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Pharmacoepidemiological analysis of routine management of heart failure patients in the Russian Federation. Part II

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Aim. To assess the healthcare system costs for the management of patients with heart failure (HF) based on a retrospective analysis of primary medical documentation.

Material and methods. We performed the analysis of outpatient records of 1000 patients, followed up for 1 year by a general practitioner or cardiologist in ambulatory clinic in 7 Russian regions. The assessment of the HF socioeconomic burden was carried out from the perspective of the state. A bottom-up approach was applied to the cost analysis. To calculate the average costs per patient per year, the costs for each patient were calculated, followed by estimation for the entire cohort. Direct costs (medical: outpatient care, inpatient care, drug therapy; nonmedical: disability pensions and temporary disability) and indirect costs (loss of gross domestic product) were estimated.

Results. It was shown that the average cost of managing 1 HF patient is RUB 160338 per year. The cost of drug therapy varied significantly depending on the source of funding. So, the total therapy cost was about RUB 90000 per year, while within the drug assistance programs — about RUB 7000 per year. Thus, the proportion of drug therapy in cost pattern per patient from the state's perspective was only 4,7%, while the maximum costs were for inpatient care (45,5%), stay in intensive care units (16,4%) and disability payments (21,6%). The direct costs for HF therapy, with the exception of drug therapy (examination, inpatient and outpatient treatment), averages RUB 108291 per year. The total direct nonmedical and indirect costs per HF patient per year were about RUB 44519 per year. It should be noted that the rehabilitation costs were not included in the calculation.

Conclusion. Taking into account the significant burden of HF on the Russian healthcare system, the growing costs of healthcare and the increase in life expectancy, prevention and treatment of HF should be improved. The development of a HF centers' network, creating a seamless system of HF care, as well as improving the availability of medication therapy and the inpatient management of patients can improve the healthcare quality for HF patients in Russia.

Keywords: pharmacoepidemiology, heart failure, left ventricular ejection fraction, functional class, disease burden, cost of illness.

Relationships and Activities: none.

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Heart failure (HF) is associated with huge health care costs. Data from a number of countries show that HF is the primary diagnosis in approximately 1 million hospitalizations per year and accounts for 1 to 2% of all hospitalizations [1]. As the elderly population grows, so does the number of HF hospitalizations, which leads to an increase in healthcare costs. Studies of the cost of managing HF patients in several countries with different income levels, such as the United States [2], Portugal [3], Denmark [4], China [5] and others, show that HF accounts for less than <2% of total health care costs [6]. Analysis of the cost of illness (COI) is one of clinical and economic analysis methods, which is used to assess and plan costs, as well as to determine tariffs for healthcare system and medical insurance [7].

Therefore, the aim of our study was to assess the healthcare system costs for managing HF patients based on a retrospective analysis of the primary medical records of patients, followed up for by a general practitioner or cardiologist in ambulatory clinic.

In the first part of the work [8], the results of the analysis of clinical and demographic characteristics, parameters of disease control, the frequency and volume of dispensary follow-up, as well as the structure of pharmacotherapy for HF patients were presented.

This paper presents the second part of the study results, including the pharmacoeconomic features of managing patients with HF in Russia.

Material and methods

The study used data obtained from the analysis of outpatient records of 1000 patients who were followed up for 1 year by a general practitioner or cardiologist in an ambulatory clinic in 7 Russian regions. The final analysis included 888 HF patients who agreed to participate in the study and signed informed consent forms (Patient Information Sheet). In 112 patients, the quality of primary medical documentation after completing the questionnaire was insufficient to process the study results. It should be noted that the assessment of the completeness and reliability of information in outpatient records was not included in the study objectives, and all data available for analysis were included in the analysis.

Research centers: nine in 7 Russian cities (Volgograd, Yekaterinburg, Kazan, Moscow, Novosibirsk, Perm, Rostov-on-Don). For the analysis, a sample of patients from nine large health care facilities were formed (Rostov Regional Clinical Hospital, Perm Regional Hospital for War Veterans, Volgograd Regional Clinical Hospital № 3, Volgograd Regional Clinical Cardiology Center, Interregional Clinical and Diagnostic Center, Kazan, Sverdlovsk Regional Clinical Hospital № 1, City Clinical Hospital № 2, Novosibirsk, City Clinical Hospital № 1, Novosibirsk). The choice of health care facilities is due to their general direction and the lack of a narrow specialization.

The search for data on HF patients was performed among patients assigned to the above health facilities, whose outpatient records met the following criteria: the presence of a completed list of final diagnoses, men and women over 18 years old with a diagnosis of class II-IV HF in history for at least 1 year. A prerequisite was the presence of at least one hospitalization in a hospital (cardiology or therapeutic department) with a typical picture of acute decompensated heart failure (HF) within 12-month follow-up. The starting point of 12-month time period was any case of seeking medical help due to HF at the inpatient or outpatient stage in the period from January 1, 2018 to March 31, 2019. Due to the fact that the primary outpatient records

of patients take into account a limited number of parameters, for a more detailed analysis, as well as for the purpose of verifying and validating the data, a questionnaire was developed that includes data from outpatient records, as well as information about social status, the presence of disability and its reason, source of payment for pharmacotherapy and the patient's right to receive medicines (MP) under the medicine assistance program.

The clinical trial was approved by the Local Ethics Committee at the Volgograd State Medical University. All patients agreed to participate in the study and signed an informed consent. Research procedures fully comply with the current legislation of the Russian Federation, including Federal Law № 152-FZ "On Personal Data".

Information about the number of examinations, outpatient visits, hospitalizations, emergency ambulance calls and pharmacotherapy was obtained from primary medical records (outpatient records, hospital discharge records, EMIAS system). For a more detailed analysis, as well as to verify and validate the data, a questionnaire was developed that, in addition to the information included in the outpatient records, includes data on social status, disability and its cause, the source of payment for pharmacotherapy and the patient's right to receive medicines under the drug benefit program.

The assessment of the socio-economic burden of HF was carried out from the state position. A bottom-up approach was applied to the cost analysis. Costs were calculated for each patient, and then the average value for the entire cohort was estimated. The total cost of HF treatment was calculated for one year.

The total costs were calculated using the following equation:

$COI = DC(m) + DC(n) + IC,$

where COI — cost of illness (total costs); DC — direct costs, including direct medical (DCm) and direct non-medical (DCn) costs; IC — indirect costs.

The study analyzed the sources of direct medical costs and direct non-medical costs for 1 patient, as well as indirect costs (IC).

The following direct costs due to HF were identified:

- drug therapy for HF;
- concomitant therapy;
- outpatient care;
- elective inpatient treatment of HF patients;
- emergency inpatient treatment of HF patients;
- the cost of diagnosing and monitoring the condition of HF patients.

Drug therapy costs. The analysis included drugs for HF treatment, as well as concomitant therapy received by patients for the treatment of cardiovascular disease (CVD). Due to the fact that HF is a chronic disease and requires lifelong treatment, the study made the assumption that the patient takes specific therapy throughout the year. For the analysis, it was assumed that the drug was used in the same dose during the year.

Specific therapy for HF, according to clinical guidelines [9-11], included standard HF therapy, including angiotensin-converting enzyme inhibitors (ACE inhibitors)/angiotensin receptor blockers (ARBs) or angiotensin receptor antagonist/neprilysin inhibitors, beta-blockers and aldosterone antagonists (mineralocorticoid receptor antagonists), which are recommended for the treatment of all patients with symptomatic HF (class II-IV) to reduce HF hospitalizations and death. Sacubitril/valsartan is recommended instead of an ACE inhibitor/ARB in patients with symptomatic HF with reduced ejection fraction and persistent HF symptoms despite optimal therapy with an ACE inhibitor/ARB, beta-blockers, and mineralocorticoid receptor antagonists to reduce the risk of HF hospitalizations and death. At the time of the study, drugs from the group of sodium-glucose cotransporter type 2 inhibitors, including dapagliflozin were not indicated for HF, as a result of which they were not included in the calculation of drug therapy cost.

The cost of drugs from the List of Essential Medicines was determined according to the State Register of Maximum Selling Prices (the calculation was carried out on March 01, 2020). When calculating the cost of therapy, value-added tax (VAT) (10%) and an estimated 12% wholesale markup were additionally taken into account according to the data of the Federal Antimonopoly Service on the maximum wholesale markups and the maximum retail markups on prices for essential drugs established in the Russian constituent entities (as of February 10, 2020) [12]. The cost of drugs not included in the List of Essential Medicines was determined according to the unified directory of medicines (as of May 27, 2019), including 10% VAT [13]. Due to the large number of trade names of drugs and taking into account the difference in the cost of drugs from different manufacturers, we used the weighted average cost of drug therapy for two analysis options — the cost of therapy with reference drugs according to the State Register of Maximum Selling Prices and the cost of therapy with generic drugs according to international nonproprietary names (INN). At the same time, the average cost of drug therapy was calculated taking into account epidemiological data on the drug distribution, average doses and INN in actual clinical practice. The average cost of 1 drug unit was equal to the cost of 1 pack divided by the number of units in

the pack. The average cost of the annual course of treatment for 1 patient when prescribing the drug (rubles per year) was equal to the product of the calculated weighted average cost of 1 drug unit and the average prescribed daily dose (PDD), expressed in units/day, multiplied by 365 days. As a result, the average annual cost of specific and concomitant drug therapy for 1 patient with HF was estimated.

The costs for provision of outpatient care and emergency calls were calculated in accordance with Decree of the Government of the Russian Federation of December 28, 2020 № 2299 [14]. The average financial standards for 1 presentation on an outpatient basis by medical organizations, established for 2021, at the expense of compulsory medical insurance, amounted to RUB 1374,90. The total costs of providing outpatient care are calculated as the product of the established standard for financing this medical service and the number of episodes of providing this type of care per year. The cost of emergency call was RUB 2713,4.

To calculate the costs of inpatient care for HF patients, we used the cost ratios provided by the payment system for diagnostic related groups [15], and the average standard of financial costs for 1 hospitalization in a 24-hour hospital of RUB 37382,30 or in a day-stay hospital of RUB 22261,50 [14]. We used data on the actual distribution of patients between hospitalizations in 24-hour and day-stay hospitals.

In accordance with the methodological recommendations for the comparative clinical and economic evaluation of drugs, approved by the order of the Center for Expertise and Quality Control of Health Care [7], when calculating the costs, adjustment factors were used equal to 0,65 for the 24-hour hospital and 0,60 for the day-stay hospital (65% and 60% of the average financial cost standard, respectively).

In addition, due to the presence in the structure of HF patients of persons with type 1 and 2 diabetes, as well as patients older than 75 years, patient treatment difficulty factor (PTDF) was also taken into account [15]. Calculations of the total PTDF in the presence of several criteria are performed according to the following equation: total PTDF = PTDF1 + (PTDF2-1) + (PTDFn-1). At the same time, in accordance with the guidelines, the total PTDF in the presence of several criteria did not exceed 1,8, with the exception of cases of extra-long hospitalization [7].

The cost of hospitalization in the intensive care unit was calculated according to the Territorial Compulsory Medical Insurance Fund 2021 tariffs [16], depending on its duration (category 1 complexity — RUB 17047,26, category 2 complexity — RUB 97193,09, category 3 complexity — RUB 139188,75; category 4 complexity — RUB 178017,75, category 5 complexity — RUB 221825,88).

The costs of diagnosing and monitoring the condition of HF patients were estimated from two sources — Territorial Compulsory Medical Insurance Fund 2021 [16] and National Medical Research Center for Therapy and Preventive Medicine [17].

An analysis of direct non-medical costs (payment of disability benefits and wages for temporary disability) was calculated based on the number of patients who became disabled due to HF and the amount of disability pension, which in 2021 amounted to RUB 183596,64 for disability group, RUB 102302,04 for group II, and RUB 85223,64 for group III [18]. When calculating the wages for disability, the average monthly accrued wages in the country for 2020 were multiplied by the number of days of temporary disability. The average salary in 2020 in Russia was RUB 51344 per month, or RUB 1369,2 per day [19].

Analysis of indirect costs (calculation of lost gross domestic product (GDP) per capita) was carried out for 1 year. Lost GDP due to loss of earnings due to temporary disability of working-age people was calculated based on the number of disability days over the past year, multiplied by the average GDP per day, equal to RUB 1997,69 (GDP per capita in 2020 was RUB 729157,87 [20]).

Statistical analysis. Statistical processing was carried out using STATISTICA 10.0 (Stat Soft Inc.) and Microsoft Excel 2016. The hypothesis of the distribution normality of quantitative traits was assessed using the Shapiro-Wilk, Kolmogorov-Smirnov, Cramer von Mises and Anderson-Darling tests.

Continuous quantitative data were presented as the mean and its standard deviation: M (SD). With a nonnormal distribution of quantitative traits, the data are presented as the median and its interquartile range: Me (25-75 percentiles). Dichotomous and ordinal qualitative variables were presented as frequencies (n) — the number of objects with the same feature value and proportion (%).

Results

Of the 1000 patients included in the study, 888 patients were included in the analysis. In 112 patients, the quality of primary medical documentation after completing the questionnaire was insufficient to process the study results.

The total cost of diagnostic examinations per 1 patient per year amounted to RUB 1786,39 according to the tariffs of Territorial Compulsory Medical Insurance Fund and RUB 8002,50 according to the

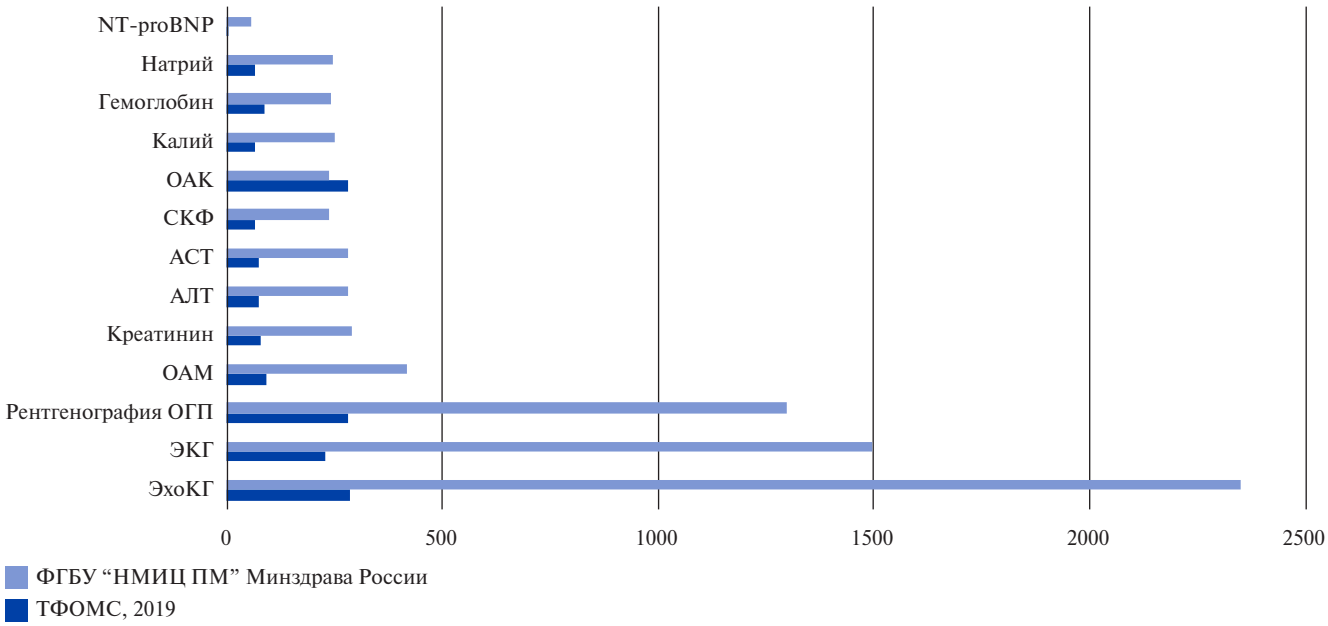

Figure 1. Cost of examinations per 1 patient per year, RUB.

Table 1

Average cost of outpatient care per patient per year

	Number of visits	Cost, SGP 2021 (CHI), RUB
Number of GP visits in the last 12 months	3 [2; 4]	4785,99
Of these, at home	0 [0; 1]	678,51
Of these, due to HF	1 [1; 2]	2314,11
Number of cardiologist visits in the last 12 months	1 [1; 2]	1976,69
Of these, at home	0 [0; 0]	3,01
Of these, due to HF	1 [1; 2]	1738,54

Abbreviations: GP — general practitioner, CHI — compulsory health insurance, SGP — state guarantee program, HF — heart failure.

Table 2

Average cost of hospitalizations per patient per year

Parameter	Value per cohort	Value per person	Cost, RUB
Total number of hospitalizations	1067	1,20	72934,71
Of these, number of hospitalizations with ICD I50	410	0,51	15505,72
Average duration of hospitalization, days	11,46±4,09	-	-
Hospitalization in 24-hour hospital, N (%)	819 (76,8%)	0,92	62059,67
Hospitalization in day-stay hospital, N (%)	241 (22,6%)	0,27	10875,04
Hospitalization in ICU, N (%)	241 (22,6%)	0,27	26271,28
Hospitalized patients, N (%)	888 (100%)	-	-
Patients with 1 hospitalization, N (%)	714 (80,4%)	-	-
Patients with 2 hospitalizations, N (%)	146 (16,8%)	-	-
Patients with ⩾3 hospitalizations, N (%)	23 (0,02%)	-	-

Abbreviations: ICD — International Classification of Diseases, ICU — intensive care unit.

tariffs of the National Medical Research Center for Therapy and Preventive Medicine, which illustrates the difference in assessing the HF burden from the standpoint of the state and a patient [21] (Figure 1).

An analysis of the periodicity of medical screening of HF patients revealed compliance with current clinical guidelines [10, 11]. The average cost of outpatient care per patient per year is presented in Table 1.

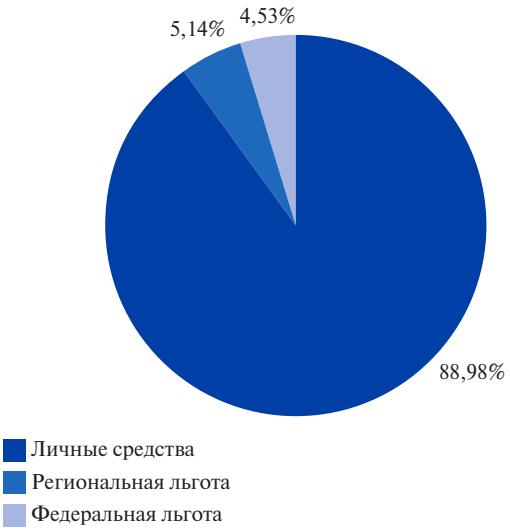

Figure 2. Sources of drug therapy.

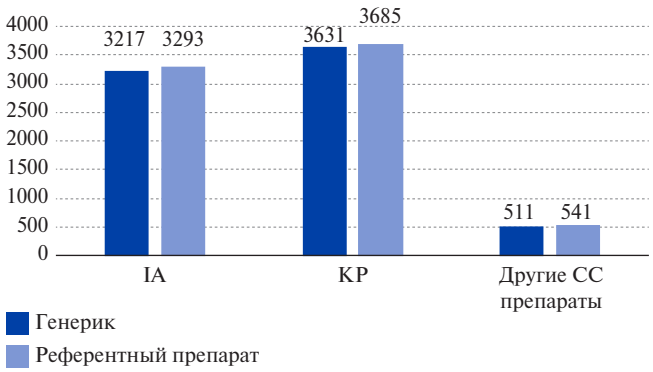

Figure 3. Cost of prescribed therapy within the medicine assistance channel, RUB.

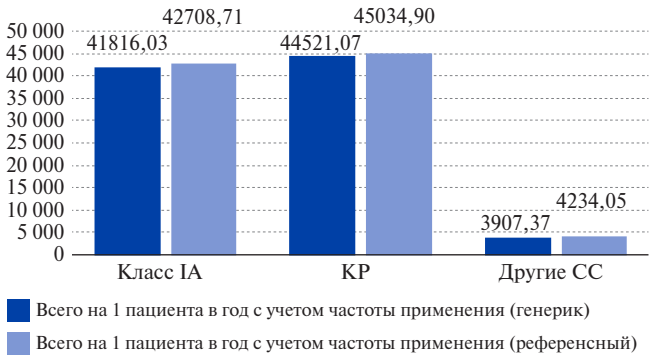

Figure 4. Cost of drug therapy for a HF patient for 1 year, RUB.

The average number of hospitalizations for any reason per patient with HF was 1,21 hospitalizations per year, of which according to ICD I50 — 0,51 hospitalizations. The average cost of hospitalizations per patient per year according is presented in Table 2.

A total of 4457 drugs were prescribed to 888 patients with HF. The structure of drug therapy and its

Table 3

Average cost of drug therapy for HF per 1 patient per year, RUB

Preparation	Median dose per day, mg	Frequency of use, %	Average cost per patient per day, RUB		Average cost per 1 patient per year depending on the frequency of use		Total for 1 patient per year depending on the frequency of use	
			Generic drug	Reference drug	Generic drug	Reference drug	Generic drug	Reference drug
Class IA according to clinical guidelines							41816,03	42708,71
Atenolol	25	0,23%	0,13	0,64	0,11	0,53		
Bisoprolol	5	51,83%	2,78	4,90	526,48	926,76		
Captopril	50	0,80%	1,08	11,37	3,14	33,17		
Carvedilol	50	4,11%	19,46	22,16	291,89	332,37		
Lisinopril	10	6,85%	5,39	9,17	134,83	229,14		
Metoprolol	100	17,69%	3,78	4,40	244,42	283,94		
Nebivolol	10	8,68%	74,42	74,42	2356,48	2356,48		
Perindopril	5	18,72%	12,26	10,66	837,65	728,51		
Ramipril	5	2,28%	22,63	22,63	188,60	188,60		
Spironolactone	25	47,49%	3,56	3,88	616,85	673,14		
Fosinopril	20	2,63%	137,04	137,04	1313,28	1313,28		
Enalapril	10	27,28%	0,75	4,17	74,54	415,01		
Eplerenone	25	18,15%	531,74	531,74	3522,78	3522,78		
Other medicines included in the clinical guidelines							44521,07	45034,90
Azilsartan+chlorthalidone	40	1,48%	1084,60	1084,60	5874,92	5874,92		
Apixaban	10	5,02%	166,50	166,50	3052,51	3052,51		

Table 3. Continuation

Preparation	Median dose per day, mg	Frequency of use, %	Average cost per patient per day, RUB		Average cost per 1 patient per year depending on the frequency of use		Total for 1 patient per year depending on the frequency of use	
			Generic drug	Reference drug	Generic drug	Reference drug	Generic drug	Reference drug
Atorvastatin	20	38,58%	11,10	13,19	1563,58	1857,03		
Acetazolamide	250	0,68%	5,94	8,23	14,85	20,59		
Valsartan	160	7,53%	422,93	422,93	11630,52	11630,52		
Valsartan+Sacubitril	200	2,28%	169,54	169,54	1412,86	1412,86		
Warfarin	5	6,96%	3,89	3,80	98,96	96,56		
Hydrochlorothiazide	25	4,57%	0,88	1,35	14,59	22,47		
Dabigatran	150	4,00%	64,51	64,51	940,80	940,80		
Dapagliflozin	10	0,23%	83,65	83,65	69,71	69,71		
Digoxin	0,125	9,70%	0,52	0,52	18,47	18,47		
Ivabradin	10	1,94%	35,81	42,38	253,62	300,21		
Isosorbide mono/dinitrate	40	3,54%	1,87	3,91	24,21	50,56		
Indapamide	1,5	2,28%	10,33	12,14	86,11	101,20		
Candesartan	8	1,60%	83,68	83,68	488,13	488,13		
Clopidogrel	75	10,62%	27,03	33,53	1047,46	1299,42		
Losartan	50	21,35%	4,47	3,08	348,03	239,96		
Pitavastatin	4	0,11%	45,79	45,79	19,08	19,08		
Rivaroxaban	20	9,02%	154,07	154,07	5071,52	5071,52		
Rosuvastatin	10	19,75%	108,49	108,49	7820,54	7820,54		
Simvastatin	20	2,17%	6,08	3,21	48,14	25,39		
Telmisartan	40	0,68%	216,48	216,48	541,20	541,20		
Torasemide	10	34,25%	32,56	32,56	4070,00	4070,00		
Furosemide	40	4,91%	0,63	0,63	11,25	11,26		
Other drugs for the treatment of CVD							3907,37	4234,05
Amiodarone	200	6,51%	0,60	6,73	14,31	159,94		
Amlodipine	5	21,69%	0,66	2,96	52,62	234,33		
Anaprilin	40	0,11%	1,58	1,58	0,66	0,66		
Acetylsalicylic acid	75	57,31%	1,22	0,91	255,50	190,89		
Verapamil	40	0,11%	1,46	2,15	0,61	0,90		
Diltiazem	90	0,11%	4,51	4,51	1,88	1,88		
Doxazosin	2	0,11%	14,97	30,85	6,24	12,86		
Potassium and magnesium aspartate	1	0,46%	7,58	2,89	12,64	4,82		
Lappaconitine hydrobromide	50	0,46%	40,20	40,20	67,00	67,00		
Lercanidipine	10	1,14%	94,36	94,36	393,16	393,16		
Moxonidine	0,2	1,83%	9,39	19,26	62,62	128,41		
Molsidomine	2	0,11%	15,45	15,45	6,44	6,44		
Nicorandil	10	0,23%	76,85	76,85	64,04	64,04		
Nifedipine	30	0,68%	5,42	3,08	13,54	7,69		
Propafenone	75	0,23%	4,12	4,80	3,43	4,00		
Sotalol	80	2,05%	2,70	3,28	20,24	24,61		
Ticagrelor	90	0,68%	87,20	87,20	218,01	218,01		
Trimetazidine	80	3,42%	203,54	203,54	2544,30	2544,30		
Omega-3-acid ethyl esters	1500	0,57%	81,67	81,67	170,14	170,14		

Abbreviation: CVD — cardiovascular diseases.

Table 4

Calculation of the average cost of managing 1 HF patient for 1 year, RUB

Parameter	Number per 1 patient	Cost, RUB	
Direct costs			
Direct medical costs, of which:			115819,12
Drug therapy (generic/reference drugs)			
— within the MAP only, of which:		7360,6/7527,2	
Class IA drugs		3216,9/3292,5	
Drugs included in the clinical guidelines of the Ministry of Health, except for class IA		3631,0/3684,6	
Other drugs for the treatment of CVD		511,0/541,1	
— including all channels for obtaining medicines, of which:		90244,5/91977,7	
Class IA drugs		41816,0/42708,7	
Drugs included in the clinical guidelines of the Ministry of Health, except for class IA		44521,1/45034,9	
Other drugs for the treatment of CVD		3907,4/4234,1	
Outpatient follow-up	3,64±2,37	5004,8	
Survey		1786,4	
Inpatient hospital (24-hour and day-stay hospital)	1,21	72934,7	
Ambulance calls	0,85	2294,8	
ICU	0,27	26271,3	
Direct nonmedical costs, of which:			38662,2
Temporary disability payments	0 [0; 0]	4014,3	
Disability payments	33%	34647,9	
Indirect costs, of which:			5857,1
Loss in GDP	0 [0; 0]	5857,1	
Total			160338,4

Abbreviations: GDP — gross domestic product, MAP — medicine assistance program, ICU — intensive care unit, CVD — cardiovascular disease.

compliance with clinical guidelines are given in the first part of the work [8].

An assessment of drug provision for patients showed that patients use their own funds to buy drugs in 3966 out of 4457 prescriptions, while the regional and federal benefit covers 229 and 202 prescriptions (Figure 2).

The calculation of drug therapy costs within the framework concessional financing channel, taking into account the average daily doses of drugs with constant intake, depending on the position in the clinical guidelines, is shown in Figure 3.

Within pharmaceutical benefits from group IA, eplerenone turned out to be the most expensive drug: the annual cost of therapy was RUB 2658,7 per patient or 80,75% of the cost of class IA drugs. Among the other drugs included in the clinical guidelines, the largest costs were for valsartan (RUB 1057,32 per patient per year or 28,70% of all costs for drugs in this group), rosuvastatin (RUB 723,29 rubles or 19,6%), rivaroxaban (RUB 641,96 or 17,4%) and torasemide (RUB 488,40 rubles or 13,3%). Among other drugs for the treatment of CVD, the main amount of funds was spent on trimetazidine therapy — RUB 339,24 per year (62,7%).

At the same time, the total cost of drug therapy received by patients for the treatment of HF and CVD is 90244,5/91977,7 per year, taking into account the cost of generic and reference drugs, respectively (Figure 4).

When analyzing the average cost of drug therapy per 1 patient per year, eplerenone turned out to be the most expensive drug, the annual cost of which was RUB 35227,78 per patient or 82% of the cost of therapy with class IA drugs. Among the other drugs included in the clinical guidelines, the largest costs were for valsartan (RUB 11630,52 per patient or 25,8% of all costs for drugs in this group), rosuvastatin (RUB 7820,54 or 17,4%) and rivaroxaban (RUB 5071,52 or 11,3%). Among the other drugs for the treatment of CVD, the funds were spent on trimetazidine therapy — RUB 2544,30 per year (60,1%).

The cost of individual components of HF drug therapy, taking into account the frequency of provision, is presented in Table 3.

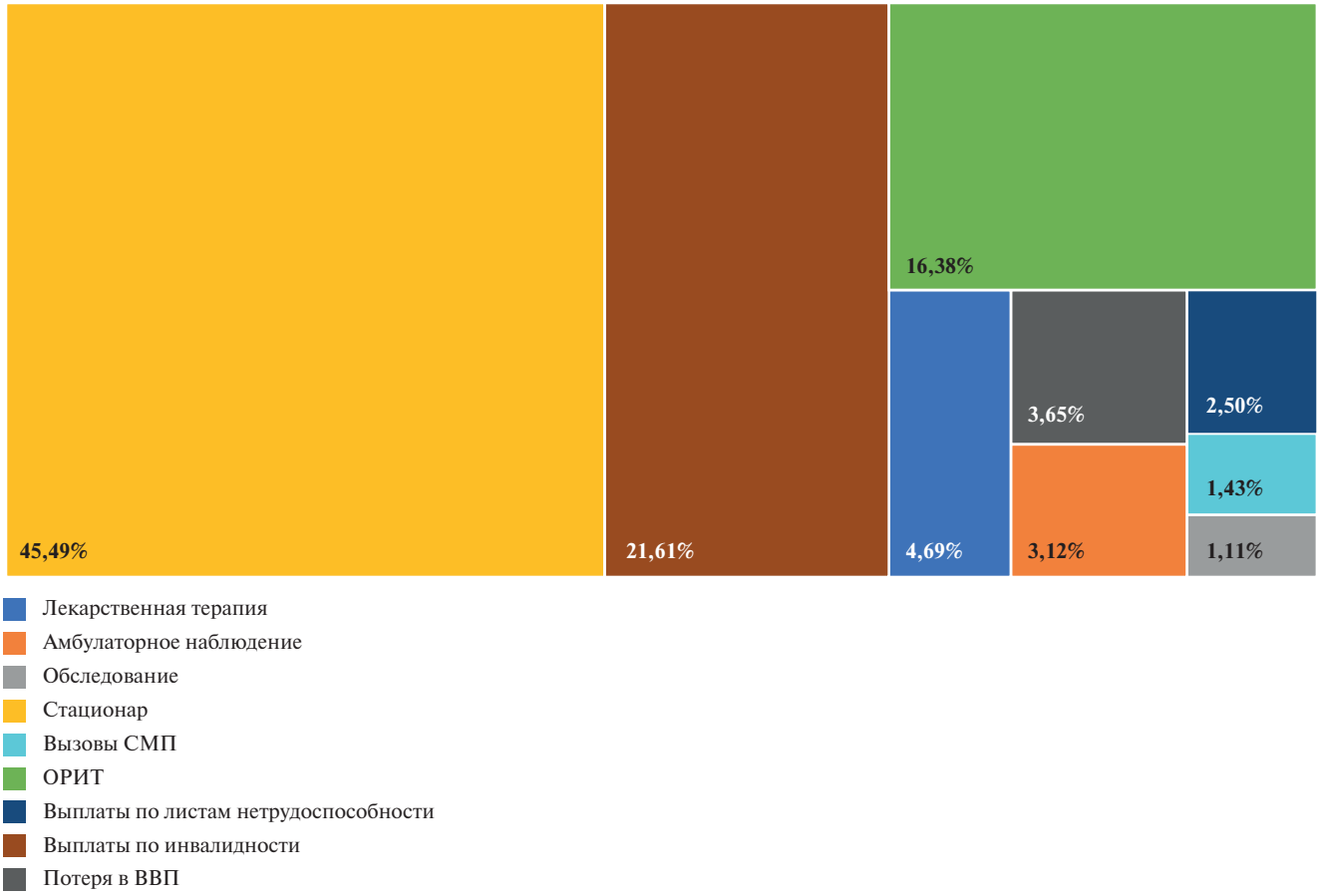

Figure 5. Structure of costs for a patient with HF during 1 year.

Calculation of the cost of managing a HF patient

Based on the data obtained, the average cost of managing one HF patient in Russia in actual clinical practice was calculated (Table 4).

It should be noted that the cost of drug therapy varied significantly depending on the source of funding — the total cost of therapy received by patients was about RUB 90000 per year, while within medicine assistance programs, a patient received therapy in the amount of RUB ~7000 per year. When considering the costs of healthcare system only, the proportion of drug therapy in the structure of costs per patient from the state's point of view was only 4,7%, and the maximum costs were for inpatient care (45,5%), stay in intensive care units (16,4%) and disability payments (21,6%) (Figure 5).

The sum of direct costs for HF therapy, with the exception of drug therapy (examination, inpatient and outpatient treatment), averages RUB 108291,92 per year. The total direct nonmedical and indirect costs per patient with HF per year are RUB ~44519,32 per year. It should be noted that the calculation did not include the provision of rehabilitation assistance.

Discussion

Back in 2014, the burden of HF in Russia amounted to over RUB 520 billion, and there was a serious increase in costs compared to 2008-2010 [22]. Our analysis showed that the total direct cost of managing 1 patient with HF is RUB 115819,12 per year, which at the rate of the Central Bank of the Russian Federation as of August 20, 2021 is $~1636,34. Similar studies in other countries show that the annual HF costs range from $908 to $40,971 per patient [1]. A recent analysis in Denmark showed that the total direct cost per patient with HF is €~11926 per year [4]. A systematic review by Shafie A, et al. (2018) on the cost of HF showed that although the cost estimates presented were inconsistent due to differences in methodological approaches, the cost of hospitalization is the main factor in the total cost of healthcare for a patient with HF and ranges from 44% to 96% of all direct costs. In our study, the cost of inpatient treatment accounted for 45,5% of all direct costs, which is on average corresponds to the world data. In industrialized countries, 62-75% of all funds are

spent on inpatient treatment of patients with HF [1, 23], and in the period from 2012 to 2030, costs are expected to increase by 127% [24]. Another systematic review on HF costs is Lesyuk W, et al. [6] also showed that hospitalization costs are the most expensive element, with estimated annual costs for HF patients ranging from $868 in South Korea to $25,532 in Germany. At the same time, the cost of managing patients with HF was estimated at $126,819 per patient for the entire period of life.

It is for this reason that back in 2010, the health care reform in the United States identified a reduction in the number of readmissions for HF as a key area for achieving a potential reduction in the cost of managing HF patients [25].

It should be noted that in Russia, due to the peculiarities of coding and financing of hospitalizations due to HF within payment system for diagnostic related groups [15], the cost of completed treatment of a patient with this disease is lower than for other CVDs. As a result, the average number of hospitalizations for any reason per patient with HF was 1,21 hospitalizations per year, of which only 0,51 hospitalizations with ICD I50. This trend is reflected in the statistical observation and understanding of the importance of HF problem in terms of preventing an increase in the number of patients with class III-IV HF, which are characterized by frequent rehospitalizations [14].

In addition, it should be emphasized that the major part of the cost of drug therapy is covered by patients' own funds — the total cost of therapy received by patients was about RUB 90 thousand per year, while within the medicine assistance programs, patients received therapy in the amount of RUB ~7000 per year.

Study limitations. This retrospective study is based on the use of data included in outpatient records. Despite the high representativeness of the sample, the results obtained should be extrapolated to a wider population with caution, since the study is purely descriptive and is based on data on treatment and clinical conditions entered by physicians into outpatient records in 9 health facilities. In addition, as mentioned earlier, the assessment of the completeness and reliability of information in outpatient records was not included in the study objectives. Due to the large number of trade names of drugs and taking into account the difference in the cost of drugs from different manufacturers, we used the weighted average cost of drug therapy for two analysis options — the cost of therapy with reference drugs according to the State Register of Maximum Selling Prices and the cost of therapy with generic drugs according to INN. The calculation did not include the provision of rehabilitation assistance. It should also be noted that there was no accounting for the provision of invasive medical care and surgical treatment of diseases that led to the development of HF (coronary angiography, coronary artery stenting, cardiac pacing, catheter ablation, etc.).

Conclusion

The study revealed data that makes it possible to make the following conclusions:

1. The maximum costs for the management of HF patients from the state position fall on inpatient management and stay in intensive care units.
2. The proportion of drug therapy in the structure of costs per patient from the state's point of view is only 4,7%, while 89% of drugs are purchased by patients at their own expense.
3. The average number of hospitalizations for any reason per HF patient was 1,21 per year, of which only 0,51 hospitalizations for ICD I50.

Relationships and Activities: none.

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