



Original Research Article

Medical-Expert, Rehabilitation, and Clinical-Functional Aspects of Disability Due to Chronic Obstructive Pulmonary Disease in the Republic of Dagestan

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Abstract: Chronic obstructive pulmonary disease (COPD) is one of the most pressing issues in modern society. The effectiveness of rehabilitation measures aimed at improving the quality of life of patients with COPD depends on the severity of clinical-functional impairments and the dynamics of their changes, which lead to varying degrees of limitations in vital activity. Purpose of the study. Based on the analysis of the clinical-functional and medical-expert and rehabilitation characteristics of persons with disability due to chronic obstructive pulmonary disease—necessary for conducting medical and social expertise to assess the severity of impaired body functions—the study aimed to evaluate the degree of their limitations in vital activity. **Materials and methods.** The study data were compiled in Excel tables using the following methods: document analysis and data extraction (324 units). For quantitative variables, descriptive statistics were used: mean and median. The mean value (M) and standard deviation (SD) were calculated; when comparing two groups, the Student's t-test was applied, and its p-value (p_t) was determined. For continuous non-normally distributed variables, the median (Me), 1st (Q1) and 3rd (Q3) quartiles were calculated. For group comparisons, the Mann–Whitney U-test and its p-value (p_{mu}) were used. For ordinal or numerical variables, the Spearman correlation coefficient and its p-value ($r(p)$) were calculated for each pair of variables. To identify relationships between categorical variables, the Chi-square test of the corresponding contingency table and its p-value ($p(\chi^2)$) were applied. When the expected frequency in some cells was less than 5, Yates' continuity correction was used. Data processing and analysis were carried out in the R statistical environment ([<https://www.r-project.org/>]). **Results.** Among persons with disability due to COPD-related diseases, the most frequently reported complaints were dyspnea, cough, general weakness, fatigue, headache, pain, discomfort, dizziness, and episodes of choking. Moderate impairments of respiratory function were observed in 71.6% of cases, including 87% at stage 2, 81.8% at stages 2–3, 52.5% at stage 3, 16.7% at stages 3–4, and 33.3% at stage 4 of the

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disease. Severe impairments were observed in 25% of cases, including 11.6% at stage 2, 18.2% at stages 2–3, 43.3% at stage 3, 33.3% at stages 3–4, and 55.6% at stage 4. Significantly severe impairments were noted in 14% at stage 2, 50.0% at stages 3–4, and 11.1% at stage 4 of the disease. Cardiovascular function impairments were mild in 9% of cases—9.6% at stage 2, 9.1% at stages 2–3, and 9.3% at stage 3. Moderate impairments were found in 14.8% of cases—8.9% at stage 2, 4.5% at stages 2–3, 26.8% at stage 3, and 27.8% at stage 4. Severe impairments were observed in 33.3% at stages 3–4 and 16.7% at stage 4. Overall, moderate cumulative impairments were identified in 71.9% of cases—87% at stage 2, 81.8% at stages 2–3, 53.6% at stage 3, 16.7% at stages 3–4, and 33.3% at stage 4. Severe cumulative impairments were found in 25% of cases—11.6% at stage 2, 18.2% at stages 2–3, 43.3% at stage 3, 33.3% at stages 3–4, and 55.6% at stage 4. Significantly severe cumulative impairments were observed in 50% at stages 3–4 and in 11.1% at stage 4 of the disease.

Among persons with disability due to COPD, first-degree limitations in mobility, self-care, and work activity were observed. A strong direct correlation was found between respiratory dysfunction and work activity, and a moderate direct correlation with self-care. Between the total functional impairments of the body and self-care, there was a moderate direct correlation, as well as a strong direct correlation with work activity.

Conclusion. Medical-expert and rehabilitation diagnostics of persons with disability of various age groups due to COPD, conducted through medical and social expertise, make it possible to determine an individualized and necessary scope of rehabilitation measures, including those performed in accordance with the International Classification of Impairments, Disabilities, and Handicaps.

Keywords: Disability, chronic obstructive pulmonary disease, age groups, clinical-functional impairments, limitations of vital activity.

INTRODUCTION

Respiratory diseases represent a large group of disorders of various etiologies and pathogeneses, characterized by the localization of the pathological process in the respiratory tract. They are among the most common diseases in the population. Statistical data indicate that in the Russian Federation, the incidence of respiratory diseases significantly exceeds that of other classes of diseases and continues to grow steadily. Since the beginning of the 21st century, the incidence of respiratory diseases has increased from 317.2 per 100,000 population in 2000 to 407.1 in 2021 [1]. According to various researchers, this group of diseases affects from 4–6% to 10–25% of the adult population and shows a consistent upward trend in prevalence in both developed and developing countries. It is among the ten diseases with the highest economic burden. Chronic obstructive pulmonary disease (COPD) remains the only disease for which mortality continues to rise. COPD is a steadily progressive disorder leading to disability and mortality among individuals of working age [2,3,6,8]. In the

current literature, the issue of assessing the rehabilitation potential of patients with chronic obstructive pulmonary disease who have undergone medical and social expertise remains insufficiently studied [4,5,7,9,10,11].

Purpose of the study.

Based on the analysis of the clinical-functional and medical-expert and rehabilitation characteristics of persons with disability due to chronic obstructive pulmonary disease, necessary for conducting medical and social expertise to assess the severity of impaired body functions, the study aimed to evaluate the degree of their limitations in vital activity.

Results.

To investigate the medical-expert and rehabilitation as well as clinical-functional aspects of persons with disability due to COPD, a sample of records and protocols was analyzed for individuals aged 18 years and older who underwent assessment at the Bureau of Medical and Social Expertise (MSE) of the Federal

State Institution “Main Bureau of MSE for the Republic of Dagestan” under the Ministry of Labor of Russia, based on Form 088/u-06, including 324 patients.

For statistical processing of the primary documentation, three data blocks were created:

1. Socio-demographic and physical data,
2. Clinical-functional and laboratory data,
3. Medical-social data, which were analyzed within the scope of the study.

The degree of severity of persistent impairments of body functions in persons with disability (DSPIFPD) was assessed according to four levels: mild, moderate, severe, and significantly severe. The main categories of vital activity (MCVA)—self-care, independent mobility, orientation, communication, behavioral control, learning ability, and work activity—and their degrees of limitation (first, second, and third) were evaluated in accordance with Sections II and III of Order № 585n of the Ministry of Labor of the Russian Federation, dated August 27, 2019, “Classifications and Criteria Used in Conducting Medical and Social Expertise by Federal State Institutions of Medical and

Social Expertise.”

The data prepared for analysis in XLSX format were uploaded into the R environment. Data processing and analysis were performed using R scripts. In the presented results, different indicators have varying numbers of observations (N), since not all medical records contained complete data for every parameter. Only patients with non-missing values were included in comparative analyses.

For continuous normally distributed variables, the mean (M) and standard deviation (SD) were calculated. When comparing two groups, the Student’s t-test was used, and its p-value (p_t) was determined. For continuous non-normally distributed variables, the median (Me), 1st (Q1) and 3rd (Q3) quartiles were calculated. When comparing groups, the Mann–Whitney U-test and its p-value (p_{mu}) were applied. If the compared variables were ordinal or numerical, the Spearman correlation coefficient and its p-value ($r(p)$) were calculated for each pair of variables. To identify relationships between categorical variables, the Chi-square test of the corresponding contingency table and its p-value ($p(\chi^2)$) were used. When the expected frequency in some cells was less than 5, Yates’ continuity correction was applied.

RESULTS

The study established that among persons with disability, there were 196 men (60.5%) and 128 women (39.5%). In the younger age group, the proportion of men—49 out of 196 (25%)—was significantly lower than that of women—73 out of 128 (56.3%) ($p(\chi^2) < 0.001$). In the older working-age group, the proportion of men—87 out of 196 (44.4%)—was significantly higher than that of women—15 out of 128 (11.7%) ($p(\chi^2) < 0.001$). The largest proportion consisted of persons with Group III disability—233 individuals (71.9%); persons with Group II disability accounted for 25% (81 individuals); and persons with Group I disability—10 individuals (3.1%). The most common clinical-functional indicators for assessing the severity of impaired body functions in persons with disability (SIBFPD) were analyzed. Clinically, the most frequently observed symptoms were: dyspnea—92.4%, cough—90.2%, general weakness—80.8%, fatigue—64%, headache—54.6%, pain or discomfort—44.5%, dizziness—43.2%, and episodes of choking—39.1%.

Table 1 – Statistically significant correlation coefficients between the severity of clinical symptoms and other COPD indicators in persons with disabilities due to chronic obstructive pulmonary disease

Clinical symptoms	Indicators	Indicator characteristics	Number of persons with disabilities	Total number of persons with disabilities	Percentage (%)	$p(\chi^2)$	$r(p)$
Pronounced clinical symptoms	Degree of respiratory failure (RF)	≤ 2	156	203	76.8	0.001	0.19 (<0.001)
		$\geq 2-3$	111	120	92.5		
	Frequency	Moderate	59	104	56.7	<0.001	0.41

	of bronchitis relapses						(<0.001)
		≥ Frequent	197	207	95.2		
	Education	≤ Secondary general	124	153	81.0	0.015	
		≥ Secondary	59	62	95.2		
	Disability group	III	180	233	77.3	<0.001	0.23 (<0.001)
		≥ II	88	91	96.7		

The severity of clinical symptoms was observed in 76.8% of patients with respiratory failure (RF) ≤ 2 and in 92.5% of patients with RF $\geq 2-3$ ($p(\chi^2) = 0.001$; $r = 0.19(0)$). Severe clinical symptoms were recorded in 56.7% of patients with bronchitis of moderate exacerbation frequency and in 95.2% of patients with frequent bronchitis exacerbations ($p(\chi^2) < 0.001$; $r = 0.41(0)$). Severe clinical symptoms were observed in 81% of patients with an education level $\leq$ secondary general and in 95.2% of those with an education level $\geq$ secondary ($p(\chi^2) = 0.015$). Similarly, severe clinical symptoms were recorded in 77.3% of patients with group III disability and in 96.7% of those with group II and I disability ($p(\chi^2) < 0.001$; $r = 0.23(0)$) (Table 1).

Neuromuscular, skeletal, and statodynamic function impairments related to movement were recorded as moderate in 0.9% of cases and significantly severe in 0.6% of cases. Mental function impairments were noted as moderate and severe in 0.3% of cases. Respiratory system functional impairments (RFIs) were moderate in 72% of cases, severe in 25%, and significantly severe in 3.1%. Cardiovascular system functional impairments (CFIs) were mild in 9.0% of cases, moderate in 15%, and severe in 2.8%. Cumulative functional impairments were moderate in 72% of cases, severe in 25%, and significantly severe in 3.1% (Table 3).

Table 2 – Statistically significant correlation coefficients between COPD clinical data and anthropometric indicators of patients with chronic obstructive pulmonary disease

COPD Indicator	Indicator Name	R (p)
Degree of respiratory insufficiency (RI)	Age	0.27 (<0.001)
	Disability group	0.67 (<0.001)
Oxygen saturation	Age	-0.3 (<0.001)
	Disability group	-0.2 (0.006)
	BMI	-0.18 (0.012)

As shown in Table 2, there was a moderate direct correlation between the degree of respiratory failure and age ($r = 0.27$), as well as with disability group ($r = 0.67$). A weak inverse correlation was observed between oxygen saturation and age group, disability group, and body mass index (BMI).

Moderate respiratory system impairments were observed in 71.6% of cases: 87% at stage 2, 81.8% at stages 2–3, 52.5% at stage 3, 16.7% at stages 3–4, and 33.3% at stage 4 of the disease. Severe impairments were observed in 25% of cases: 11.6% at stage 2, 18.2% at stages 2–3, 43.3% at stage 3, 33.3% at stages 3–4, and 55.6% at stage 4. Significantly severe impairments were noted in 14% at stage 2, 50.0% at stages 3–4, and 11.1% at stage 4.

Mild cardiovascular system impairments were observed in 9% of cases: 9.6% at stage 2, 9.1% at stages 2–3, and 9.3%

at stage 3. Moderate impairments were recorded in 14.8% of cases: 8.9% at stage 2, 4.5% at stages 2–3, 26.8% at stage 3, and 27.8% at stage 4. Severe impairments were observed in 33.3% at stages 3–4 and 16.7% at stage 4.

Endocrine and metabolic function impairments were mild in 0.3% of cases at stage 3 and moderate in 1.2% of cases, including 11.1% at stage 4.

Moderate cumulative impairments were observed in 71.9% of cases: 87% at stage 2, 81.8% at stages 2–3, 53.6% at stage 3, 16.7% at stages 3–4, and 33.3% at stage 4. Severe cumulative impairments were recorded in 25% of cases: 11.6% at stage 2, 18.2% at stages 2–3, 43.3% at stage 3, 33.3% at stages 3–4, and 55.6% at stage 4. Significantly severe cumulative impairments were observed in 50% at stages 3–4 and 11.1% at stage 4 of the disease (Table 4).

Table 3 – Characteristics of impaired body functions in patients with COPD by severity (absolute number; %)

Impaired body functions	Severity									
	Normal		Mild		Moderate		Severe		Very severe	
	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%
Neuromuscular, skeletal and statodynamic functions	319	98,0	-	-	3	0,9	-	-	2	0,6
Mental functions	322	99,0	-	-	1	0,3	1	0,3	-	-
Sensory functions	323	99,7	-	-	1	0,3	-	-	-	-
Respiratory system functions	1	0,33	-	-	232	72,0	81	25,0	10	3,1
Urinary system functions	322	99,4	-	-	1	0,3	1	0,3	-	-
Cardiovascular system functions	238	73,0	29	9,0	48	15,0	9	2,8	-	-
Blood and immune system functions	322	99,4	1	0,3	1	0,3	-	-	-	-
Endocrine system and metabolism functions	319	98,0	1	0,3	4	1,2	-	-	-	-
Total impairments	-	-	-	-	233	72,0	81	25,0	10	3,1

Table 4 – Characteristics of impaired body functions in patients with COPD by severity and disease stage (absolute number; %)

Impaired body functions	Severity	COPD stage												p. trend
		Total (N=324)		2 (N=180)		2-3 (N=22)		3 (N=98)		3-4 (N=6)		4 (N=18)		
		abs.	%	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%	
Respiratory	Normal	1	0,3	-		-		1	1,	-	-	-	-	< 0,

system									0					0 0 1
	Moderate	23 2	71 ,6	12 7, 0	87, 0	18	81, 8	51	5 2 , 6	1	1 6, 7	6	3 3, 3	
	Severe	81	25 ,0	17 ,0	11, 6	4	18, 2	42	4 3 , 3	2	3 3, 3	1 0	5 5, 6	
	Very severe	10	3, 1	2, 0	14, 0	-	-	3	3 , 1	3	5 0	2	1 1, 1	
Cardi ovasc ular system	Normal	23 8	73 ,5	11 8, 0	80, 8	19	86, 4	60	6 1 , 9	4	6 6, 7	1 0	5 5, 6	< 0, 0 0 1
	Mild	29	9, 0	14 ,0	9,6	2	9,1	9	9 , 3	-	-	-	-	
	Moderate	48	14 ,8	13 ,0	8,9	1	4,5	26	2 6 , 8	-	-	5	2 7, 8	
	Severe	9	2, 8	1, 0	0,7	-	-	2	2 , 1	2	3 3, 3	3	1 6, 7	
Endoc rine system and metab olism	Normal	31 9	98 ,5	14 ,5	99, 3	22	10 0,0	95	9 7 , 9	6	1 0 0, 0	1 6	8 8, 9	< 0, 0 0 7
	Mild	1	0, 3	-	-	-	-	1	1 , 0	-	-	-	-	
	Moderate	4	1, 2	1	0,7	-	-	1	1 , 0	-	-	2	1 1, 1	
Total impair ments	Moderate	23 3	71 ,9	12 7, 0	87, 0	18	81, 8	52	5 3 , 6	1	1 6, 7	6	3 3, 3	< 0, 0 0 1

	Severe	81	25,0	17,0	11,6	4	18,2	42	43,3	2	33,3	10	55,6	
	Very severe	10	3,1	2,0	1,4	0	0	3	3,1	3	50,0	2	11,1	



Table 5 – Statistically significant correlation values between impaired body functions in patients with COPD and main clinical indicators

Clinical indicators	Impairment of body functions		
	Cardiovascular system	Respiratory system	Total impairments
COPD stage	0,22	0,41	0,41
Degree of respiratory failure (RF)	0,34	0,67	0,67
Severity of clinical symptoms		0,23	0,23
Saturation		-0,21	-0,2
Asthma control degree		0,39	0,39
Hormone dependence	-0,42	-0,36	-0,36

A weak direct correlation ($r = 0.22$) was observed between the stage of COPD and cardiovascular system dysfunction. A moderate direct correlation ($r = 0.41$) was found between respiratory system dysfunction and overall functional impairments. A moderate direct correlation ($r = 0.67$) was also recorded between the degree of respiratory failure and cardiovascular, respiratory, and overall functional impairments. A weak inverse correlation ($r = 0.21$) was noted between oxygen saturation and respiratory system dysfunction as well as overall functional impairments. A moderate direct correlation ($r = 0.39$) was identified between the degree of asthma control and respiratory system dysfunction and overall functional impairments. Finally, a moderate inverse correlation ($r = 0.36$) was observed between hormone dependence and cardiovascular, respiratory, and overall functional impairments (Table 5).

Table 6 – Statistically significant Spearman correlation coefficients between disability group and impaired body functions in patients with chronic obstructive pulmonary disease

Disability group	Impaired body functions	R (p)
	Cardiovascular system functions	0,44 (<0,001)
	Respiratory system functions	1 (<0,001)
	Total impairments	1 <0,001)

A moderate direct correlation ($r = 0.44$) was observed between the disability group and cardiovascular system dysfunction, while a strong direct correlation ($r = 1.0$) was found between the disability group and respiratory system dysfunction as well as overall functional impairments (Table 6).

A moderate direct correlation ($r = 0.3$) was recorded between arterial hypertension and cardiovascular system dysfunction, and a weak direct correlation ($r = 0.23$) between respiratory system dysfunction and overall functional impairments. A moderate direct correlation was also identified between the risk of cardiovascular complications and cardiovascular, respiratory, and overall functional impairments. A weak direct correlation was registered between chronic pulmonary heart disease and cardiovascular system dysfunction, and a moderate direct correlation ($r = 0.26$) between chronic pulmonary heart disease and respiratory system dysfunction as well as overall functional impairments (Table 7).

Table 7 – Statistically significant correlations between impaired body functions in patients with chronic obstructive pulmonary disease and comorbidities

Comorbidities	Cardiovascular system functions	Respiratory system functions	Total impairments
Arterial hypertension	0,3	0,23	0,23
Cardiovascular risk	0,34	0,27	0,27
Chronic pulmonary heart disease	0,18	0,26	0,26

Table 8 – Characteristics of activity limitations in patients with chronic obstructive pulmonary disease by severity (absolute number; %)

Activity limitation	Severity							
	Normal		1st		2nd		3rd	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%
Communication	323	100	1	0,3				
Orientation	323	100	1	0,3				
Mobility	40	12,0	256	79,0	25	7,7	3	0,9
Self-care	17	5,2	265	82,0	35	11,0	7	2,2
Work activity			233	72,0	82	25,0	9	2,8

It was established that among persons with disability due to COPD, 79% had first-degree mobility limitation, 7.7% had second-degree, and 0.9% had third-degree limitation. Regarding self-care ability, 82% had first-degree, 11% had second-degree, and 2.2% had third-degree limitation. For work activity, limitation of the first degree was recorded in 72% of cases, second degree in 25%, and third degree in 2.8% of cases (Table 8).

Table 9 presents the characteristics of activity limitations in persons with disability due to chronic obstructive pulmonary disease, taking into account the disease stage. First-degree mobility limitation was observed in 84.4% of patients at Stage 2, 86.4% at Stage 2–3, 76.5% at Stage 3, and 44.4% at Stage 4; second-degree limitation was found in 3.9% at Stage 2, 4.5% at Stage 2–3, 66.7% at Stage 3–4, and 27.8% at Stage 4; third-degree limitation was registered in 11.1% at Stage 4 ($p = 0.005$).

First-degree limitation of self-care ability was recorded in 87.2% at Stage 2, 86.4% at Stage 2–3, 80.6% at Stage 3, and 44.4% at Stage 4; second-degree limitation in 15.3% at Stage 3, 33.3% at Stage 3–4, and 44.4% at Stage 4; third-degree limitation in 33.3% at Stage 3–4 and 11.1% at Stage 4 ($p < 0.001$).

First-degree limitation of work ability was observed in 86.1% at Stage 2, 81.8% at Stage 2–3, 34.1% at Stage 3, and 11.1% at Stage 4; second-degree limitation in 55.6% at Stage 4, 33.3% at Stage 3–4, and 18.2% at Stage 2–3; third-degree limitation in 50% at Stage 3–4 and 11.1% at Stage 4 ($p < 0.001$).

Table 9 – Characteristics of activity limitations in patients with chronic obstructive pulmonary disease by disease stage (absolute number; %)

Activity limitation	Severity	Severity												
		All stages (N=324)		2 (N=180)		2-3 (N=22)		3 (N=98)		3-4 (N=6)		4 (N=18)		p.tr end
		Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%	
Mobility	normal	40	12,3	20	11,1	2	9,1	15	15,3	-	-	3	16,7	0,005
	1st	256	79	152	84,4	19	86,4	75	76,5	2	33,3	8	44,4	
	2nd	25	7,7	7	3,9	1	4,5	8	8,2	4	66,7	5	27,8	
	3rd	3	0,9	1	0,6	-	-	-	-	-	-	2	11,1	
Self-care	normal	17	5,2	13	7,2	1	4,5	3	3,1	-	-	-	-	<0,001
	1st	265	81,8	157	87,2	19	86,4	79	80,6	2	33,3	8	44,4	
	2nd	35	10,8	8	4,4	2	9,1	15	15,3	2	33,3	8	44,4	
	3rd	7	2,2	2	1,1	-	-	1	1	2	33,3	2	11,1	
Work activity	1st	233	71,9	155	86,1	18	81,8	53	54,1	1	16,7	6	33,3	<0,001
	2nd	82	25,3	24	13,3	4	18,2	42	42,9	2	33,3	10	55,6	
	3rd	9	2,8	1	0,6	-	-	3	3,1	3	50	2	11,1	

Table 10 – Statistically significant correlation coefficients between activity limitations and impaired body functions in patients with chronic obstructive pulmonary disease

Impaired body functions	Activity limitation		
	Self-care	Mobility	Work activity
Neuromuscular, skeletal, and statodynamic functions	0,18	0,23	0,22
Cardiovascular system	0,23	0,25	0,44
Respiratory system	0,6	0,24	1

Total impairments	0,61	0,25	1
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A direct weak correlation was observed between impairment of neuromuscular, skeletal, and movement-related functions and activity limitation: in self-care ($r = 0.18$), mobility ($r = 0.23$), and work activity ($r = 0.22$). Between cardiovascular function impairment and activity limitation, there was a direct weak correlation for self-care ($r = 0.23$), a direct moderate correlation for mobility ($r = 0.25$), and a direct moderate-to-strong correlation for work activity ($r = 0.44$). For respiratory function impairment, there was a direct strong correlation with work activity ($r = 1.0$), a direct moderate correlation with self-care ($r = 0.6$), and a direct weak correlation with mobility ($r = 0.24$). Between total body function impairments and self-care, a direct moderate correlation was found ($r = 0.61$); with mobility, a direct weak correlation ($r = 0.25$); and with work activity, a direct strong correlation ($r = 1.0$) (Table 10).

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Conceptualization

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The authors declare no conflict of interest.

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