ORIGINAL INVESTIGATIONS

Medical and economic analysis of the impact of rheumatoid disease-associated disability on the country's economy in terms of implementation of pension reforms

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The paper presents the data of an original study evaluating the impact of disability associated with a number of rheumatic diseases (RDs) (rheumatoid arthritis, ankylosing spondylitis, and psoriatic arthritis) on the country's economy, as well as their related losses of the state under the conditions of implementation of the upcoming pension reform (PR). The authors consider the socioeconomic importance of disability associated with RDs in the current period and after PR implementation in 2019–2028, determine the degree of its influence on the country's gross domestic product, and also calculate the economic efficiency of return of the potentially able-bodied proportion of disabled people (able-bodied population) to socioeconomic activity.

The opinions of experts and leading experts in this area from different subjects of the Russian Federation were taken into account when preparing the study.

***Keywords**: rheumatoid arthritis; psoriatic arthritis; ankylosing spondylitis; disability; pension reform; economic burden; organization of medical care and drug provision; normative legal acts.*

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Relevance of the problem

Rheumatic diseases (RDs) take an important place in the structure of morbidity of the population worldwide. Their socioeconomic significance is due to high prevalence, negative impact on the quality of patient's lives because of the high level of disability[1] (especially of the able-bodied population) and, as a result, significant labor and economic losses. This determines the importance of systematization and preparation of recommendations to improve the organization of the rheumatology service in the Russian Federation. Thus, the research aimed at studying the influence of disability associated with RDs on the economy, taking into account the implementation of the pension reform (PR)[2] and transition of a certain proportion of RD patients to employable status, is of particular importance.

This study examines three nosological forms – rheumatoid arthritis (RA), ankylosing spondylitis (AS) and psoriatic arthritis (PsA), which are characterized by high prevalence, morbidity and frequent disability at working age.[3]

[1]Disability C loss of ability to work due to illness, injury, transition to the position of a disabled person. Early disability, forced inaction of a person of working age causes him serious moral trauma [1]. As of December 2018, there were more than 11 million 277 thousand disabled people in the Russian Federation, of which 85.8% had a disability associated with RDs[2].

[2]Pension reform 2019–2028 is the stage of reforming the pension system in Russian Federation, providing gradual increase in the retirement age from 55 to 60 years for women and from 60 to 65 years for men. It is carried out in accordance with Federal Law No 350 dated October 3, 2018 «On Amending Certain Legislative Acts of the Russian Federation on the Issue and Payment of Pensions» (adopted by the State Duma on September 27, 2018, approved by the Federation Council on October 3, 2018). The changes concern most citizens of the Russian Federation, but there are benefits for workers of certain specialties (doctors, teachers, artists, etc.), residents of the Far North, women with three or more children. The reform does not imply changes for people engaged in hard work and hazardous industries, law enforcement officers. The reform will not affect citizens who already have pensioner status. The Government of the Russian Federation expects that the reform will significantly increase pension payments.

[3]According to some estimates, from 800 thousand to 1 million people can suffer from RA in the Russian Federation [3, 4]. In compliance with official statistics, in 2016 the incidence of RA in our country was 33 232 patients (22.7 per 100 thousand); a total of 302 516 patients were registered (206.4 per 100 thousand) [5]. The prevalence of AS in different countries ranges from 0.01 to 6% of the population [6]. The disease is characterized by high disability of patients of young working age. According to some reports, there are more than 150 thousand patients with AS in the Russian Federation [7]. PsA is diagnosed in 1–3% of the population [8], while there is no correct data on the incidence of arthritis in the population of patients with psoriasis C this indicator varies from 5–7 to 61% (an average of 37–48%) [8, 9]. PsA usually develops in patients 25–55 years old. Under official statistics, the incidence of PsA in the Russian Federation in 2016 was 3 540 patients (2.42 per 100 thousand); a total of 20 022 patients were registered (13.66 per 100 thousand) [5].

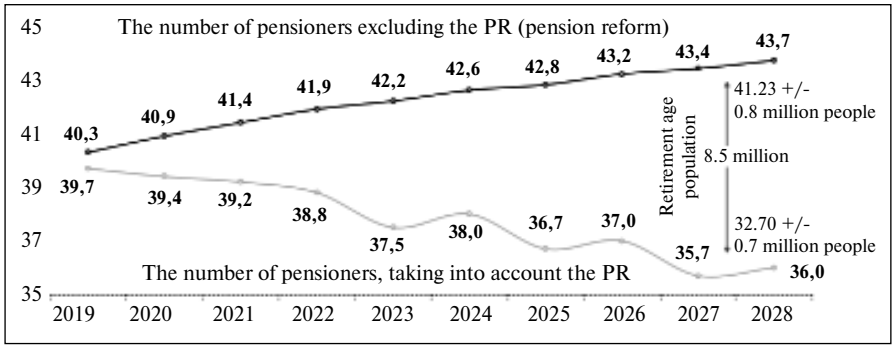

Fig. 1. *Forecast of changes in the number of pensioners of the Pension Fund of the Russian Federation in 2019–2028 (in million people)*

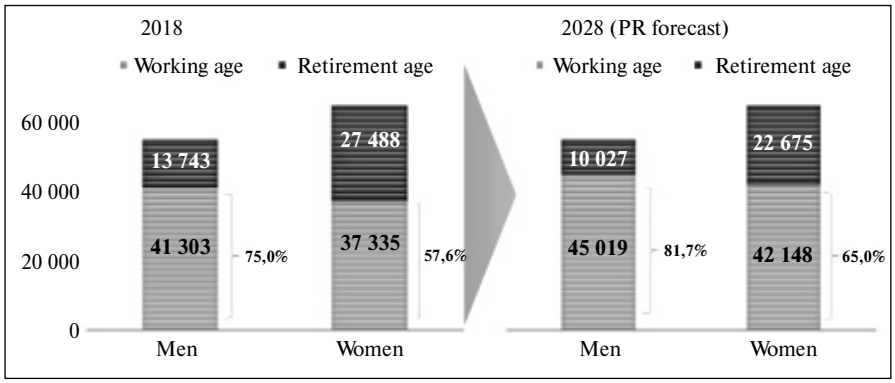

Fig. 2. *Structure of the Russian population before and after the PR (in thousand people)*

This study took into account the fact that the official statistics may differ significantly from the results of independent international research and expert assessments on all three nosological forms [3, 4, 6, 8–10]. This discrepancy is largely explained by a delay in seeking medical aid by patients and the complexity of diagnosis in outpatient settings, as well as by a non-systematic approach to statistical data collection due to the lack of Federal registers. At the same time, it is RDs that lead to a high level of patientsX disability in the first 5 years of the disease [11–13].

Considering the fact that there is not much systematic statistical information, alternative to official, in our study the data from different sources on the prevalence of RA, AS and PsA (Ministry Of Health [5], V.A. Nasonova Research Institute of Rheumatology) and associated disability (V.A. Nasonova Research Institute of Rheumatology, regional units of medical and social expertise of the Ministry of Labor of Russia, the Federal Bureau of Medical and Social Expertise of the Ministry of Labor and Social Protection of the Russian Federation) were distributed relative to their medians.

The impact of the PR on the structure of the working population in the Russian Federation

At the first stage of the study, the authors made assessment and prognosis of the number of people of retirement and working age in various population groups, as well as assessment and prognosis of disability in the Russian Federation.

Presented below is the method of estimating the number of retirement-age population and pensioners during the PR period (2019–2028). For calculations, the following initial data were taken from the Rosstat newsletter:

- the size and structure of the population (population number; components of changes in the population of the Russian Federation; the number of men and women; distribution of the population by age groups);
- demographic forecast until 2035 (population changes according to forecast variants; number of men and women; population by specific age groups; number of people of the same age; age dependency ratio, births, deaths and natural population growth);
- complex data of the Federal State Information System «Federal Register of Disabled Persons», the Federal State Statistics Service and the Pension Fund of Russia [14, 15];
- data on the disability of the population (the number of people first recognized as disabled; distribution of people first recognized as disabled by reasons of disability; distribution of children first recognized as disabled under the age of 18 years by type of disease; the number of children with disabilities under the age of 18 receiving social pensions; stationary institutions of social services for elderly citizens and people with disabilities; the number of people with disabilities in the Russian Federation and subjects of the Russian Federation distributed by sex, age groups, disability groups, causes of disability).

The main database for the calculations was the Rosstat statistical bulletin «Estimated population of the Russian Federation until 2035» with the update of 10/03/2018. At the same time, the available data on the categories of the working age population do not take into account the age-related changes resulting from the PR. The forecast data of Rosstat were recalculated taking into account the mechanism for introducing the PR in accordance with Federal Law No 350 «On Amending Certain Legislative Acts of the Russian Federation on the Issue and Payment of Pensions». Predicted values of the number of pensioners with/without the influence of the PR were obtained on the basis of the analysis and calculations (Fig. 1).

According to the data obtained, the implementation of the PR by 2028 will increase the number of able-bodied people by 8.5 million people, while the number of working-age men will increase by 8.9% and amount to 45.019 thousand, the number of women – by 12.9% and will reach 42.148 thousand, which will lead to an additional gross domestic product (GDP) of 6 032 million rubles per year (based on GDP per capita in 2018[4]; Fig. 2).

[4]The data were obtained using the software «Rheumatoid arthritis, psoriatic arthritis, ankylosing spondylitis: a model for calculating the economic burden.»

A model of impact of the Russian PR 2019–2028 on the socio-medical, financial and economic indicators of the healthcare system using the profile «Rheumatology» (RA, AS, PsA) as an example

At the second stage of the study, the data on the level and prevalence of disability were analyzed using the example of three nosological forms (RA, AS and PsA) on the basis of the data from the V.A. Nasonova Research Institute of Rheumatology, regional units of medical and social expertise of the Ministry of Labor of Russia and the Federal Bureau of Medical and Social Expertise of the Ministry of Labor and Social Protection of the Russian Federation. The total sample included a three-year (2016P2018) analysis of disability indicators for a group of diseases and amounted to: for RA – 23 686, for AS - 8362 and for PsA – 1820 people.

We have developed a mathematical variable «Model for calculating the impact of the Pension Reform 2019–2028 in the Russian Federation on disability and economic burden of rheumatoid arthritis, ankylosing spondylitis and psoriatic arthritis». The following calculations were made in the model:

1. Estimation of the number of pensioners in the Russian Federation by years (2019–2028): «if there was no PR» and taking into account the PR.

2. Estimation of the number of disabled people in the Russian Federation by years (2019–2028): the number of disabled people of working age was separately estimated in the structure «if there was no PR» and taking into account the PR (the disability structure in the Russian Federation was taken as the basis for calculations).

3. Calculation/forecast of the number of patients of the profile «Rheumatology» in the Russian Federation by years (2019–2028).

4. Calculation/forecast of the number of disabled people among patients of the profile «Rheumatology» in the Russian Federation by years (2019–2028): «if there was no PR» and taking into account the PR.

5. Calculation of the number of people with disabilities who would become pensioners before the PR, but who were of working age as a result of it.

6. Calculation of the number of disabled people among patients of the profile «Rheumatology», who would become pensioners before the PR, but who were of working age as a result of it.

7. Evaluation of the direct and indirect costs for 1 disabled person of the profile «Rheumatology» for patients of working age and for pensioners.

8. Calculation of the economic burden of the profile «Rheumatology» in the structure: «if there was no PR» and taking into account the PR.

9. Comparative analysis of the impact of the PR in terms of the effectiveness of medical care and drug provision for patients of the profile «Rheumatology» using a number of selected indicators.

According to the available data, in 2018 the Russian Federation had a population of 146 880 thousand people, among them 46.4% were men and 53.6% were women [2]. The country's GDP was estimated at 103 875.8 billion rubles (707 215 rubles per capita). The total working-age population and pensioners in 2018 amounted to 122 616 thousand people, of whom 66.4% were people of working age and 33.6% were of retirement age.

The number of disabled people by age groups in the Russian Federation, calculated as of December 2018, reached 11 277 668, of whom 57% (6 476 721) were women and 43% (4 800 947) were men [14]. The distribution of disabled people by age groups is presented in Table 1.

To determine the state expenses, the population groups were assessed as «working age/retirement age» and «working/unemployed». As the analysis has shown, in the presented groups the greatest financial burden is created by unemployed disabled people of working age. So, for RA the annual economic burden associated with this category of disabled people amounted to 1 651 258 rubles per person – it is 3.63 times more than for 1 working disabled person of working age, 5.51 times more than for 1 working person of pension age and 6.95 times more than for 1 unemployed person of pension age[5] (Fig. 3).

A study conducted by the Center of Social Economics based on the analysis of the materials submitted by the regional authorities of medical and social expertise, the Federal Bureau of Medical and Social Expertise of the Ministry of Labor and Social Protection of the Russian Federation, V.A. Nasonova Research Institute of Rheumatology, followed by mathematical modeling, showed that the total share of people with disabilities in the stud-

[5]The data were obtained using the software «Rheumatoid arthritis, psoriatic arthritis, ankylosing spondylitis: a model for calculating the economic burden.»

Table **1**. *Distribution of the disabled in the Russian Federation by age groups*

Indicator	Age group				
	18–30	31–40	41–50	51–60	Over 60
Number of persons with disabilities	501 013	783 269	1 031 400	1 954 125	7 007 861

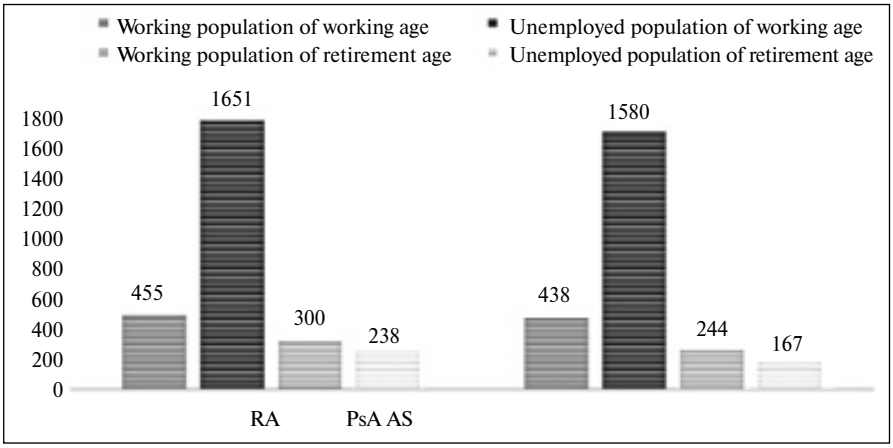

Fig. 3. *The economic burden per 1 disabled person with RA, PsA and AS in 2018 (in thousand rubles)*

Table **2**. *The level of disability in patients with RA, PsA and AS in the Russian Federation: the forecast for 2028, taking into account the PR, %*

RA			PsA			AS		
both genders	men	women	both genders	men	women	both genders	men	women
Working age population								
22.7	26.1	21.4	17.2	19.6	14.9	13.6	15.7	8.0
Retirement age population								
18.1	19.0	18.0	17.9	18.3	17.8	22.6	20.1	29.0
Total								
20.4	23.7	19.6	17.3	19.4	15.7	13.8	15.8	8.5

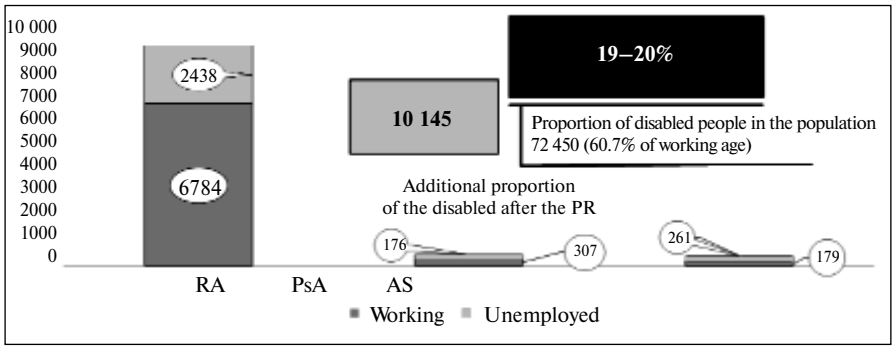

Fig. 4. *The structure of disability and additional number of people with disabilities among RA, AS and PsA patients who have moved to working age population after the PR (per year): forecast, baseline scenario*

ied groups in 2018 reached 19.3%, and according to the results of the PR implementation, it could be 19.4% (Table 2).[6]

The average age of patients with the diagnosis of RA was 44 years, the average age of disability associated with the disease was 51 years (7 years from the diagnosis to disability, 9 «lost» years of working age for women and 14 for men). The average age of patients with the diagnosis of PsA was 29 years, the average age of disability associated with the disease was 48 years (19 years from the diagnosis to disability, 12 «lost» years of working age for women and 17 for men).

The analysis of patientsX disability revealed some specific features. Thus, despite a three-fold excess in the incidence of RA in women, the proportion of disability in women was slightly lower than in men. According to experts, this is associated more with social and gender aspects than with medical reasons. According to some researchers, compliance in women is generally higher than in men, so the effectiveness of the therapy is higher, which, in turn, affects the general level of disability [16, 17]. In general, adherence to therapy in patients with RA, according to foreign and domestic authors, varies from 22.8 to 80% [18P20].

Thus, the PR annually adds about 50 thousand people of working age with the diagnoses of RA, AS and PsA, of whom about 10 145 will be disabled. So, as a result of the PR, the total number of people with disabilities in the patient population with these three nosological forms will be about 72.45 thousand, 60.7% of whom will be of working age (Fig. 4).

To calculate the economic burden, we used the software product «Rheumatoid arthritis, psoriatic arthritis, ankylosing spondylitis: a model for calculating the economic burden». The research methodology and the results obtained were described in more detail in the paper «Assessment of the organization of medical care and drug provision for patients with rheumatic diseases, and the socioeconomic burden of these diseases in the Russian Federation» [21].

According to the forecast, by 2028 the annual economic burden due to disability of patients with RA, AS and PsA will amount to 44.4 billion rubles, of which 36.4 billion (82% of the economic burden for all disabled people) will be for disabled people of working age, 8 billion for disabled people of retirement age.

The economic burden for the proportion of the disabled who will additionally move to the category of working age population after the PR will be a total of about 8 billion rubles (23% is the share of economic losses from the disability of patients who, as a result of the PR, become people of working status), while 41% of the economic burden will be associated with working disabled people and 59% with unemployed. *The amount of 8 billion rubles is nothing more than economic losses from the disability of patients with RA, AS and PsA.* When calculating the additional economic effect of the PR (additional GDP generated by the transition of part of the population from retirement age to working age), these losses must be taken into account.

In our study, we calculated the potential values of the economic burden, the number of people with disabilities and the economic losses of the state from the disability of the population associated with RDs, especially disability of its working part. Several options were considered in the context of modeling. Thus, «The model for calculating the impact of the pension reform of 2019–2028 in the Russian Federation on disability and the economic burden for rheumatic diseases: rheumatoid arthritis, psoriatic arthritis, ankylosing spondylitis» suggests an assessment of two main scenarios. The *baseline* scenario is based on the prevalence statistics of RA, PsA, and AS, according to the Russian Ministry of Health; *expert scenario* – on the choice of values from a set of expert evaluations/evaluations of patients' associations and data from published studies. The results of mathematical modeling are presented in Tables 3–5.

The economic burden created by all people with disabilities who have reached working age after the PR will be approximately 8 billion rubles, of which 7.1 billion rubles are costs for patients with RA; and 414.0 and 490.0 million rubles for patients with PsA and AS, respectively.

Thus, the simulation results indicate that 60.7% of able-bodied patients with RDs generate 82% of the state's costs associated with disability. These data confirm the high social

[6]These results are a weighted average indicator of the level of disability in the studied groups of diseases for 3 years and take into account the internal multidirectional dynamics (a moderate increase in disability in patients with AS and a moderate decrease in its level in patients with RA).

and economic importance of this pathology for society as a whole and the need for the development and subsequent implementation of the federal program to reduce disability in patients with RDs.

In this study, in addition to calculating the baseline scenario, which was based on estimating the prevalence of RA, AS and PsA according to the statistics from the Ministry of Health of Russia [5], the expert scenario was calculated taking into account expert estimates of the prevalence of RA, AS and PsA in the Russian Federation. According to the results of the analysis, the potential number of patients with the analyzed diseases is approximately 816 thousand, of which 671 thousand are patients with RA, 35 thousand – with PsA and 110 thousand – with AS. With this assessment, the estimated number of disabled people among these patients will be 157 353 as of 2018 and 158 195 if the PR is implemented. In accordance with the expert scenario, as a result of the PR, an additional 108.9 thousand disabled people of working age will appear in total in these three nosologies. The economic burden associated with all disabled people of the study group after the PR under this scenario will be more than 96.9 billion rubles, of which about 79.3 billion rubles will fall on people of working age with disabilities (Table 6).

An additional number of people with disabilities due to RA, PsA and AS who have reached working age after the PR will be 22 138 by 2028 according to the expert scenario. The share of the total economic burden of the part of disabled people who will additionally enter the working age after the PR will be equal to 17.5 billion rubles, while 41% of the burden is associated with working people with disabilities and 59% – with non-working people. When assessing the additional economic effect of the PR (additional GDP generated by the transition of part of the population from retirement age to working age), these costs should be taken into account.

The expert data validation performed in our study showed that the level of disability associated with RDs in the Russian Federation, besides the medical component, largely depends on the following factors:

• the law enforcement practice of using Federal Law No 178 of July 17, 1999 «On State Social Assistance». In particular, the legal collision is that the possibility of obtaining highly effective targeted medications (genetically engineered biological drugs – GEBD, small molecules) that contribute to reducing the level of disability and returning patients with RDs to a working status, is directly related to Tthe disability statusУ of a patient;

• the amount of financing for the procurement of high-tech drugs (GEBD, small molecules). In many regions the level of provision with necessary drugs does not correspond to the actual need, which leads to maintaining a high level of patient disability;

• general level of financial and economic development of a region/federal subject. In some subsidized regions, «the disability status» is rather a measure of social support of the population, in which disability and related payments actually become an additional source of income for some poor families. This situation forces patients with rheumatic diseases to actually «resist» effective therapy, maintaining the level of activity of the disease, allowing to keep the indications for the establishment of disability;

Table **3**. *The economic burden of disability (excluding children): the baseline scenario based on the PR, in thousand rubles/year*

All disabled	RA	PsA	AS	Total
Working	17 664 986	869 118	1 192 631	19 726 735
Unemployed	16 868 827	1 621 301	6 180 144	24 670 271
Total	34 533 812	2 490 418	7 372 775	44 397 005

Table **4**. *The economic burden associated with all disabled people of working age: the baseline scenario based on the PR, in thousand rubles/year*

All disabled people of working age	RA	PsA	AS	Total
Working	11 601 212	759 791	1 166 661	13 527 664
Unemployed	15 141 463	1 578 376	6 154 251	22 874 090
Total	26 742 675	2 338 167	7 320 913	36 401 754

Table **5**. *The number of disabled people of working age by nosology after the PR*

Disabled people of working age	RA	PsA	AS	Total
Working	25 518	1 735	2 664	29 917
Unemployed	9 170	999	3 894	14 063
Total	34 688	2 734	6 559	43 980

Table **6**. *Economic burden associated with all persons with disabilities (excluding disabled children): expert scenario based on the PR, in thousand rubles/year*

All disabled	RA	PsA	AS	Total
Working	38 896 892	1 532 990	2 656 216	43 086 098
Unemployed	37 143 813	2 859 725	13 764 351	53 767 889
Total	76 040 705	4 392 715	16 420 567	96 853 986

• low socialization of patients with disabilities (objective difficulties in finding a job in the presence of disability, especially in patients of pre-retirement age), which often leads to hiding their true state of health;

• specific features of collection and registration of statistical data in the Russian Federation (current registration system does not allow to allocate and consider «binding» of patients to diagnoses with the established disability).

Conclusion

Thus, according to the results of the study, the disability of patients with RDs, who have become people of working age as a result of the PR, creates additional economic burden associated with disabled patients: according to the baseline scenario, it is equal to 8.0 billion rubles, according to the expert scenario -about 17.5 billion rubles. The economic losses resulting from the disability of patients with RA, AS and PsA who have additionally moved to working age category as a result of the PR, will amount to about 22–23% of the estimated additional GDP.

Reducing the economic burden associated with disability is a complex systemic task, which requires the implementation of a number of *major measures* complementing each other:

• development and approval (by order of the Ministry of Health of the Russian Federation) of a regulatory mechanism governing the organization and effective functioning of the Federal Register of Patients with RDs, including a system of recording and monitoring the use of high-tech drugs (GEBD, small molecules);

• creation and implementation of the modern standard of medical care in RA in accordance with clinical recommendations;

• development of the document «On the routing of patients with rheumatic diseases» and its approval at the level of the federal subjects of the Russian Federation;

• increase in the number of rheumatologists (per 100 thousand population) providing specialized medical care;

• allocation of rheumatological diagnoses as the main ones for their adequate reflection in the data of the Medical Information and Analytical Center;

• increase in the coverage of patients with targeted therapy (GEBD, small molecules) to average world standards (15–20%), which corresponds to a cohort of patients for whom conventional therapy is ineffective;

• removal of existing structural imbalances between the regulatory framework and financing: justification of tariff calculation of clinical and statistical groups for the CMI (compulsory medical insurance) channel, and development of payment mechanisms for provision of medical care, thus, excluding uncontrolled contact of patients with medical drugs in primary care settings;

• introduction of the indicator «Prevention of early disability of patients with rheumatic diseases» (including through the timely use of high-tech drugs) as one of the main indicators of the effectiveness of the rheumatology service in a region;

• elimination of the linkage between prescribing GEBD (small molecules) to RD patients within the framework of preferential provision (according to Federal Law No 178) and officially registering patients as disabled;

• creating a working group with the participation of public health officials at the federal and regional levels, representatives of specialized medical community, patient organizations, health system experts for practical implementation of the tasks to improve the effectiveness of rheumatology services;

• preparation of the draft Federal Program for the fight against RDs and its submission to the Ministry of Health of the Russian Federation.

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