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ESTIMATION OF SOCIO-ECONOMIC BURDEN OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE FOR A 5-YEAR PERIOD: A REGIONAL ASPECT

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The aim of the study was to estimate the economic damage by COPD, including direct medical and non-medical costs and indirect costs associated with premature deaths of working-age individuals.

Materials and methods. First, estimation of the economic COPD burden in Astrakhan region (AR) was carried out using the clinical and economic analysis of the "cost of illness" (COI). Direct medical costs of inpatient, outpatient, ambulance and emergency medical care, as well as direct non-medical costs associated with the disability benefits payments, were taken into account. Indirect costs were defined as economic losses from undelivered products due to premature deaths of working-age individuals.

Results. From 2015 to 2019, the economic COPD burden in AR amounted to 757.11 million rubles in total, which is equivalent to 0.03% of the gross regional product covering a five-year period of the study. Direct medical and non-medical costs totaled 178.02 million rubles. In the structure of direct medical expenses, expenses for inpatient, as well as ambulance and emergency medical care during the study period, increased by 92.5% and 45.5%, respectively. While the costs for the outpatient care decreased by 31.9%, the increase in direct non-medical costs associated with the disability benefits payments, increased by 5.1% (2019). Indirect losses amounted to 579.09 million rubles.

Conclusion. The structure of the main damage is dominated by indirect losses in the economy associated with premature deaths of working-age individuals. In the structure of direct medical costs, inpatient care costs prevailed. These studies indicate the need to continue an advanced analysis of the economic burden of COPD, as well as to optimize the treatment and prevention of the exacerbations development of this disease.

Keywords: Chronic Obstructive Pulmonary Disease; economic burden; direct medical costs; direct non-medical costs; indirect costs; Astrakhan region

List of abbreviations: AR – Astrakhan region; RDs – respiratory diseases; COPD – Chronic Obstructive Pulmonary Disease; EU – European Union; TD – temporary disability; TCMIF – Territorial Compulsory Medical Insurance Fund; A – Ambulance; EMC – emergency medical care; DRG – Diagnosis-related group; GRP – gross regional product; YPLL – years of potential life lost

ОЦЕНКА СОЦИАЛЬНО-ЭКОНОМИЧЕСКОГО БРЕМЕНИ ХРОНИЧЕСКОЙ ОБСТРУКТИВНОЙ БОЛЕЗНИ ЛЕГКИХ ЗА 5-ЛЕТНИЙ ПЕРИОД – РЕГИОНАЛЬНЫЙ АСПЕКТ

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Цель. Оценка экономического ущерба от ХОБЛ, включая прямые медицинские и немедицинские затраты и косвенные затраты, связанные с преждевременной смертью лиц трудоспособного возраста.

Материалы и методы. Впервые проведена оценка экономического бремени ХОБЛ в Астраханской области (АО) с использованием клинико-экономического анализа «стоимость болезни». В исследовании учитывались прямые медицинские затраты на стационарное, амбулаторное лечение, скорую и неотложную медицинскую помощь, а также прямые немедицинские затраты, связанные с выплатами пособий по инвалидности. Косвенные затраты определялись как экономические потери от не произведенной продукции вследствие преждевременной смерти в экономически активном возрасте.

Результаты. Экономическое бремя ХОБЛ в АО за период с 2015 по 2019 гг. суммарно составило 757,11 млн рублей, что эквивалентно 0,03% валового регионального продукта за пятилетний период исследования. Прямые медицинские и немедицинские затраты суммарно составили 178,02 млн. рублей. В структуре прямых медицинских затрат расходы на стационарную, а также скорую и неотложную медицинскую помощь за период исследования увеличились на 92,5% и 45,5% соответственно. В то время как затраты на амбулаторную помощь уменьшились на 31,9%, прирост прямых немедицинских затрат, связанных с выплатами пособий по инвалидности, вырос на 5,1% к 2019 г. Косвенные потери составили 579,09 млн рублей.

Заключение. В структуре основного ущерба преобладают косвенные потери в экономике, связанные с преждевременной смертью населения экономически активного возраста. В структуре прямых медицинских затрат преобладали затраты на стационарную помощь. Данные исследования свидетельствуют о необходимости продолжения более углубленного анализа экономического бремени ХОБЛ, а также оптимизации лечения и профилактики развития обострений данного заболевания.

Ключевые слова: хроническая обструктивная болезнь легких; экономическое бремя; прямые медицинские затраты; прямые немедицинские затраты; косвенные затраты; Астраханская область

Список сокращений: АО – Астраханская область; БОД – болезни органов дыхания; ХОБЛ – хроническая обструктивная болезнь легких; ЕС – Европейский союз; ВН – временная нетрудоспособность; ТФОМС – Территориальный фонд обязательного медицинского страхования; СМП – скорая медицинская помощь, НМП – неотложная медицинская помощь; КСГ – клинико-статистические группы; ВРП – валовый региональный продукт; ППЖ – потерянные годы потенциальной жизни.

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is the most common chronic respiratory disease (RD). Currently, more than 250 million people suffering from this pathology, are registered worldwide [1]. In recent decades, there has been an increase in morbidity and mortality from COPD [2]. If in Western Europe the prevalence of COPD is 10–27% [3], in Russia it is 21.8% [4]. COPD is the third leading cause of death in the world [5]. The high prevalence, combined with disability and mortality, represents COPD as a global medical, social and economic problem [6, 7].

The study of the economic damage caused by COPD is carried out all over the world. In the United States of America alone, direct costs for hospital admissions in cases of COPD exacerbations, is \$18 billion [8]. In the European Union (EU) countries, respiratory diseases burden health budgets by € 47.3 billion. With a total health expenditure of € 800 billion (9% of gross domestic product), direct costs for respiratory diseases account for approximately 6% of the total health budget of these countries [9]. Similar studies are being carried out in the Russian Federation. So, in the research by I.S. Krysanov [10], direct costs were studied, and they amounted to 54.6 billion rubles in 2007. By 2012, these costs had increased to 61.6 billion rubles. According to the results of the study by the “Quality of Life” (QOL) social fund, the COPD economic burden in the Russian Federation (RF) in 2013 was estimated at more than 24 billion rubles, including medical costs, the costs associated with the dis-

ability benefits payments (DBPs), and presenteeism¹. In 2016, a group of Russian researchers headed by A.V. Kontsevaya, calculated the economic damage from respiratory diseases (RRs) and COPD in the Russian Federation for 2016. It amounted to 903.9 billion rubles for respiratory diseases (RDs) and 170.3 billion rubles for COPD (18.8% of RDs and 0.2% of GRP) [12].

As evidenced by statistical regional data, in Astrakhan region (AR), just as in the Russian Federation as a whole, there are dismal projections of an increase in hospital admissions, disabilities and mortality due to COPD². The regional economic burden of COPD has not been calculated previously, which makes this study relevant.

THE AIM of the study was to estimate the economic damage from COPD, including direct medical and non-medical costs and indirect costs associated with premature deaths of working-age individuals.

MATERIALS AND METHODS

For the first time, an assessment of the economic COPD burden was made in Astrakhan region (AR) for the period of 2015–2019. The research included a step-by-step calculation of direct costs of the AR health care sys-

¹ Interregional Public Charitable Foundation “Quality of Life”. Research “Social and economic losses from bronchial asthma and chronic obstructive pulmonary disease in the Russian Federation.” Available from: <http://www.qualityoflife.ru/en/node/117>

² Statistical Yearbook of the Astrakhan Region. 2020 Stat. sb. / Astrakhan stat. – Astrakhan. Available from: <https://astrastat.gks.ru/storage/mediabank/6TaD00de/Economy of the Astrakhan region – 2015–2019.pdf>. Russian

tem in the study period, as well as indirect costs in the form of economic losses. The research included statistics on COPD (the ICD code is J44).

In order to assess the impact of COPD on the regional budget, a type of clinical and economic analysis was used – the cost of illness (COI) analysis, which includes both direct and indirect government costs [10]. The analysis was performed according to the following formula:

$$\text{COI} = \text{DC} + \text{IC},$$

where COI – Cost of Illness; DC – Direct Costs; IC – Indirect Costs.

To assess the economic burden of COPD, the following resources and databases were analyzed.

1. The data on the incidence of COPD and RDs in the population presented by Federal State Budgetary Institution “The Central Research Institute for Organization and Information Technologies” (the Ministry of Health of Russia) for the study period, including the absolute number of total and new identified cases of COPD³.

2. The data on the annual forms of statistical reporting of the Territorial Compulsory Medical Insurance Fund of Astrakhan Region: “Information on the activities of the subdivisions of a medical organization providing medical care in inpatient conditions” (a number of hospital admissions, a number of ambulance calls; emergency medical care (EMC) (Form N14)), “Information on the number of diseases registered in patients living in the service areas of medical organizations” (Form N12), “Information on the activities of day hospitals of medical organizations” (Form N141)⁴.

3. Regional economic parameters of the gross regional product (GRP), as well as statistical data on the number of deaths due to COPD by five-year age groups for each study year, were provided by the Federal State Statistics Service for Astrakhan region and the Republic of Kalmykia⁵. The statistical data were requested from the Federal State Institution “Main Office of Medical and Social Assessment of Astrakhan Region” (the Ministry of Labor of Russia) on the number of people with disabilities due to COPD by disability groups for each year of the study period.

When calculating direct medical costs, such as costs of visits to outpatient patients, emergency medical services and treatment in inpatient conditions, the cost indicators according to the tariffs of the Territorial Compulsory Medical Insurance Fund (TCMIF) in AR for the study period, were used. The economic analysis of direct medical costs of the state for the provision of COPD

medical care covering a five-year period in the Astrakhan region was based on the aggregate of the above-listed costs.

Direct non-medical costs of disability benefits payments (DBPs) were calculated taking into account the number of the COPD disabled in each group and the estimated value of the disability benefits for each group and for each study year. The parameters used to calculate the direct non-medical costs associated with disability due to COPD, are presented in Table 1.

Indirect costs associated with losses in the production of GRP due to the premature deaths of working-age individuals, were calculated taking into account the employment rate of the population. The calculation procedure was corresponded to the methodology approved in accordance with the Order dated 10 April 2012 No. 192 / 323n / 45n / 113 of the Ministry of Economic Development of the Russian Federation “On approval of the Methodology for calculating economic losses from mortality, morbidity and disablement of the population”⁶.

The main formula for calculating the loss from mortality of the population was:

$$\text{LPMY}_{x,s,d} = \text{ND}_{x,s,d} \times \frac{\text{NE}_{x,s}}{\text{PS}_{x,s}} \times \frac{\text{GRP}}{\text{NE}} \times 0,5,$$

where: $\text{LPMY}_{x,s,d}$ – lost profits in the GRP production (volume of underproduced GRP) as a result of mortality of persons in the reporting year at the age (x) of sex (s) due to deaths (d) in the Russian Federation in the reporting year; $\text{ND}_{x,s,d}$ – number of deaths at the age (x) of sex (s) due to deaths (d) in Astrakhan region; $\text{NE}_{x,s}$ – number of employed at the age (x) of sex (s) in Astrakhan region; $\text{PS}_{x,s}$ – population size at the age (x) of sex (s) in Astrakhan region; GRP – Gross regional product of Astrakhan region; NE – number of employed in the region; 0.5 – coefficient, taking into account the distribution of the time of deaths during the year.

The years of potential life lost (YPLL) were calculated according to the formula:

$$\text{YPLL} = (72 - \text{Age}_{\text{gr}}) \times \text{NDAge}_{\text{gr}},$$

where: YPLL – years of potential life lost; 72 – extreme age limit for economic activity; Age_{gr} – Age group; NDAge_{gr} – number of deaths in the studied age group.

The computational part of the study was carried out using descriptive statistics methods in the MS Excel 10.0 program (Microsoft, USA).

³ Federal Research Institute for Health Organization and Informatics of Ministry of Health of the Russian Federation. Available from: <https://mednet.ru/miac/meditsinskaya-statistika/>. Russian

⁴ Territorial fund of compulsory health insurance of the Astrakhan region. Tariffs. Available from: <https://astfond.ru/oms/tarify/>. Russian

⁵ Office of the Federal State Statistics Service for the Astrakhan Region and the Republic of Kalmykia. Available from: <https://www.astrastat.gks.ru>.

⁶ Order of the Ministry of Economic Development of the Russian Federation, the Ministry of Health and Social Development of the Russian Federation, the Ministry of Finance of the Russian Federation and the Federal State Statistics Service of April 10, 2012 N 192 / 323-n / 45-n / 113 “On approval of the Methodology for calculating economic losses from mortality, morbidity and disability of the population”. Available from: <https://base.garant.ru/70170542/>. Russian

Table 1 – Cost indicators used in the analysis

Indicator	Value				
Coefficient of relative input intensity in DRG for COPD	0.91				
Costs:	Costs, rubles				
	2015	2016	2017	2018	2019
1 hospital admission on the policy of compulsory medical insurance	14933.72	15141.61	13524.03	15016.73	17725.39
1 prophylactic treatment	302.8	160.0	97.6	120.3	137.0
1 treatment for a disease	803.20	620.298	617.30	830.01	849.93
1 emergency call taking into account the DRG coefficient	453.2	490	443.8	568.5	592.9
1 ambulance call taking into account the DRG coefficient	1724.5	1747.7	1819.5	2122.7	2248.92
1 case of day hospital treatment taking into account the DRG coefficient	10056.18	8538.3	7 622.19	8253.27	11 627.83
Indicator	2015	2016	2017	2018	2019
Gross regional product (GRP), mln. rubles	322303.0	346779.4	420961.1	553395.7	561695.9
Gross regional product (GRP) per caput, mln. rubles	315996.9	340398.3	413440.6	544793.4	552965.3
Average monthly salary, rubles	25499	27423.1	29599.2	33630.1	35791.5
Calculated value of the disability benefits payments (DBPs) taking into account the indexation coefficient	Group	2015	2016	2017	2018
	I	16285.6	17934.3	24466.6	20270.7
	II	13193.2	14613.3	20915.9	16062.6
	III	10777.1	12070.8	18318.3	13489.6

Table 2 – COPD and RDs incidence for 5 years in AR (2015–2019)

Indicator	2015	2016	2017	2018	2019
Number of persons with RDs	289876	316565	300636	313889	310706
Number of persons with COPD	2869	2788	2721	2913	3180
COPD incidence, incident cases	445	226	266	310	496
Share of COPD in RDs,%	0,99	0,88	0,91	0,93	1,02

Table 3 – Direct medical costs in AR associated with COPD covering the period of 2015–2019

Inpatient care for COPD patients within 5 years (2015–2019)					
Indicator	2015	2016	2017	2018	2019
Number of hospital admissions	1121	1365	1699	1671	1818
Number of bed-days, in total	10089	12285	16141	15039	16362
Average duration of treatment, bed-days	9,0	9,0	9,5	9,0	9,0
Costs for hospital admissions, mln. rubles	16.74	20.67	22.97	25.09	32.22
Outpatient care for COPD patients covering 5 years (2015–2019)					
Number of visits for preventive and other purposes	2656	2419	2554	2596	3333
Number of treatments for diseases	2737	2445	2163	1965	1595
Number of day hospital admissions.	165	185	174	144	117
Outpatient care costs, mln rubles	4.66	3.48	2.91	3.13	3.17
Emergency medical care (ambulance+ emergency) for COPD patients covering 5 years (2015–2019)					
Number of ambulance calls	1844	2013	1830	1994	2031
Number of emergency medical care cases	554	951	868	844	722
Costs for ambulance and emergency care, mln rubles	3.43	3.98	3.71	4.71	4.99
Summary total of direct medical costs					
Direct medical costs for COPD, mln rubles	24.83	28,14	29.60	32.94	40.39
Share of costs for inpatient care,%	67.4	73.5	77.6	76.2	79.8
Share of costs for outpatient care,%	18.8	12.4	9.8	9.5	7.8
Share of costs for ambulance and emergency care, mln rubles	13.8	14.1	12.5	14.3	12.4

Table 4 – Number of people with disabilities due to COPD and direct non-medical costs in AR for 5 years (2015–2019)

Disablement group	Number of COPD disabled persons				
	2015	2016	2017	2018	2019
I	0	0	0	2	0
II	5	5	5	11	10
III	27	15	19	14	14
In total	32	20	24	27	24
Number of RDa disabled persons	201	153	142	130	142
Share of persons disabled due to COPD in RDs, %	15,9	13	16,9	20.7	16.9
Costs of disability benefits, mln rubles	4.28	3.05	5.43	4.87	4.48

Table 5 – Structure of mortality due to RDs and COPD in AR within 2015–2019

Years		2015	2016	2017	2018	2019
Deaths due to all diseases	Male	6418	6340	5838	5893	5780
	Female	6119	5889	5782	5841	5646
In total		12537	12229	11620	11734	11426
Deaths due to RDs	Male	291	271	253	273	291
	Female	139	114	116	144	123
In total		430	385	369	417	414
Deaths due to COPD	Male	48	46	43	52	58
	Female	10	10	11	11	15
In total		58	56	54	63	73
Share of deaths due to COPD in RDs		13.5	14.5	14.6	15.1	17.6
Relative mortality rate among COPD patients, %		2.0	2.0	2.0	2.2	2.3

Table 6 – Age structure of mortality from COPD, and YPLL in AR for 2015–2019

Age	Years	Up to 69 years old		Older than 70 years		Years of potential life lost (YPLL)
		n	%	n	%	
2015		35	60%	23	40%	500
2016		42	75%	14	25%	556
2017		24	44%	30	56%	274
2018		32	51%	31	49%	321
2019		37	51%	36	49%	396
Average value		34.0 ± 6.7	56% ± 12%	26.8 ± 8.5	44% ± 12%	409.4 ± 118.4

Table 7 – Economic burden of COPD in RDs for the period of 2015–2019

Cost type	2015	2016	2017	2018	2019	For 5 years
Direct costs for COPD, mln rubles	29.12	31.19	35.03	37.81	44.87	178.02
Indirect costs due to premature COPD deaths, mln rubles	102.63	124.94	82.63	118.65	150.24	579.09
Summary total of losses and costs due to COPD, mln rubles	131.75	156.12	117.66	156.46	195.11	757.11
Share in GRP, %	0.04	0.05	0.03	0.03	0.03	0.03

RESULTS

The analysis showed an increase in the incidence of RDs from 2015 to 2019 by 7.2%. The number of COPD patients in the study period also increased by 10.8%. The largest share of COPD in RDs was 1.02% in 2019 (Table 2).

Covering a five-year period, there was an increase in hospital admissions of patients with COPD by 62.2%,

with its highest value of 1818 cases in 2019. The number of bed-days spent by patients with COPD in a round-the-clock hospital during the analyzed period, with a relatively equal average duration of treatment for each patient, also increased by 62.2%. The actual costs of inpatient care for COPD patients during the study period increased by 92.5% (Table 3).

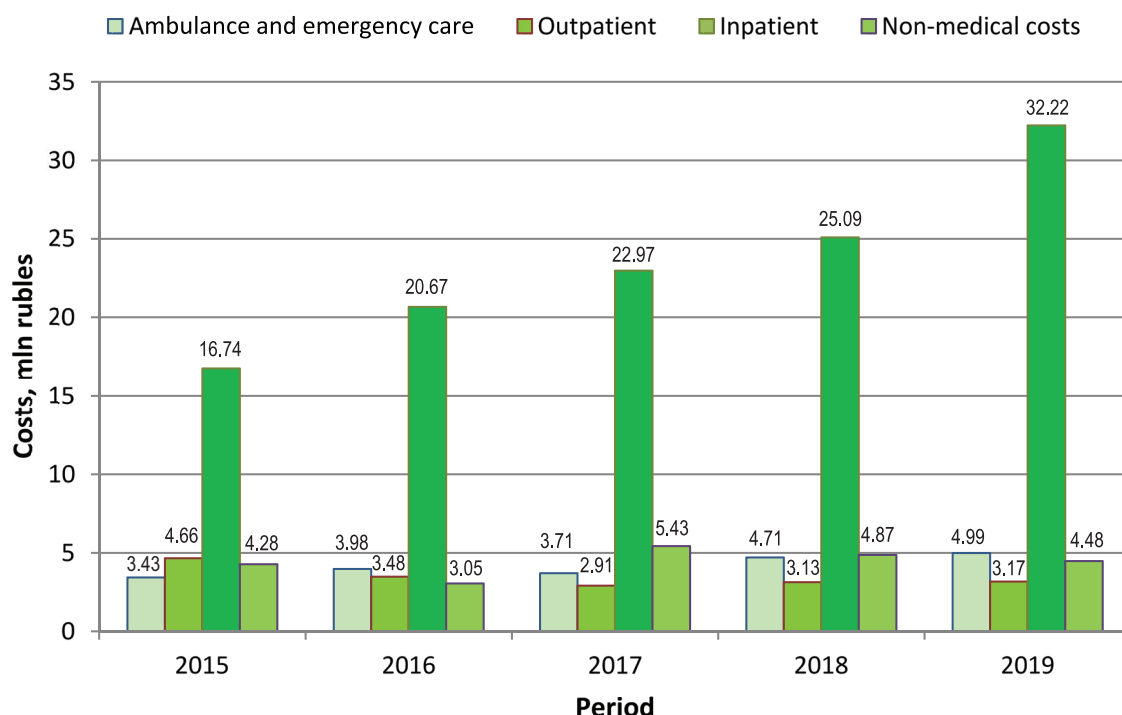


Figure 1 – Structure of direct costs for COPD in Astrakhan region within a five-yearperiod (2015–2019)

Economic burden of COPD within the period of 2015–2019 in AR

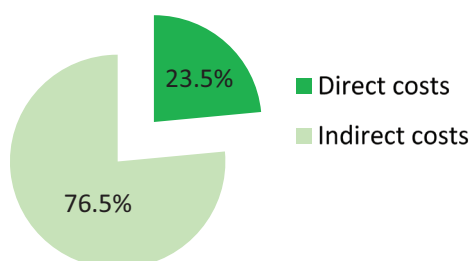


Figure 2 – Structure of COPD economic burden in Astrakhan region within the period of 2015–2019

In calculating the direct medical costs of the RF for the outpatient care of COPD patients, the following indicators were taken into account: the number of visits to patients for preventive and other purposes; the number of treatments for diseases; number of day hospital admissions. During the study period, the indicator “a number of visits for preventive purposes” increased by 25.5%, while “treatments for diseases” and “the number of day hospital admissions” decreased by 41.7% and 29%, respectively. In this regard, direct medical costs for outpatient COPD care during the study period, decreased by 31.9%, amounting to 3.17 million rubles in 2019 (Table 3).

During the study period, there was an increase in the

number of ambulance calls and the provision of emergency medical services to COPD patients by 10.1% and 30.3%, respectively. This contributed to an increase in the emergency medical care costs for the period 2015–2019 by 45.5%, and in monetary terms, it amounted to 4.99 million rubles in 2019 (Table 3).

Direct medical costs for treating COPD patients increased by 62.7% covering the five-year period, and amounted to 40.39 million rubles in 2019. The analysis of the structure of direct medical costs associated with COPD in RDs for the study period (Table 3) shows, that the largest share of costs for inpatient COPD patients coincided with 2019 (79.8% of direct medical costs), the share of costs for outpatient care prevailed in 2015 (18.8% of direct medical costs), and the share of expenses for emergency medical services and emergency medical care was the largest in 2018 (14.3% of direct medical costs).

In the calculation of direct non-medical costs, the cost of disability benefits for each surveyed year was taken into account. Table 4 shows the number of people with disabilities due to COPD and RDs according to disability evaluation groups. In the period of 2015–2019, the number of persons with disabilities due to COPD decreased from 32 to 24, the number of persons with disabilities due to RDs also decreased from 201 to 142. However, the proportion of persons with disabilities due to COPD in RDs during this period increased by 1%. The analysis of direct non-medical costs associated with disability benefits payments shows an increase by 5.1% in 2019, at the same time, the largest cost indicator coin-

cided with 2017, which, in monetary terms, corresponds to 5.43 million rubles.

The structure of direct costs for COPD in AR within the study period is shown in Fig. 1. The main share of direct costs was the cost of inpatient care.

Indirect losses in the economy were analyzed on the basis of premature deaths of working-age individuals. As Table 5 shows, a total of 304 people (217 men and 87 women) died due to COPD within the period of 2015–2019. There was an increase in the absolute number of deaths due to COPD, and it amounted to 25.9% for a five-year observation period. An increase in the share of deaths due to COPD in relation to the number of deaths due to RDs, which increased from 13.5% to 17.6% for a five-year period, is also worth notifying. At the same time, a relative mortality rate among COPD patients remained relatively stable, due to the increase in the number of COPD cases, and averaged to $2.1 \pm 0.13\%$.

Due to COPD, within the entire study period, 2047 years of potential life were lost on the basis of premature deaths of working-age individuals. In particular, the largest number of years (500) of YPLL took place in 2015, and the smallest (274 years) – in 2017. This is due to the fact that in 2015, 60% of patients died at premature deaths of working-age individuals (up to 69 years old); in 2017 their number decreased to 44%, and COPD patients began to die at a later age (Table 6).

The total amount of losses and costs for the five-year observation period reached 757.1 million rubles, which is equivalent to 0.03% of the GRP of Astrakhan region. In the structure of the main damage by COPD, indirect losses associated with premature deaths of working-age individuals, prevail in economy. In economic terms it means that within a five-year observation period, all losses and costs amounted to 579.09 million rubles (76.5%). The total amount of direct costs for the study period reached 178.02 million rubles (23.5% of all losses and costs) (Table 7; Fig. 2).

DISCUSSION

COPD is the cause of colossal costs in the health care system of all the countries around the world. According to the studies from various countries, the prevailing share of costs for COPD associated with hospital admissions of patients during exacerbations [12–15], is represented by direct government costs. These costs increase with the severity of COPD exacerbations requiring emergency care, longer hospital stays or intensive care units [16]. Recent studies of economic costs in Asian countries have confirmed that these results are universal. However, the burden of chronic diseases, such as COPD, is a particular problem in low-income countries, where health resources have traditionally been focused on episodic management of acute diseases, especially infectious ones, and are not adapted to the treatment of chronic diseases [14]. The tendency to increase costs depending on the severity of COPD was noted in the

studies of scientists from Italy [17] and Great Britain [18]. The economic research on determining the burden of COPD is regularly conducted in the United States. In a 2010 study, direct costs for COPD were \$ 32 billion and indirect costs were \$ 20.4 billion [19]. Another study, which included an estimation of the total costs for COPD in 2010 and projected medical costs up to 2020, found out that the economic damage by COPD was \$ 36 billion per year. Of these, the direct medical costs associated with COPD and its consequences, were estimated at \$ 32.1 billion, and the costs associated with the loss of 16.4 million workdays, was \$ 3.9 billion [20]. In the UK, the damage by COPD was 1.9 billion pounds [21]. However, in a 2016 study conducted in 12 countries (USA, UK, Germany, Italy, etc.), it was shown that indirect costs were several times higher than direct ones, which reflects the hidden nature of the economic burden associated with a decrease in labor productivity [22]. Losses in labor productivity due to the unexcused absence and premature retirement are key drivers of higher indirect costs [23]. Determining the indirect costs associated with COPD, can be challenging [24], but it is clear that accounting for them will help to identify the true socioeconomic burden of COPD.

The study by A.V. Kontsevaya et al. [11] also showed the prevalence of indirect losses associated with premature COPD deaths of working-age individuals. In this study, similar results of the COPD burden in Astrakhan region within a 5-year period, were obtained. Indirect costs significantly exceeded direct ones in them (Fig. 2).

In the structure of direct medical costs, there is an increase in costs for inpatient care, emergency care and emergency medical services, with a simultaneous decrease in outpatient care costs associated with a decrease in visits for illness and hospital admissions in a day hospital. In the structure of direct medical costs, there is an increase in costs for inpatient care, ambulance care and emergency medical services, with a simultaneous decrease in outpatient care costs associated with a decrease in treatments for diseases and day hospital admissions. This indicates an increase in the frequency and severity of COPD exacerbations, which indirectly leads to high costs for the treatment of these exacerbations in hospital settings. Reducing the cost of outpatient care requires its optimization, since economically, it is less expensive than inpatient care and, therefore, a possible increase in investment of health care resources in the treatment and prevention of this disease is justified.

Limitations of the study

The study did not include the cost of medical care at the outpatient stage of treatment. When calculating indirect costs, the costs associated with temporary disability (TD) and primary disability output due to COPD, were not taken into account. According to the methodology for calculating economic losses due to premature deaths, the calculation was carried out

taking into account the number of deaths by age (one-year groups) and gender. However, in connection with the provision of statistics for five-year age groups, it was decided to calculate economic losses at the upper limit of the five-year age group (Example: the group of 45–49 – 49 years were used), which probably underestimates the result of total economic losses.

Due to the availability of information on the number of the working-age population by age groups and gender only for 2018 and 2019, the average values of 2018 and 2019 were used when calculating indirect costs for previous years.

CONCLUSION

This paper was the first to assess the impact of the economic COPD burden on the regional budget of Astrakhan region for the period of 2015–2019. Economically, the damage by COPD in AR for this period amounted to 757.11 million rubles, which is equivalent to 0.03% of the GRP for the study period. The structure of damage is dominated by the losses associated with premature deaths of working-age individuals, amounting to 579.09 million rubles. Direct costs (medical and non-

medical ones) totaled 178.02 million rubles. In the structure of direct medical costs, inpatient care costs prevail.

Taking into account the fact that there are unaccounted costs associated with temporary disability, primary disability, and other factors that limit this study, it seems relevant to conduct a further analysis of the economic COPD burden, which will contribute to the most complete assessment of the costs of this disease. For the leaders of the regional health care system, it is also very important to pay attention to the development of measures aimed at preventing the contraction of the disease and reducing COPD exacerbations. To do this, it is necessary to increase investments in the treatment, improve the possibilities of the outpatient link. At the outpatient stage, sustaining COPD drug therapy will make it possible to “control” the course of the disease, reducing the number of hospital admissions – the most expensive treatment option. In addition, it is necessary to stimulate the coverage of pneumococcal vaccination in this category of chronic patients, which will help to reduce exacerbations and significantly reduce hospitalization costs.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORS' CONTRIBUTION

Ekaterina A. Orlova – material collecting, text writing, editing; Adelya R. Umerova – text writing and editing;

Inna P. Dorfman – material collecting, editing; Mikhail A. Orlov – text writing and editing;

Musalitdin A. Abdullaev – text writing and compiling a bibliographic list.

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