

Экономическое бремя инвалидности от рака легкого

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Актуальность исследования: Многие формы инвалидности ведут к значительным медико-санитарным потребностям населения и соответственно значительным расходам государства. По мимо расходов государства на здравоохранение и медицинскую помощь при лечении онкологический больных, идёт льготное обеспечение инвалидизации населения, реализуются программы по защите и обеспечению полного и равного осуществления всеми инвалидами всех прав человека и основных свобод, а также экономические потери по причине временной нетрудоспособности населения. Одной из основных причин инвалидности по классам болезней является инвалидность, полученная в связи с тяжёлым бременем онкологических заболеваний. В связи со старением населения, с урбанизацией, с изменением экологической ситуации в последние годы во всем мире наблюдается рост онкозаболеваний. Инвалидизация онкобольных приобретает большой размах, уступая лишь заболеваниям сердечно-сосудистой системы. По локализации злокачественных новообразований – рак легкого занимает одно из первых мест среди опухолей различной локализации и является одной из главных причин инвалидности у онкологических больных.

Ключевые слова: Социально-экономическое бремя, инвалидность, рак легкого, стоимость болезни, прямые немедицинские затраты, косвенные затраты.

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Economic burden of disability of lung cancer

Many forms of disability result in extensive healthcare demands of the population and respective significant state expenses. Apart from expenses for healthcare and treatment of cancer patients the state also provides subsidized medical assistance of disabled persons, carries out programs intended to protect and ensure complete and equal exercise of human rights and fundamental freedoms by all disabled persons and incurs economic loss resulting from temporary disability of patients. One of the primary causes of disability is severe burden of cancers. The cancer prevalence rate is on the rise in recent years all over the world due to population ageing, urbanization and ecological turnover. The disability rate among cancer patients is becoming very high, second only to patients with cardiovascular diseases. Lung cancer is among the most prevalent tumors of all localizations and one of the primary causes of disability among cancer patients.

Keywords: Socio-economic burden; disability; lung cancer; cost of illness; direct non-medical costs; indirect costs.

1. Introduction

The disability in consequence of malignant neoplasms is becoming more widespread in the Russian Federation with every passing year. According to the changes in the disability structure by diseases over time for the past 10 years, the rate of primary disability in consequence of malignant neoplasms has increased almost 3 times: from 11.10 % (2006) to 30.70 % (2015) [2]. Cancers are the most widespread cause of disability second only to diseases of the circulatory system, however, if the positive growth trend persists for a few more years, they will soon become an indisputable leader (table 1).

To characterize the structure of disability in consequence of lung neoplasms we analyzed research papers and articles published in recent years with a detailed analysis of regions of the Russian Federation in terms of primary and recurrent disability in consequence of neoplasms with due consideration of disability degrees, age and tumor location. Below are the results of the analysis of scientific literature in recent years share of lung cancer [3-16] along all disabling malignant neoplasms.

The relevance of the study of the economic burden of disability from lung cancer and of this article is due to the fact that Lung cancer is among the most prevalent tumors of all localizations and one of the primary causes of disability among cancer patients in Russian Federation. Most of the studies are aimed at studying the costs of drug provision and hospitalization; complete and relevant studies aimed at calculating the economic burden of disability are less common in modern literature. In this study were calculated Indirect costs and Direct costs caused by disability in consequence of lung cancer.

2. Methods and Results

2.1. Modeling of the number of people disabled in consequence of lung cancer

Table 1

Comparison of primary disability in consequence of neoplasms and diseases of the circulatory system (%).

N o.	Disease classes	2005	2006	2007	2008	2009	2010	2012	2013	2014	2015
1	Malignant neoplasms	11.1	13.0	15.5	17.6	19.5	20.4	22.9	24.6	26.4	30.7
2	Diseases of the circulatory system	54.7	51.2	48.1	44.6	41.3	39.2	37.8	36.1	35	35.7

Region and period of data collection	Share of lung cancer among all disabling malignant neoplasms
Republic of North Ossetia – Alania, 2012	6.5 %
Tomsk Region, 2014	9.2 %
Krasnodar Krai, 2008	9.5 %
Chuvash Republic, 2014	12 %
Chelyabinsk Region, 2010	10.5 %
Belgorod Region, 2013	10.1 %
Udmurt Republic, 2014	10.7 %
Novosibirsk Region, 2014	13.1 %
Kursk Region, 2013	10.4 %
Saint-Petersburg, 2004	9.1 %
Northern parts of the Omsk Region, 2010-2012	16.3 %

Table 2

Number of newly declared and redeclared disabled persons due to MN in the Russian Federation in 2015 [2-3].

Grouping by age of disability diagnosis	Total	Including by disability degree groups			Including by age		
		Degree I group	Degree II group	Degree III group	up to 44 years	45-54 years women, 45-59 years, men	Retirement age
Newly declared disabled persons	213,172	59,426	102,031	51,715	24,147	58,372	130,653
Redeclared disabled persons in consequence MN	207,504	39,433	114,869	116,202	35,144	76,317	159,043

Using the data from the reference book of the FSBI FB MSE of the Ministry of Labor of Russia (Tab. 2), we performed modeling of people with disabilities in consequence of malignant neoplasms newly or re-diagnosed in 2015.

In addition, using the data from Federal State Statistics Service on employment of working-age and retirement-age population, we calculated the percentage of newly declared disabled persons in consequence of malignant neoplasms, who

are involved in economic activity. It made about 47.4 %. The formula used for calculation is shown below:

$$P_{empl} = [N_{tr} \times K_{empl tr} + N_{pens} \times K_{empl pens}] / N$$

where P_{empl} is the share of economically active people among those with confirmed disability,
 $N_{tr(pens)}$ is the number of disabled people of working (retirement) age,
 $K_{empl tr(pens)}$ is the employment rate among population of working (retirement) age,

Table 3
Share of economically active people (%)

Share of economically active men and women, for the working age	76.00 %
Share of economically active men and women, for the retirement age	29.40 %

Table 4
Share of newly diagnosed disabilities due to MN accruing to LC (based on literature data) [3-16]

Region and period of data collection	Share of lung cancer among all disabling malignant neoplasms
Republic of North Ossetia-Alania, 2012	6.5 %
Tomsk Region, 2014	9.2 %
Krasnodar Krai, 2008	9.5 %
Chuvash Republic, 2014	12 %
Chelyabinsk Region, 2010	10.5 %
Belgorod Region, 2013	10.1 %
Udmurt Republic, 2014	10.7 %
Novosibirsk Region, 2014	13.1 %
Kursk Region, 2013	10.4 %
Saint-Petersburg, 2004	9.1 %
Northern parts of the Omsk Region, 2010-2012	16.3 %
Average value	10.67 %
Standard deviation	2.51 %
Median	10.40 %

Table 5
Share of patients of the corresponding disability degree group among newly declared disabled persons in consequence MN.

Region	Disability degree I group	Disability degree II group	Disability degree III group
Russian Federation	27.9 %	47.9 %	24.2 %

N is the total number of people with confirmed disability.

Thus, according to results of our study, we may note that 75.7 % (the share of degree I and II groups) of newly declared disabled persons in consequence of malignant neoplasms completely cease their working activity, i.e. are incapable for work. In general, 35.9 % of newly declared disabled persons in consequence of malignant neoplasms completely cease their work and, therefore, contribution to GDP. We obtained the above data from the calculation where the share of economically active people, i.e. 47.7 %, is multiplied by the share of disabled people of degree I and II groups, i.e. 75.7 %.

From Table 4 below we can see the number of newly declared disabled persons in consequence of malignant neoplasms of lung cancer in various

regions of the Russian Federation. The table is based on literature data.

The average value of the lung cancer share obtained from calculations made 10.67 % and was taken as a basis of modeling of the number of people with disability in consequence of lung MN.

The share of newly and re-diagnosed disabilities in consequence of lung cancer (NtdisLC) made 51,621.

The share of newly diagnosed disabilities in consequence of lung cancer (NfdisLC) made 22,751.

Distribution of newly declared disabled persons depending on the disability stage was determined using the reference book of the FSBI FB MSE of the Ministry of Labor of Russia.

Table 5 below shows data of newly declared disabled persons depending on the disability stage

Table 6
Distribution by disability groups in the model

	Disability I group	Disability II group	Disability III group	Total
Newly declared disabled persons	6,342.4	10,889.5	5,519.4	22,751.3
	Disability I group	Disability II group	Disability III group	Total
Redeclared disabled persons	4,208.6	12,259.7	12,401.9	28,870.2

Table 7
Data of economically active people [17]

Total number of economically active people in 2015, thousand people	72,323.6
Total number of business days in 2015	247.0
GDP of the Russian Federation in 2015, bln rubles	80,804.3
GDP generated by an economically active person per one business day, rubles	4,523.3
Average monthly accrued wages for women and men in 2015	25,627.0
Estimated wages in 2015	27,933.43
Average monthly accrued wages in 2015, rubles	34,012.3
Payment per 1 day of temporary disability, rubles	1,118.2
Average amount of a social pension in 2015, rubles	8,302.0
Factor reflecting uniformity of events within a year	0.5
Friction cost factor	0.1
Number of months in a year	12.0

collected from the reference book of FSBI FB MSE of the Ministry of Labor of Russia.

In course of the study, we have determined the number of patients who would be registered as disabled in consequence of malignant neoplasms of lung cancer in every disability group. For this purpose, we multiplied the number of disabled people at a certain stage by the share of primary disabilities in consequence of malignant neoplasms of lung cancer.

We have assumed that the share of LC among re-diagnosed disabilities is similar to that among newly diagnosed ones. All cases of re-diagnosed disabilities were attributed to the group of patients diagnosed before 2015.

In doing so, we kept in mind that the share of malignant neoplasms of lung cancer among re-diagnosed disabilities is similar to that among newly diagnosed ones. All cases of re-diagnosed disabilities were attributed to the group of patients diagnosed before 2015.

2.2 Modeling of the number of disability days and the days off work

In this study, the number of days of temporary disability in patients at various stages of neoplastic process and diagnosis age was equated to the number of days of day or round-the-clock hospitalization, multiplied by the share of working population. In addition, the number of days off work due to temporary disability was calculated: the number of temporary disability days was divided by the number of days a week, i.e. 7, and multiplied by the number of business days a week, i.e. 5. It was accepted that detriment to GDP occurred throughout the employee's temporary disability period since he/she was not replaced during that period.

Further, to calculate the number of days off work of newly declared disabled persons, we multiplied the number of disabled people at various stages of neoplastic process by the number of business days in a year and by the correction factor which made 0.5, reflecting the uniformity of retirement on disability within the year under study. In the study, we used the supplementary cost method to calculate indirect costs due to disability of workers; therefore, to reflect the length of a friction

Table 8
Formulas for calculation of costs of paying temporary disability allowances

Name of calculated parameter	Calculation formula	Name of indicators	Data source
CTD – costs of paying temporary disability allowances in the group of patients with MN location under study	CTD = VTD * PTD	VTD – number of temporary disability days in the group of patients with MN location under study	Formula
		PTD – amount of an average daily temporary disability allowance in the year under study	Formula
PTD – amount of a daily temporary disability allowance	PTD = Q * 365/12	Q is the average monthly accrued wages in 2015	Statistical observation
Costs of paying temporary disability allowances, rubles (CTD) (Sum, rubles):		442 195 017,45	

Table 9
Formulas for calculation of direct nonmedical costs

No. of formula	Name of calculated parameter	Calculation formula	Name of indicators	Data source
Formula 3	CSOCDP – costs of paying pensions to people disabled due to MN under study	CSOC DP = ?P SOC* NDP*0.5*12	PSOC – the average amount of a disability retirement pension in the year under study	Report of the Pension Fund of the Russian Federation
			NDP – number of people with diagnosed disability due to MN under study	Formula
			0.5 – the correction factor reflecting uniformity of retirement on disability within a year, only for newly declared disabled persons	Assumption
			12 – the number of months in a year	
The total amount of social payments (Sum, rubles):			4 009 452 560	

period when disabled employees are replaced with new employees, we have multiplied the resultant number of days off work by the factor 0.1, and the received result only was included in calculation of GDP.

In the study for re-diagnosed disabilities, no days off work occur, as it is considered that they already have been replaced in the workplace.

2.3 Cost estimation algorithm for payment of temporary disability allowances

Costs of paying temporary disability allowances are calculated on the assumption that all economically active patients with the MN location under study have been insured and may apply for payment of

temporary disability allowances.

1) The amount of a daily disability allowance is determined based on data of Federal State Statistics Service on the average monthly accrued wages in 2015, multiplied by 12 (the number of months in a year) and divided by 365 (the number of days in 2015).

2) Expenditures are calculated as the product of the number of temporary disability days by the amount of daily allowance (Table 8).

2.4 Cost estimation algorithm for payment of disability allowances

Calculation of costs caused by disability is made for disabled people who have been examined in the

year under study. It is supposed that all people with diagnosed disability receive disability pensions.

1) The average amount of a monthly disability pension is determined based on data of the Pension Fund of the Russian Federation.

2) Costs of paying disability pensions are calculated as the product of the number of people with disability due to the MN location under study by the average amount of pension and the length of socio-economic burden (SEB) assessment period in months. For newly declared disabled persons, the correction factor 0.5 reflecting the distribution of retirement on disability during the time period under review is used (Table 9).

Conclusions

The model of the number of people disabled in consequence of lung cancer was developed. The share of first and re-diagnosed disabilities in consequence of lung cancer amounted to 51,621 people. The share of newly diagnosed disabilities in consequence of lung cancer amounted to 22,751 people. 75.7 % of them cease their economic activity.

The model provided the following distribution by disability degree groups: degree I group – 27.9 %, degree II group – 47.9 % and degree III group – 24.2 %.

Direct costs caused by paying of allowances and social pensions for disability in consequence of lung cancer were calculated. The total amount of social payments made 4 009 452 560 rubles.

Indirect costs caused by disability and retirement on disability in consequence of lung cancer were calculated. The lost profits in generation of GDP amounted to 178 875 042,25 rubles. Costs of paying temporary disability allowances amounted to 442 195 017,45 rubles.

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