple form of basic therapy in the most severe COPD patients, had the highest AR of 8.53.

We did not find a statistically significant difference between AR of original and generic drugs (p=0.026), except for "fluticasone + salmeterol" combination.

The correlation analysis of the relationship between the physical and economic availability of drugs for basic COPD treatment revealed a relatively strong correlation (V=0.446; p<0.05).

Price availability / Ценовая доступность препаратов

The MPR was determined only for four drugs that have an international reference price. For all drugs, regional prices were found to exceed reference prices, but not more than 2.5 times, with the exception of "fluticasone + salmeterol" combination in the original form (**Table 4**).

DU90% analysis / DU90%-анализ

The most purchased drugs for bronchodilator and anti-inflammatory therapy according to the results of DU90% analysis for all studied years were drugs from the group of short-acting bronchodilators (salbutamol, fenoterol, "ipratropium bromide + fenoterol") and IGC (budesonide, becomethasone (in 2020)) (**Fig. 1**).

The highest level of consumption (55%, 58% and 56% in 2020, 2021 and 2022, respectively) was found for salbutamol. The DU10%

Table 3 (beginning). Economic affordability of drugs for the treatment of chronic obstructive pulmonary disease

Таблица 3 (начало). Экономическая доступность лекарственных препаратов для лечения хронической обструктивной болезни легких

МНН / INN	Form (dosage) / Форма выпуска (дозировка)	CEA / КЭД	
		Original / Оригинальные	Generic* / Воспроизведенные*
Salbutamol / Сальбутамол	Aerosol for inhalation dosed (100 mcg, 200 doses) / Аэрозоль для ингаляций дозированный (100 мкг, 200 доз)	0,25	0,26
	Solution for inhalation (1 mg/ml, 2.5 ml, N10) // Раствор для ингаляций (1 мг/мл, 2,5 мл, № 10)	–	0,21
Budesonide / Будесонид	Suspension for inhalation dosed (0.5 mg/ml, 2 ml, N20) // Суспензия для ингаляций дозированная (0,5 мг/мл, 2 мл, № 20)	1,89	1,59
	Powder for inhalation dosed (0.2 mg/dose, 100 doses) // Порошок для ингаляций дозированный (0,2 мг/доза, 100 доз)	0,84	–
Ipratropium bromide + fenoterol / Ипратропия бромид + фенотерол	Раствор для ингаляций (0,25 мг + 0,5 мг/мл, 20 мл) // Solution for inhalation (0.25 mg + 0.5 mg/ml, 20 ml)	0,94	0,82
	Aerosol for inhalation dosed (20 mcg + 50 mcg/dose, 200 doses 10 ml) // Аэрозоль для ингаляций дозированный (20 мкг + 50 мкг/доза, 200 доз 10 мл)	0,54	0,42
Fenoterol / Фенотерол	Aerosol for inhalation dosed (100 mcg/dose, 200 doses 10 ml) // Аэрозоль для ингаляций дозированный (100 мкг/доза, 200 доз 10 мл)	1,04	–
	Solution for inhalation (1 mg/ml, vial 20 ml) // Раствор для ингаляций (1 мг/мл, флакон 20 мл)	–	0,57
Beclomethasone / Беклометазон	Aerosol for inhalation dosed (250 mcg/dose, 200 doses) // Аэрозоль для ингаляций дозированный (250 мкг/доза, 200 доз)	0,84	0,88
Budesonide + formoterol / Будесонид + формотерол	Powder for inhalation dosed + inhaler (160 mcg + 4.5 mcg/dose, 120 doses) // Порошок для ингаляций дозированный + ингалятор (160 мкг + 4,5 мкг/доза, 120 доз)	3,75	3,36
	Capsules with powder for inhalation (400 mcg + 12 mcg, 120 doses) // Капсулы с порошком для ингаляций набор (400 мкг + 12 мкг, 120 доз)	–	2,48
	Aerosol for inhalation dosed (160 mcg + 4.5 mcg/dose, 120 doses) // Аэрозоль для ингаляций дозированный (160 мкг + 4,5 мкг/доза, 120 доз)	5,10	–

Table 3 (end). Economic affordability of drugs for the treatment of chronic obstructive pulmonary disease

Таблица 3 (окончание). Экономическая доступность лекарственных препаратов для лечения хронической обструктивной болезни легких

МНН / INN	Form (dosage) / Форма выпуска (дозировка)	CEA / КЭД	
		Original / Оригинальные	Generic* / Воспроизведенные*
Beclomethasone + formoterol / Беклометазон + формотерол	Aerosol for inhalation dosed (100 + 6 mcg, 120 doses) / Аэрозоль для ингаляций дозированный (100 + 6 мкг, 120 доз)	4,04	–
Ipratropium bromide / Ипратропия бромид	Solution for inhalation (0.25 mg/ml, 20 ml) // Раствор для ингаляций (0,25 мг/мл, 20 мл)	0,44	–
	Aerosol for inhalation dosed (20 mcg/dose, 200 doses 10 ml) // Аэрозоль для ингаляций дозированный (20 мкг/доза, 200 доз 10 мл)	0,55	–
Fluticasone + salmeterol / Флутиказон + сальметерол	Aerosol for inhalation dosed (25 mcg + 250 mcg/dose, 120 doses, N1) // Аэрозоль для ингаляций дозированный (25 мкг + 250 мкг/доза, 120 доз, № 1)	3,94	2,39
	Powder for inhalation dosed (50 + 250 mcg, 60 doses) / Порошок для ингаляций дозированный (50 + 250 мкг, 60 доз)	5,51	2,98
Tiotropium bromide / Тиотропия бромид	Solution for inhalation, cartridge (2.5 mcg/dose, 60 doses 4 ml) // Раствор для ингаляций, картридж (2,5 мкг/доза, 60 доз 4 мл)	3,81	–
Tiotropium bromide + olodaterol / Тиотропия бромид + олодатерол	Solution for inhalation dosed (2.5 mcg + 2.5 mcg/dose, 4 ml) // Раствор для ингаляций дозированный (2,5 мкг + 2,5 мкг/доза, 4 мл)	5,31	–
Umeclidinium bromide + vilanterol / Умеклидиния бромид + вилантерол	Powder for inhalation (22 + 55 mcg/dose, 30 doses) // Порошок для ингаляций (22 + 55 мкг/доза, 30 доз)	4,28	–
Glycopyrronium bromide + indacaterol / Гликопиррония бромид + индакатерол	Capsules for inhalation with breezhaler device (50 + 110 mcg, N30) / Капсулы для ингаляций с устройством бризхалер (50 + 110 мкг, № 30)	5,37	–
Fluticasone furoate + vilanterol + umeclidinium bromide / Флутиказона фуроат + вилантерол + умеклидиния бромид	Powder for inhalation dosed (22 + 55 + 92 mcg/dose, 30 doses) // Порошок для ингаляций дозированный (22 + 55 + 92 мкг/доза, 30 доз)	8,53	–
Fluticasone furoate + vilanterol / Флутиказона фуроат + вилантерол	Powder for inhalation dosed (22 + 184 mcg/dose, 30 doses) // Порошок для ингаляций дозированный (22 + 184 мкг/доза, 30 доз)	4,41	–
Aclidinium bromide + formoterol / Аклидиния бромид + формотерол	Powder for inhalation dosed (340 + 11.8 mcg/dose, 60 doses) // Порошок для ингаляций дозированный (340 + 11,8 мкг/доза, 60 доз)	5,07	–
Fluticasone / Флутиказон	Aerosol for inhalation dosed (250 mcg/dose, 60 doses) // Аэрозоль для ингаляций дозированный (250 мкг/доза, 60 доз)	3,63	–

Note. *INN – international nonproprietary name; CEA – coefficient of economic availability. * With a minimum price.*

Примечание. *МНН — международное непатентованное наименование; КЭД – коэффициент экономической доступности. * С минимальной ценой.*

segment included beclomethasone (2021, 2022), ipratropium bromide, tiotropium bromide, formoterol, fluticasone, indacaterol as well as "budesonide + formoterol", "beclomethasone + formoterol", "tiotropium bromide + olodaterol", "fluticasone + salmeterol", "fluticasone furoate + vilanterol", "beclomethasone + salbutamol", "fluticasone furoate + vilanterol + umeclidinium bromide" combinations.

DISCUSSION / ОБСУЖДЕНИЕ

An analysis of bronchodilators and anti-inflammatory drug sales volume over 3 years revealed a significant predominance of short-acting bronchodilators from the SABA group and their combination with SAMA, as well as IGC. These drugs are not specific for COPD

patients and can be used to treat various bronchopulmonary pathologies.

Drugs for basic COPD therapy had low sales volumes and entered the DU10% segment. Combinations of LABA with IGC prevailed, of which the leading position was occupied by "budesonide + formoterol" combination. A lower frequency of consumption was observed for "beclomethasone + formoterol", "fluticasone + salmeterol", "fluticasone furoate + vilanterol" combinations. Fixed combinations of LABA + LAMA, which are preferred according to current clinical guidelines, had low demand among buyers. Among them, the most frequently purchased combination was "tiotropium bromide + olodaterol" (Spiolto® Respimat). Tiotropium bromide was used with similar frequency without combination with LABA. The "glycopyrronium bromide + indacaterol" and "umeclidinium bromide + vilanterol" combinations as well as "fluticasone furoate + vilanterol + umeclidinium bromide" triple combination had low demand and were purchased in isolated cases.

The results obtained were confirmed by the results of studying physical availability. The highest percentage of physical availability was also shown for SABA (salbutamol). Quite high (50–80%) availability was observed for another representative of the SABA group (fenoterol), SABA+ SAMA combination ("ipratropium bromide + fenoterol"), and IGC (budesonide). The drugs for basic COPD therapy had a low percentage of physical availability.

In the RF, studies of drug availability using the WHO/HAI methodology have been conducted since 2011. The availability of drugs for the treatment of cardiovascular pathology and palliative patients was studied [4, 13, 15, 19, 20]. We did not find similar works on the availability of drugs for the treatment of respiratory diseases in the RF. The results of our study coincided with data obtained in other countries. Thus, in Vietnam, the highest physical availability was also observed for salbutamol: in 77.1% of pharmacies the drug was available to customers in its original form, and in 17.9% – in a generics form [14]. But it should be noted that in our study, the availability of salbutamol in a generic form predominated.

In a systematic review including 29 studies with data from 60 low- and middle-income countries, an availability rate of 80% for SABA was observed in 6 of 58 countries. For IGC, a similar indicator was

Table 4. Price availability of drugs for the treatment of chronic obstructive pulmonary disease

Таблица 4. Ценовая доступность лекарственных препаратов для лечения хронической обструктивной болезни легких

МНН / INN	Form (dosage) / Форма выпуска (дозировка)	MPR / КМЦ	
		Original / Оригинальные	Generic* / Воспроизведенные*
Salbutamol / Сальбутамол	Aerosol for inhalation dosed (100 mcg/dose, 200 doses) // Аэрозоль для ингаляций дозированный (100 мкг/доза, 200 доз)	1,29	1,35
Beclomethasone / Беклометазон	Aerosol for inhalation dosed (250 mcg/dose, 200 doses) // Аэрозоль для ингаляций дозированный (250 мкг/доза, 200 доз)	1,70	1,66
Budesonide / Будесонид	Powder for inhalation dosed (0.2 mg/dose, 100 doses) // Порошок для ингаляций дозированный (0,2 мг/доза, 100 доз)	2,22	–
Fluticasone + salmeterol / Флутиказон + сальметерол	Aerosol for inhalation dosed (25 + 250 mcg/dose, 120 doses) // Аэрозоль для ингаляций дозированный (25 + 250 мкг/доза, 120 доз)	4,18	2,53

Note. *INN – international nonproprietary name; MPR – median price ratio. * With a minimum price.*

Примечание. *МНН – международное непатентованное наименование; КМЦ – коэффициент медианной цены. * С минимальной ценой.*

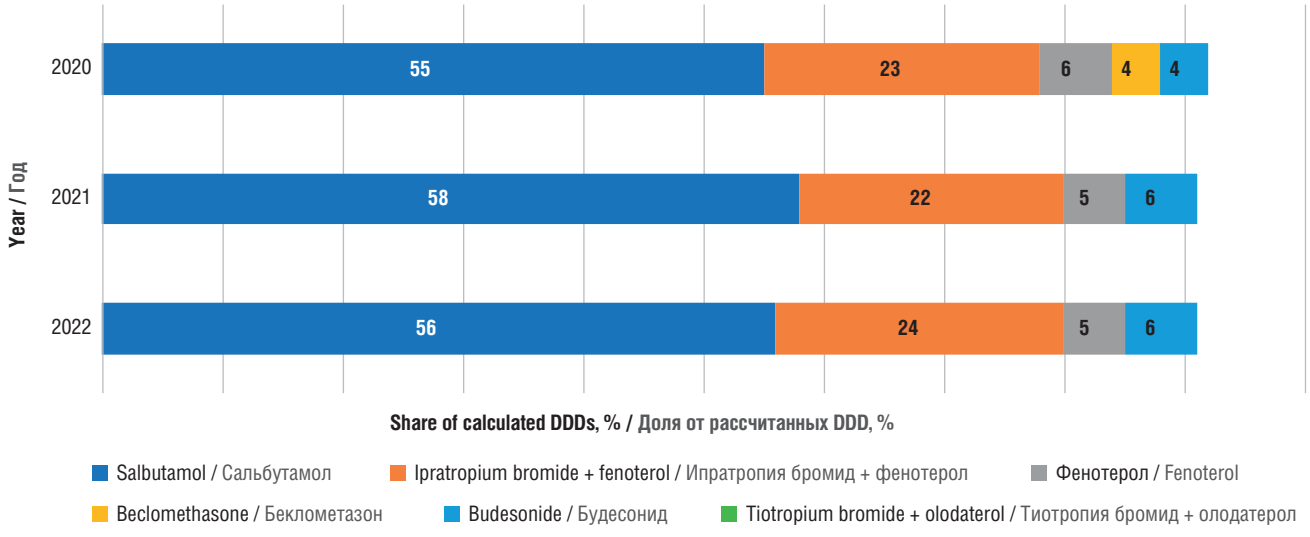

Figure 1. The results of DU90% analysis of the consumption structure of drugs for the treatment of chronic obstructive pulmonary disease in 2020–2022.
DDD – defined daily dose

Рисунок 1. Результаты DU90%-анализа структуры потребления лекарственных препаратов для лечения хронической обструктивной болезни легких в 2020–2022 гг.
DDD (англ. defined daily dose) – установленная суточная доза

observed in three of 48 countries [21]. Despite the fact that regional prices were found to exceed international reference prices (MRP>1), according to WHO methodology, prices were considered acceptable for patients, except of the original drug "fluticasone + salmeterol". According to the results of a study conducted in Vietnam, the salbutamol MRP also exceeded 1, but was less than the permissible limit of 2.5 and was 2.26 and 1.76 for the original and generic drugs, respectively [14].

When studying economic accessibility, it turned out that the only drugs available (AR≤1) were SABA and IGC. Drugs for basic therapy had AR higher than 1. The highest AR was observed in the triple fixed combination. According to a systematic review, the cost of SABA inhalers was usually about 1–4 days' wage, IGC – 2–7 days, and IGC + LABA – at least 6 days. Availability of LAMA ranged from 4 days' wages in Jordan, a third of monthly income in Brazil, up to 75 days in Nigeria and 95 days in Gambia [21].

Our study did not reveal a statistically significant difference between AR of original and generics drugs. Perhaps this explains the predominance of physical availability of original drugs. In contrast, in a study to set WHO targets for the availability and affordability of essential drugs for the treatment of noncommunicable diseases in countries with different income levels, original brands were less accessible than the cheapest generics in both sectors in all three groups of countries [22]. The low percentage of physical availability of drugs for basic COPD treatment can be explained by their high AR, which was confirmed by the identification of a relatively strong correlation between physical and economic availability (V=0.446; p<0.05).

The inability to purchase drugs in accordance with current clinical guidelines leads to progression of the disease, frequent hospitalizations, and disability, which ultimately causes an increase in the economic costs. K.E.H. Florman et al. showed that only 6% of patients with COPD received recommended treatment based on disease severity. Such results were explained by the availability of SABA alone in all countries studied [23].

Various studies demonstrated that COPD was associated with a significant economic burden in terms of both direct costs to healthcare systems and indirect costs to society [24]. For example, an observational cohort study conducted in the United States showed that patients who received delayed maintenance therapy were 68% more likely to have a subsequent exacerbation requiring hospitalization and 80% more likely to have an exacerbation requiring an emergency room visit compared with patients receiving maintenance therapy [25].

CONCLUSION / ЗАКЛЮЧЕНИЕ

Analysis of bronchodilators and anti-inflammatory drugs consumption over 3 years showed a greater demand for short-acting bronchodilators from the SABA group and their combination with SAMA, as well as IGC, compared to drugs for the basic COPD therapy. For these drugs, a low percentage of physical accessibility was also determined due to high AR, which confirms the identified inverse, relatively strong correlation between physical and economic accessibility.

Low economic accessibility of basic drugs contributes to an increase in the burden of COPD. This fact dictates the need to improve the mechanisms of drug provision for patients, especially those with low material income, which in the long term will significantly reduce the costs of the healthcare system for the treatment of such diseases by reducing the severity and frequency of exacerbations.

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