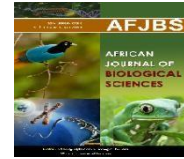


<https://doi.org/10.33472/AFJBS.6.4.2024.287-297>



## African Journal of Biological Sciences



Research Paper

Open Access

### CHARACTERISTICS OF CLINICAL AND FUNCTIONAL DISORDERS AND FEATURES OF MEDICAL AND SOCIAL REHABILITATION OF DISABLED PEOPLE DUE TO MALIGNANT NEOPLASMS OF THE BRAIN

**Olga Ivanovna Potapenko,**

Head of the 5th Expert Team of the Federal State Budgetary Institution "Main Bureau of Medical and Social Expertise for the Moscow Region" of the Ministry of Labor and Social Protection of the Russian Federation, 6 Kokkinaki Street, Moscow, 125319, Russia. E-mail: [o.i.potapenko@yandex.ru](mailto:o.i.potapenko@yandex.ru), <https://orcid.org/0009-0008-3953-0312>

**Natalia Sergeevna Zapariy,**

Doctor of Medical Sciences, Head of the Educational and Organizational Department of the Educational and Methodological Center of the Federal State Budgetary Institution "Federal Bureau of Medical and Social Expertise" of the Ministry of Labor and Social Protection of the Russian Federation, 3 Ivan Susannin Street, Moscow, 127486, Russia. E-mail: [zapariy\\_N@fbmse.ru](mailto:zapariy_N@fbmse.ru), <https://orcid.org/0000-0002-7687-763X>

**Denis Dmitrievich Bolotov,**

Ph.D., Associate Professor, Deputy Head of the Scientific and Methodological Center for the Organization of Medical and Physical Rehabilitation – Orthopedic Traumatologist at the Federal State Budgetary Institution "Main Bureau of Medical and Social Expertise" of the Ministry of Labor of Russia, Moscow, 125993, 2/1 Barrikadnaya Street, SPIN-code: 8846-6802. Associate Professor of the Department of Traumatology and Orthopedics of the Federal State Budgetary Educational Institution DPO RMANPO of the Ministry of Health of Russia, Moscow, 127486, 3 Ivan Susannin Street  
[bolotov\\_d@mail.ru](mailto:bolotov_d@mail.ru),  
<https://orcid.org/0000-0003-1320-0960>,

**Vladimir Gennadievich Levkin,**

Medical and Social Expert, Head of Bureau 51 – branch of the Federal State Budgetary Institution "Main Bureau of Medical and Social Expertise for the City of Moscow" of the Ministry of Labor of Russia. 125040 Moscow.

E-mail: [levkinvg@yandex.ru](mailto:levkinvg@yandex.ru)

ORCID: 0000-0003-1602-0658

**Artem Yuryevich Asriyan,**

Medical and Social Expert at the Federal State Budgetary Institution "Federal Bureau of Medical and Social Expertise" of the Ministry of Labor and Social Protection of the Russian Federation, 3 Ivan Susannin Street, Moscow, 127486, Russia. E-mail: [asriyan1996@icloud.com](mailto:asriyan1996@icloud.com),

<https://orcid.org/0000-0002-2751-2968>

**Svyatoslav Valerievich Novoseltsev**

M.D., D.Sc. (Medicine), Professor of the Department of Sports Medicine and Medical Rehabilitation of the Sechenov First Moscow State Medical University (Sechenov University) (Moscow, Russia)

ORCID ID: 0000-0002-0596-2343

E-mail: [snovoselcev@mail.ru](mailto:snovoselcev@mail.ru)

Article History

Volume 6, Issue 4, Feb 2024

Received: 17 Feb 2024

Accepted : 01 Mar 2024

doi: 10.33472/AFJBS.6.4.2024.287-297

### Abstract

The emergence of the direction of “comprehensive rehabilitation” requires the formation of rehabilitation programs of this type in specific nosological areas for patients with disabilities. Malignant brain tumors (MBTs) are one of the pressing problems of modern society. The effectiveness of rehabilitation measures and improving the quality of life of patients with FCI depends on the compliance of the technologies used, the severity of clinical and functional disorders and the dynamics of their changes, leading to varying degrees of severity of disability.

**Objective.** Based on clinical and functional disorders of the body of disabled people due to malignant brain tumors, assess their degree of disability.

**Materials and methods.** The study is represented in the form of Excel tables, using methods: documentary, data copying (286 units). Statistics were used for quantitative variables: average, median. To compare two independent groups of the reliability indicator study, X2 statistics and Spearman's rank correlation coefficient were performed. The level when checking the significance of statistical hypotheses was assumed to be 0,05. Processing and analysis were carried out in the R environment (an environment for statistical data analysis; <https://www.r-project.org> ).

**Results:** The analysis shows that the largest share of life restrictions caused in disabled people's lives by the malignant neoplasms of the brain are as follows: the limitation of the ability to perform basic movements and self - care tasks of the 1st degree. The limitation to perform work and self - care tasks of the 2nd and 3rd degree.

**Conclusion.** Expert-rehabilitation diagnostics of various age groups of the population with various nosological forms of MBTs, examined by the ITU bureau, generates individually oriented information about the required volume of rehabilitation measures, which take into account the provisions of the ICF. Carrying out expert-rehabilitation and medical-social diagnostics of this contingent of disabled people allows us to predict the volume of examinations, the course of the disease and the use of aspects of health care and rehabilitation care.

**Keywords:** *disability, malignant neoplasms of the brain, age groups, clinical and functional disorders, disability.*

### Introduction

In the past decade, the incidence of brain tumors has increased worldwide across all age groups of the population [1, 2, 3, 4]. The morbidity and mortality rates from brain cancer were reported as 3.4 and 3.5 per 100,000 population globally [1, 5]. According to Rosstat data, malignant neoplasms of the brain constitute 4.2% of the overall disability structure, with a noticeable trend towards an increase in the number of newly recognized individuals with disabilities, predominantly falling into the II disability group [6, 7, 8, 9, 10].

In connection with the enactment of Federal Law of December 25, 2023 No. 651-FZ “On Amendments to Certain Legislative Acts of the Russian Federation”, the majority of its provisions coming into effect on March 1, 2025, a comprehensive state system for the rehabilitation and habilitation of persons with disabilities is being formed [11]. According to the provisions of this regulatory act, comprehensive rehabilitation and habilitation of individuals with disabilities encompass the following main directions: medical rehabilitation, sanatorium-resort treatment, prosthetic-orthopedic assistance to individuals with disabilities, professional, social, sociocultural, physical rehabilitation and habilitation, early assistance to children and their families, and the provision of technical rehabilitation means to individuals with disabilities.

To conduct rehabilitation activities "based on interdepartmental cooperation" [11], it is necessary to specify the requirements for mobilizing resources (including those of a medical nature) in the process of correcting the activity limitations of individuals with disabilities. The determination of these needs is based on establishing the severity of functional impairments, which served as the rationale for conducting this study.

## Research Objective

The aim of the study is to assess the extent of activity limitations in individuals with disabilities due to malignant brain tumors based on clinical and functional impairments, in order to evaluate the need for the development of comprehensive rehabilitation programs for these individuals.

## Materials and Methods

The study was conducted using Excel tables and employed methods such as documentary analysis and data extraction (286 cases). For quantitative variables, statistical measures such as mean and median were utilized. The comparison of two independent groups involved reliability indicators, X2 statistics, and Spearman's rank correlation coefficient. The significance level for testing statistical hypotheses was set at 0.05. Data processing and analysis were carried out using the R environment (a platform for statistical data analysis; [https://www.r-project.org]).

## Results

The study revealed the socio-medical characteristics of individuals with disabilities due to malignant brain tumors as follows: 52.1% were male, 47.9% were female, with 41.0% in the young age group, 28.0% in the middle age group, and 31.0% above working age. Among them, 55% had higher education, 30.8% had secondary vocational education, and 11.2% had general secondary education. The average age for both men and women was 49 years, average height was 172 cm, average weight was 76 kg, and the average body mass index was 25.7 kg/m<sup>2</sup>, with 25.3 for women and 25.95 for men. Disabled individuals in Group I constituted 47.9%, Group II - 39.2%, and Group III - 12.9%. The majority (50.0%) had malignant diseases at stage IV - 143 individuals, 32.5% at stage III, and 16.5% at stage II. In terms of malignancy grade, 50% were identified at grade 4, 22.5% at grade 3, and 16.4% at grade 2.

Among the clinical manifestations, the most frequently observed symptoms included general weakness, fatigue, headache, dizziness, cognitive impairments, ataxia, decreased vision, as well as epileptic seizures, convulsions, motor disturbances, speech impairments, and limb swelling.

As the malignancy grade of tumors increased - up to grades 2, 3, 4 - the leading complaints among patients were fatigue, general weakness, headache, cognitive impairments, and dizziness, collectively constituting 45% of all complaints. The Spearman rank correlation coefficient between complaints comparing the degree of malignancy showed values of 0.67 for 2-3, 0.74 for 2-4, and 0.90 for 3-4 (Table 1).

For patients in disability groups II-I, limb weakness was more frequently noted than for those in disability group III. For disability group I, motor disturbances, hearing and vision impairment, and pelvic organ dysfunction were most characteristic. The correlation coefficient between clinical symptoms for disability groups I-II was 0.92, for I-III was 0.77, and for II-III was 0.81.

Disruption of sensory visual functions was observed in 13.3%, with minor impairments noted in 13.3% and significant impairments in 0.3%. Sensory auditory function disruptions were minimal, noted in 0.3%.

Neuromuscular, skeletal, and movement-related disorders were identified in 17.0% with minor impairments, 23% with moderate impairments, 11% with severe impairments, and 7.7% with significantly severe impairments. Disorders affecting the blood and immune system were reported in 15.0%, with moderate impairments in 15.0%, severe impairments in 39.0%, and significantly severe impairments in 46.0%.

Respiratory system impairments were documented in 1.4% with minor impairments, 0.3% with moderate impairments, and 0.3% with severe impairments. Cardiovascular system impairments were noted in 31.0% with minor impairments and 0.7% with moderate impairments. Language and speech function impairments were reported in 3.5% with minor impairments, 1.4% with moderate impairments, and 3.8% with severe impairments. Endocrine system and metabolism function disruptions were noted in 9.8% with minor impairments and 0.7% with significantly severe impairments. Impairments of the urinary system were identified in 1.4% with minor impairments, 2.8% with moderate impairments, 8.0% with severe impairments, and 0.3% with significantly severe impairments. Cumulative impairments were moderate in 15%, severe in 38%, and significantly severe in 47%.

**Table 1. Comparative structure of complaints of disabled people due to malignant brain tumors, taking into account the degree of malignancy**

I stage	N	Rank	II stage	N	Rank	III stage	N	Rank	IV stage	N	Rank
Pain	3	16	Fatigue, general weakness	39	1	Fatigue, general weakness	78	1	Fatigue, general weakness	100	1
Dizziness	2	4	Headache	27	2	Headache	56	2	Headache	77	2

Visual impairment	2	6	Ataxia	16	5	Dizziness	36	4	Cognitive impairment	68	3
Cognitive impairment	2	3	Dizziness	15	4	Cognitive impairment	35	3	Dizziness	62	4
Numbness in limbs	2	12	Cognitive impairment	15	3	Emotional and personality disorders	29	8	Ataxia	47	5
Weakness in limbs	2	7	Numbness of the limbs	10	12	Ataxia	22	5	Decreased vision	44	6
Fatigue, general weakness	2	1	Decreased vision	9	6	Decreased vision	20	6	Weakness in the limbs	43	7
Ataxia	1	5	Seizures, convulsions, tremors	9	9	Weakness in the limbs	18	7	Speech Impairment	36	11
Headache	1	2	Nausea, vomiting	8	13	Seizures, convulsions, tremors	17	9	Movement disorders	29	10
Pain in limbs	1	17	Numbness	6	21	Nausea, vomiting	16	17	Emotional and personality disorders	25	8
Thought disorders	1	26	Weakness in the limbs	6	7	Pain	15	16	Seizures, convulsions, tremors	24	9
Cardiovascular system disorders	1	15	Pain in limbs	5	17	Movement disorders	14	10	Violation of the cardiovascular system	21	15
Tinnitus	1	23	Movement disorders	5	10	Numbness of the limbs	13	12	Dysfunction of the pelvic organs	20	14
			Pelvic organ dysfunction	5	14	Pain in limbs	9	17	Numbness of the limbs	17	12
			Syncope	4	18	Violation of the cardiovascular system	9	15	Nausea, vomiting	15	13
			Emotional and personality disorders	4	8	Dysfunction of the pelvic organs	9	14	Pain	11	16
			Swelling	3	19	Speech Impairment	8	11	Pain in limbs	10	17
			Speech Impairment	2	11	Syncope	8	18	Swelling	10	19
			Spasticity	2	34	Hearing loss	5	22	Disorientation	9	20

To specify the need for rehabilitation measures, patients, based on a combination of clinical symptoms, were categorized into three clusters (Table 2).

Cluster 1 included the following impairments: cognitive deficits, coordination and motor disorders, muscle weakness, and pelvic organ dysfunction. The distinctive feature of the first cluster was that it comprised patients showing a tendency toward disease progression and an aggravation of disability status.

Cluster 2 encompassed dizziness, pain, fatigue, general weakness, and reduced vision. Patients with complaints common to all disabled individuals were assigned to the second cluster.

Cluster 3 comprised epileptic seizures, convulsions, tremors, emotional-personal disorders, and limb pain. Patients with less pronounced functional impairments, usually belonging to the third disability group, were placed in the third cluster, with a tendency for a decrease in prevalence corresponding to the severity of disability.

**Table 2. Characteristics of complaints by clusters and groups of disabilities, disabled people due to malignant brain tumors (absolute number, %)**

Disability group	Number of patients		Cluster 1		Cluster 2		Cluster 3	
	abs. number	%	abs. number	%	abs. number	%	abs. number	%
I	43	100,0	19	44,2	34	79,1	25	58,1

II	110	100,0	58	52,7	85	77,3	56	50,9
III	133	100,0	88	66,2	91	68,4	62	46,6

The distribution of the main types of persistent functional impairments in the bodies of individuals with disabilities due to malignant brain tumors, based on the degree of their severity, is reflected in Table 3 in absolute numbers and as a percentage.

The identified types of impairments allow determining the spectrum of functional disorders characteristic for patients with established disability due to malignant brain tumors.

**Table 3. Characteristics of the main types of persistent dysfunctions of the body of disabled people due to malignant neoplasms of the brain according to the degree of their severity (absolute number, %)**

Title of main types of persistent impairments in the functions of a disabled person	Severity of impairment									
	Normal		Minor		Moderate		Severe		Significantly Severe	
	abs. number	%	abs. number	%	abs. number	%	abs. number	%	abs. number	%
Sensory visual impairment	246	86,0	39	13,7	0	0	0	0	1	0,3
Sensory auditory dysfunction	285	85,0	1	0,3	0	0	0	0	1	0,3
Sensory dysfunction	243	85,0	42	14,7	0	0	0	0	1	0,3
Impairment of neuromuscular, skeletal and movement-related (static-dynamic) functions	116	41,0	50	17,0	66	23,0	32	11,0	22	7,7
Respiratory system dysfunction	280	98,0	4	1,4	1	0,3	1	0,3	0	0
Impaired functions of the cardiovascular system	196	69,0	88	31,0	2	0,7	0	0	0	0
Impaired language and speech functions	261	91,0	10	3,5	4	1,4	11	3,8	0	0
Endocrine and metabolic disorders	256	90,0	28	9,8	0	0	0	0	2	0,7
Dysfunction of the blood and immune system	2	0,7	0	0	42	15,0	111	39,0	131	46,0
Mental dysfunction	270	94,0	9	3,1	4	1,4	1	0,3	2	0,7
Urinary system disorder	250	87,0	4	1,4	8	2,8	23	8,0	1	0,3
Skin dysfunction and related systems	284	99,0	0	0	2	0,7	0	0	0	0
Disorders caused by external deformity	284	99,0	0	0	1	0,3	1	0,3	0	0
Total violations	0	0	0	0	43	15,0	110	38,0	133	47,0

The distribution of the main types of persistent functional impairments in the bodies of disabled individuals due to malignant brain tumors, based on the degree of their severity, taking into account age groups, is reflected in Table 4.

Minor impairments of the cardiovascular system were noted in 30.8%, among individuals of young age in 13.8%, middle age in 35.8%, and in 43% of individuals older than working age in 48.3%. Moderate impairments were identified in 2.3% of individuals older than working age ( $p<0.001$ ). Impairments in the blood and immune system functions were recorded in 14.7%, including 19.0% among individuals aged 18-44, 13.6% among middle-aged individuals, and 10.1% among individuals older than working age. Severe impairments were noted in 38.8%, with 46.6% among young individuals, 35.8% among middle-aged individuals, and 31.5% among individuals older than working age. Significantly pronounced impairment of blood and immune system functions was observed in 45.8%, with 32.8% among young individuals, 50.6% among middle-aged individuals, and 58.4% among individuals older than working age ( $p<0.007$ ).

Moderate impairments were observed in 15% of cases, including 20.7% among young individuals, 13.6% among middle-aged individuals, and 8.99% among individuals older than working age ( $p<0.004$ ). Severe cumulative impairments were present in 38.5% of cases, comprising 45.7% among young individuals,

35.8% among middle-aged individuals, and 31.5% among individuals older than working age. Significantly pronounced cumulative impairments were identified in 46.5% of cases, with 33.6% among young individuals and 50.6% among individuals older than working age. The correlation between neuromuscular, skeletal, and movement-related functions was 0.20, impairment of cardiovascular system functions and age groups ( $r=0.34$ ), impairment of the urinary system, cumulative impairment ( $r=0.23$ ). A direct moderate correlation ( $r=0.30$ ) was observed between ataxia and neuromuscular impairments, while a direct moderate correlation ( $r=0.50$ ) was observed between speech and language impairments. A direct moderate correlation ( $r=0.37$ ) was found between weakness in the limbs and impairment of postural dynamic functions, a weak direct correlation ( $r=0.20$ ) between impairment of blood and immune system functions, and a weak direct correlation ( $r=0.23$ ) between cumulative impairments. A moderate direct correlation ( $r=0.31$ ) was noted between hearing loss and sensory auditory function impairments. A strong direct correlation ( $r=0.48$ ) was identified between motor impairments and postural dynamic functions, as well as a moderate direct correlation ( $r=0.34$ ) with impairment of urinary system function. A moderate direct correlation ( $r=0.57$ ) was observed between impairments of pelvic organ function and impairment of urinary system function.

**Table 4. Characteristics of impaired body functions in disabled people due to malignant brain tumors by severity, taking into account age groups (absolute number, %)**

Title of disabled individual's bodily functions	Degree of severity	Age groups								P	P trend
		Total		18-44 years old		45-54 years old, women 45-59 years old, men		55 years and >, women 60 years old, men			
		abs. number	%	abs. number	%	abs. number	%	abs. number	%		
Impaired cardiovascular function	normal	196	68,5	100	86,2	52	64,2	44	49,4	<0,001	<0,001
	minor	88	30,8	16	13,8	29	35,8	43	48,3	-	-
	moderate	2	0,7	0	0	0	0	2	2,3	-	-
Dysfunction of the blood and immune system	normal	2	0,7	2	1,72	0	0	0	0	0,007	<0,001
	moderate	42	14,7	22	19,0	11	13,6	9	10,1	-	-
	severe	111	38,8	54	46,6	29	35,8	28	31,5	-	-
	significantly severe	131	45,8	38	32,8	41	50,6	52	58,4	-	-
Urinary system dysfunction	normal	250	87,4	110	94,8	72	88,9	68	76,4	0,002	<0,001
	Minor	4	1,4	2	1,72	0	0	2	2,25	-	-
	moderate	8	2,8	2	1,72	2	2,47	4	4,49	-	-
	severe	23	8,04	2	1,72	7	8,64	14	15,7	-	-
	significantly severe	1	0,35	0	0	0	0	1	1,12	-	-
Total violations	moderate	43	15,0	24	20,7	11	13,6	8	8,99	0,004	<0,001
	severe	110	38,5	53	45,7	29	35,8	28	31,5	-	-
	significantly severe	133	46,5	39	33,6	41	50,6	53	59,6	-	-

The distribution of the degree of impaired body functions in disabled individuals due to malignant brain neoplasms, depending on gender, is reflected in Table 5.

Among men, mental function impairments are more pronounced than among women. Among men, a higher proportion of moderate (75.0%), severe (100.0%), and significantly severe impairments (50.0%) were observed (Table 5). Language and speech function impairments are more pronounced among women – 63.6% compared to 36.4% among men, and the proportion of moderate impairments is higher among men (75.0%) compared to 25.0% among women. Neuromuscular, skeletal, and movement-related function impairments, both minor and moderate, are more common among men (62.0% and 62.1%) than among women (38.8% and 37.9%). Impairment of the cardiovascular system function in men is minor in 52.3% and moderate in 100%, while in women, it is minor in 47.7% of cases. Impairment of blood and immune system function is moderate among women in 57.1%, and severe and significantly severe among men (52.3% and 55.7%), compared to 47.7% and 44.3% among women. Cumulative impairments are moderate among women in 58.21%, severe and significantly severe among men (51.8% and 55.6%). Impairment of language and speech functions was more frequently noted among severely disabled individuals, with 11 cases (100%) at stage 4 malignancy of the tumor ( $p=0.006$ ).

**Table 5. Characteristics of the severity of impaired body functions of disabled people due to malignant brain tumors depending on gender (absolute number, %)**

Functions of the disabled person's body	Degree of impairment of functions	Total	Gender			
			Male		Female	
			abs. number	%	abs. number	%
Impairment of mental functions	normal	270	139	51,5	131	48,5
	Minor	9	5	55,6	4	44,4
	moderate	4	3	75,0	1	25,0
	severe	1	1	100,0	0	0
	significantly severe	2	1	50,0	1	50,0
Impairment of language and speech functions	normal	261	134	51,3	127	48,7
	minor	10	8	80,0	2	20,0
	moderate	4	3	25,0	1	25,0
	severe	11	4	36,4	7	63,6
Impairment of sensory functions	normal	243	124	51,0	119	49,0
	minor	42	24	57,1	0	42,9
	significantly severe	1	1	100,0	121	0
Impairment of visual sensory functions	normal	246	125	50,8	121	49,2
	minor	39	23	59,0	16	41,0
	significantly severe	1	1	100,0	0	0
Impairment of neuromuscular, skeletal, and movement-related functions	normal	116	57	49,1	59	50,9
	minor	50	31	62,0	19	38,8
	moderate	66	41	62,1	25	37,9
	severe	32	11	34,4	21	65,6
	significantly severe	22	9	40,9	13	59,1
Impairment of cardiovascular system functions	normal	196	101	51,5	95	48,5
	minor	88	46	52,3	42	47,5
	moderate	2	2	100,0	0	0
Impairment of respiratory system	normal	280	145	51,8	135	48,2
	minor	4	2	50,0	2	50,0
	moderate	1	1	100,0	0	0

Functions of the disabled person's body functions	Degree of impairment of functions	Total	Gender			
			Male		Female	
			abs. number	%	abs. number	%
	severe	1	1	100,0	0	0
Impairment of digestive system functions	normal	264	137	51,9	127	48,1
	minor	20	11	55,0	9	45,0
	severe	2	1	50,0	1	50,0
Impairment of endocrine system and metabolism functions	normal	256	136	53,2	120	46,9
	minor	28	13	46,4	15	53,6
	significantly severe	2	0	0	2	100,0
Impairment of blood and immune system functions	normal	2	0	0	2	100,0
	moderate	42	18	42,9	24	57,1
	severe	111	58	52,3	53	47,7
	significantly severe	131	73	55,7	58	44,3
Impairment of urinary system functions	normal	250	133	53,2	117	46,8
	minor	4	2	50,0	2	50,0
	moderate	8	3	37,5	5	62,5
	severe	23	11	47,8	12	52,2
	significantly severe	1	0	0	1	100,0
Overall impairments	moderate	43	18	41,9	25	58,1
	severe	110	57	51,8	53	48,2
	significantly severe	133	74	55,6	59	44,4

The dependence of the degree of impairment of organ functions in disabled individuals due to malignant brain tumors, taking into account the malignancy grade of the tumor process, is reflected in Table 6.

**Table 6. Characteristics of the severity of impaired body functions of disabled people due to brain cancer, taking into account the degree of malignancy of the tumor process (absolute number, %)**

Impairment of body functions	Grade	Severity of impairment										P trend
		Normal		Minor		Moderate		Severe		Significantly Severe		
		Abs. number	%	Abs. number	%	Abs. number	%	Abs. number	%	Abs. number	%	
Language and speech functions	1	2	0,77	1	10,0	0	0	0	0	0	0	0,006
	2	47	18,0	0	0	0	0	0	0	0	0	-
	3	87	33,3	3	30,0	3	75,0	0	0	0	0	-
	4	125	47,9	6	60,0	1	25,0	11	100,0	0	0	-
Neuromuscular, skeletal, and movement-related functions	1	1	0,86	1	4,0	0	0	0	0	0	0	0,009
	2	18	15,5	10	20,0	15	22,7	2	6,2	2	9,1	-
	3	45	38,8	19	38,0	19	28,8	5	15,6	5	22,7	-
	4	52	44,8	19	38,0	32	48,5	25	78,1	15	68,2	-



Cardiovascular system functions	1	1	0,51	2	2,27	0	0	0	0	0	0	0,040
	2	36	18,4	11	12,5	0	0	0	0	0	0	-
	3	72	36,7	20	22,7	1	50,0	0	0	0	0	-
	4	87	44,4	55	62,5	1	50,0	0	0	0	0	-
Blood and immune system functions	1	0	0	0	0	2	4,76	1	0,9	0	0	0,000
	2	2	100,0	0	0	25	59,5	16	14,4	4	3,1	-
	3	0	0	0	0	10	23,8	76	64,0	12	9,2	-
	4	0	0	0	0	5	11,9	23	20,7	115	87,8	-
Urinary system functions	1	3	1,2	0	0	0	0	0	0	0	0	0,024
	2	44	17,6	0	0	2	25,0	1	4,3	0	0	-
	3	84	33,6	1	25,0	2	25,0	6	26,1	0	0	-
	4	119	47,6	3	75,0	4	50,0	16	69,6	1	100,0	-
Overall impairments	1	0	0	0	0	2	4,65	1	0,91	0	0	0,000
	2	0	0	0	0	26	60,5	16	14,5	5	3,76	-
	3	0	0	0	0	10	23,3	70	63,6	13	9,77	-
	4	0	0	0	0	5	11,6	23	20,9	115	86,5	-

Impairment of neuromuscular, skeletal, and movement-related functions was observed in 20.0-22.7% of cases with mild to moderate impairment at Grade 2 malignancy, and in 38% with mild impairment. In cases of Grade 3 malignancy, 28.8% exhibited moderate impairment, 15.6% had severe impairment, and 22.7% had significant impairment. For Grade 4 malignancy, 48.5% had moderate impairment, 78.1% had severe impairment, and 68.2% had significant impairment. Impairment of cardiovascular functions was observed in 50% of cases with moderate impairment, noted at Stages 3-4 malignancy ( $p=0.009$ ). Impairment of blood and immune system function showed moderate impairment in 4.7% at Stage I, 59.5% at Stage II, 23.8% at Stage III, and 11.9% at Stage IV malignancy. Severe impairments were noted in 64% at Stage III and 20.7% at Stage IV, while significantly severe impairments were observed in 87.8% at Stage IV. Impairment of the urinary system was observed in 25% of cases with moderate impairment at Stages II-III, and in 59% at Stage IV; at Stage IV, severe impairments were noted in 69.6% of cases ( $p=0.024$ ). Significant impairments were observed in 86.5% of cases at Stage 4, severe impairments in 63.6% at Stage III, and moderate impairments in 60.5% at Stage II. The correlation between neuromuscular, skeletal, and movement-related functions was  $r=0.15$ , impairment of cardiovascular functions was  $r=0.15$ , impairment of blood and immune system functions was  $r=0.70$ , and with cumulative impairments was  $r=0.68$ .

### Conclusion

In accordance with the changes in legislation and the formation of a state system for comprehensive rehabilitation and habilitation of individuals with disabilities [11], which includes medical rehabilitation, it is expected that the structure of rehabilitation activities will be altered. Therefore, there is a need to specify the priority directions for carrying out rehabilitation measures, taking into account the needs of individuals with various nosologies, considering the degree of expression of functional impairments and the dynamics of their changes, which, in turn, determine the degree and dynamics of changes in the limitations of the body's activities.

Individuals with disabilities due to malignant brain tumors have the highest proportion of limitations in the ability for self-care: 53.1% for the first degree of severity, 27.6% for the second, and 16.8% for the third. Limitations in mobility are observed in 40.6% for the first degree, 12.6% for the second, and 7.3% for the third. Restrictions in communication are noted in 2.1% for the first degree, 3.5% for the second, and 0.7% for the third. Limitations in work activity are reported in 14.7% for the first degree, 38.8% for the second, and 44.1% for the third.

The most pronounced limitations in the activities of daily living for individuals with disabilities are in the areas of self-care, mobility, and work activity.

A direct moderate correlation between impairments in mental functions is established with limitations in the ability to orient oneself ( $r=0.40$ ), and a weak direct correlation is found with limitations in communication ability ( $r=0.20$ ), learning ability ( $r=0.26$ ), and self-behavioral control ( $r=0.37$ ).

Between impairments in language and speech functions, a weak direct correlation is established with limitations in the ability for self-care ( $r=0.16$ ), mobility ( $r=0.18$ ), orientation ( $r=0.14$ ), behavioral self-control ( $r=0.21$ ), and work activity ( $r=0.14$ ).

Impairments in neuromuscular, skeletal, and movement-related functions exhibit a strong direct correlation with limitations in mobility ( $r=0.71$ ) and a moderate direct correlation with the ability for self-care ( $r=0.41$ ).

Between immune system impairments and the ability for self-care ( $r=0.44$ ), mobility ( $r=0.42$ ), there is a moderate direct correlation, and with work activity ( $r=0.90$ ), there is a strong direct correlation.

Impairments in the urinary system function show a moderate direct correlation with self-care ( $r=0.36$ ) and mobility ( $r=0.46$ ).

Thus, the conducted study among individuals with malignant brain tumors will provide a clearer understanding of limitations in activities of daily living, determining the need for rehabilitation measures, orthotics, rehabilitation equipment, and other rehabilitation interventions.

The presented algorithm for identifying functional impairments and limitations in the activities of daily living, as well as assessing the effectiveness of rehabilitation measures, can be applied to patients undergoing examination in medical-social expert institutions and can be replicated for other nosologies.

**Author contributions:** Conceptualization of the article - Zapariy N.S.; statistical data analysis - Potapenko O.I.; writing and editing of the article text - Potapenko O.I., Zapariy N.S., Bolotov D.D.; selection, review of publications on the research topic - Zapariy N.S.; article text verification and editing - Zapariy N.S., Bolotov D.D.

**The authors declare no conflicts of interest.**

## REFERENCES

1. Dyachenko A.A., Subbotina A.V., Izmailov T.R. and others. Epidemiology of primary brain tumors (literature review). **Bulletin of the Russian Scientific Center of X-ray Radiology**. 2013. (In Russ.). Access mode: [http://vestnik.ncrr.ru/vestnik/v13/papers/valkov1\\_v13](http://vestnik.ncrr.ru/vestnik/v13/papers/valkov1_v13).
2. Zhuikova L.D., Choinzonov E.L., Ananina O.A., Pikalova L.V., Odintsova I.N., Kononova G.A. Incidence of malignant neoplasms of the brain and other parts of the central nervous system (C70–C72) in the regions of Siberia and the Far East. **Tumors of the head and neck**. 2021;11(4):64-72. <https://doi.org/10.17650/2222-1468-2021-11-4-64-72>.
3. Walker D, Bendel A, Stiller C. et al. Central nervous system tumors. 2nd ed. **Springer International Publishing**. 2017:335–381.
4. Jiang B, Liu H, Sun D, Sun H, Ru X, Fu J, Ge S, Wang WW. Mortality due to primary brain tumours in China and detection rate in people with suspected symptoms: a nationally representative cross-sectional survey. **World J Surg Oncol**. 2021,19(1):71. <https://doi.org/10.1186/s12957-021-02179-5>.
5. Merabishvili A.V., Kenneth K., Valkov M.Yu. and others. Epidemiology and survival of patients with malignant neoplasms of the brain (C 71). Population study. **Oncology issues**. 2020;66(5):489-499. <https://doi.org/10.1186/s12957-021-02179-5>.
6. Osadchikh A.I., Puzin S.N., Lavrova D.I., etc. Problems of disability in Russia. Status and prospects. **Medicine**. 2012:366 s.
7. Puzin S.N., Shurgaya M.A., Pogosyan G.E. Malignant neoplasms in the Russian Federation, ranking place in the structure of disability of the population and current approaches to early medical and social rehabilitation, taking into account the nosological aspect. **Materials of the All-Russian scientific and practical conference “Comprehensive rehabilitation of disabled people at the present stage. Theoretical and applied aspects”**, Novokuznetsk. 2022:106-108.
8. Puzin S.N., Dymochka M.A., Boytsov S.A. Epidemiological picture of disability among various demographic groups of the population in the Russian Federation in the aspect of state social policy. **Medico-social examination and rehabilitation**. 2018;21(1-2):50-54. <http://dx.doi.org/10.18821/1560-9537-2018-21-1-50-54>.
9. Sklyarenko R.T., Dovgalyuk A.Z., Omarov M.A., Spiridonova V.S. Malignant neoplasms and disability: a manual for doctors. St. Petersburg; **Publishing house SPbGEU**. 2021:693 p.

10. Strukova O.G. Conceptual approaches to organizing the provision of services for comprehensive rehabilitation and habilitation of people with disabilities and disabled children. Materials of the All-Russian scientific and practical conference with international participation “Comprehensive rehabilitation of disabled people at the present stage. Theoretical and applied aspects”, Novokuznetsk.2022:48-49.
11. Federal Law of December 25, 2023 No. 651-FZ “On Amendments to Certain Legislative Acts of the Russian Federation”.