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FORECASTING THE VOLUME OF MEDICINES AS A TOOL OF PUBLIC SUPPORT

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Abstract

In this study, a forecast is made of the needs of rheumatoid arthritis patients living in the Novgorod region for basic medicines provided at the expense of the regional budget. Forecasting was carried out on the basis of information received from the State Regional Budgetary Healthcare Institution (GOBUZ) “Medical Information and Analytical Center”, which carries out personified registration of dispensing of medicines during 2010-2018. (data are encrypted). A preliminary analysis showed that the maximum value of both the number of prescriptions of medicines for the treatment of rheumatoid arthritis and the number of patients receiving these medicines fell on 2015, after which there was a decrease in the total amount of state support for the population in this direction. Forecasting for 2019-2021 illustrates the persistence of the identified trend of reducing budget expenditures for preferential drug provision for this category of needy. At the same time, the time series and trend of the indicator “number of people receiving drugs” is characterized by negative dynamics, and the indicator “average number of prescriptions of drugs per person” is positive. The solution to the problem of the high prices of original drugs for the treatment of rheumatoid arthritis was found, first of all, in the transition to generics (less expensive similar drugs, for example, of Russian origin), which, undoubtedly, requires the investment of financial and other resources in additional studies regarding their effectiveness.

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Keywords: Preferential drug provision, state support, regional budget, forecasting, regression model.



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1. Introduction

The goal of the reform implemented in modern Russian healthcare is to improve the quality of medical care for the population, including improving the drug supply system for privileged categories of citizens, the main problem of which is insufficient funding at all budget levels due to the increase in the cost of drugs (for example, the average price drug packaging in 2005-2012 increased by more than six times (Sokolov, Lin, & Orlov, 2014), the emergence of new expensive drugs, changing the number of beneficiaries and schemes of treatment. Despite the fact that in 2015 the state spent 101 billion rubles on the purchase of drugs for preferential drug provision (19% more compared to 2014), in real terms there was a decrease in the number of medicines purchased by 3% (Procurement under regional programs of preferential drug supply, 2015); this trend has persisted to the present.

At the same time, against the background of a slowdown in economic growth due to the introduction of anti-Russian sanctions and the devaluation of the national currency, public procurement (including the healthcare sector – *authors' note*) remains an important tool for regulating the market, ensuring economic growth (Popova, 2014).

It is shown that the share of drug care, including the concept of drug provision, reaches up to 95% of all medical prescriptions (Mironova, 2016). Compensatory mechanisms by which citizens can partially or fully reimburse the costs of certain medicines are one of the most important tools for regulating the pharmaceutical market.

Since 2008, the Federal Law No. 230-FZ “On Amending Certain Legislative Acts of the Russian Federation in Connection with the Improvement of Delimitation of Authorities” dated October 18, 2007, where the section “Providing Other Categories of Beneficiaries with Essential Medicines” is highlighted, in which preferential drug provision for other categories of citizens (i.e. regional beneficiaries) is a financial obligation of the regional budget, has been in force in the Russian Federation. The lists of drugs that are provided as the part of regional programs are formed by each region independently.

One of the key problems of domestic health care is forecasting the need for medicines, since the cost of their purchase is a significant part of the regional budget. The forecast allows planning and justifying the volume of procurement of drugs (Borisov & Trefilova, 2015; Dyogtev, Gladilina, Akimov, & Bannikov, 2013).

2. Problem Statement

The main research problem, in order to optimize the costs of the regional budget, is predicting the need for basic drugs which are provided to the preferential category of citizens living in the Novgorod region for the treatment of rheumatoid arthritis.

3. Research Questions

In this study, the authors intended to answer a number of questions:

- 3.1 What are the results of content analysis of databases of patients with rheumatoid arthritis in the Novgorod region in 2010-2018 and their drug supply?

3.2 3.2 What mathematical models should be used to predict the need for basic drugs?

3.3 3.3 What are the forecasting results for the next three years?

4. Purpose of the Study

In this article, on the basis of an analysis of databases of patients with rheumatoid arthritis in the Novgorod region in 2010-2018. and the volumes of their preferential drug provision, the forecasting of the need for preferential drugs for this category of patients provided at the expense of the regional budget for the period 2019-2021 was carried out. The study should be taken into account when planning the expenditure part of the regional budget for the coming periods in order to ensure the efficient spending of budget funds and improve the quality of medical care for the population of the region.

5. Research Methods

The sources of information for the study and forecasting were statistical data (The incidence of the population of Russia in 2010, 2011; The incidence of the population of Russia in 2014, 2015; The incidence of the population of Russia in 2017, 2018), regulatory documents (Federal Law No. 230-FZ “On Amending Certain Legislative Acts of the Russian Federation in Connection with the Improvement of Delimitation of Powers” dated 10/18/2007, Federal Law No. 429-FZ “On Amending the Federal Law “On Circulation of Medicines” dated 07/01/2015, “The List of Essential and Important Medicines for 2014” (approved by Order of the Government of the Russian Federation No. 2199-r of 12/07/2011), “List of Essential and Important Medicines and Medical Devices, necessary for the provision of emergency and inpatient care for 2014” (approved by the Decree of the Government of the Novgorod Region in the Territorial Program of State Guarantees of Free Medical Assistance to Citizens), ”List of Drugs included in the standard of care for patients with rheumatoid arthritis in the provision of specialized care” (approved by Order of the Ministry of Health and Social Development of the Russian Federation dated January 17, 2007 No. 41), as well as a software package for centralized data processing (providing necessary medicines, compulsory health insurance (OMS), reference books.

The authors conducted a content analysis of a database of patients with rheumatoid arthritis in the Novgorod region who are on preferential drug supply, based on which a forecast is made of the need for basic drugs. The lists of patients for the period 2010-2018 which were obtained at the State Regional Budgetary Healthcare Institution (GOBUZ) “Medical Information and Analytical Center” were used. The data of personified registration of dispensing of medicines were encrypted.

In the study of statistical data on the drug supply of patients with rheumatoid arthritis, mathematical methods of the theory of time series and regression analysis are involved. Based on the time series of drug prescriptions (2010-2018) for certain drugs and for the group of basic drugs of the first row as a whole, forecasting was conducted according to the trend and autoregressive models. Forecasts were received for the period 2019-2021. The relationships between the numbers of prescriptions of individual drugs in the group are indicated, and the change trends in both absolute indicators and average values were analyzed.

6. Findings

Rheumatoid arthritis is a disease of the musculoskeletal system that occurs with a frequency of approximately 0.8% in all countries of the world (Urman, Taklalsingh, Sorrento, & McFarlane, 2018). According to statistical reports, the incidence of rheumatoid arthritis in Russia per 100 thousand people in 2010 was 198.5; in 2014 – 244.5, in 2016 – 206.4; in 2017 – 207.6. In the Novgorod region, the following values of the incidence rates of rheumatoid arthritis per 100 thousand of population were recorded: in 2010 – 432.3; 2014 – 471.8, in 2016 – 406.9; in 2017 – 379.3 (Statisticheskie materialy, 2010, 2015, 2018). Thus, in the region a significant excess of all-Russian incidence rates was recorded, which requires increased financial costs of the regional budget for preferential drug provision.

According to personified statistics, almost half of drug prescriptions for patients with rheumatoid arthritis (22069 out of 44321) are in the first-line basic drugs - the international nonproprietary name (INN) Leflunomide, INN Methotrexate and INN Sulfasalazine. Let us follow the dynamics of the prescription of drugs on the example of this group.

The trend in the number of prescriptions for this group of drugs depending on the period (2010-2018) is estimated by the parabolic regression model: $y = 602.7381 + 777.9565t - 64.434t^2$. The found regression equation is mathematically correct and has a high determination coefficient: $R^2 = 0.9075$.

Similarly, the trend in the number of people receiving drugs in this group is estimated by the dependence: $y = 288.5714 + 144.8095t - 13.38t^2$ at $R^2 = 0.9759$.

In each of the models, the values of t in accordance with the years of observation (2010-2018) take values 1, 2, ... 9. In both cases, the maximum value of both the number of prescriptions of medicines and the number of people receiving these prescriptions falls on 2015, then a significant decrease in these indicators is decreased. Prediction of the indicator "the number of people receiving drugs" for subsequent periods - 10, 11, 12 (2019-2021) – purely mathematically supports this trend of changing values on a parabola (Figure 01). The graph of the time series "number of prescriptions of drugs" and the results of forecasting shows the same trends. It should be noted that the indicated total trends for the three basic preparations of the first series are fully preserved for INN Leflunomide and INN Methotrexate, and a growth trend is observed for the prescription of INN Sulfasalazine.

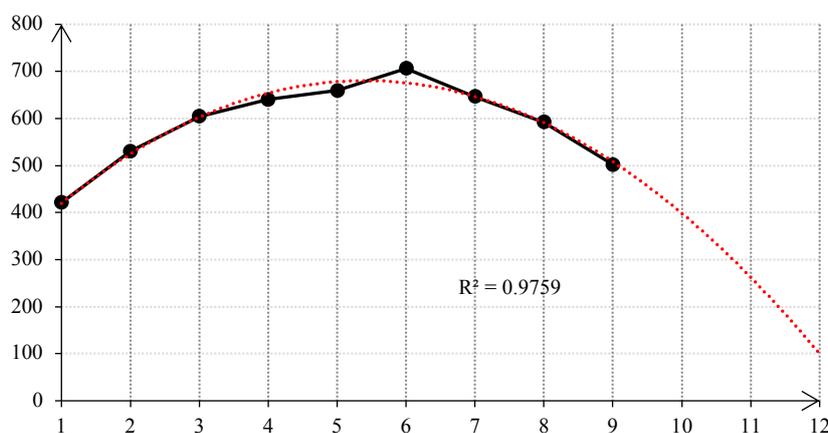


Figure 01. Time series and trend of the indicator "number of people receiving drugs"

To identify the objective needs for basic drugs of the first row, it is necessary to move from absolute quantitative indicators to their average values. The time series of the “average number of prescriptions of drugs per person” shows not sharp, but statistically noticeable growth (the corresponding graph with a subsequent forecast is shown in Figure 02).

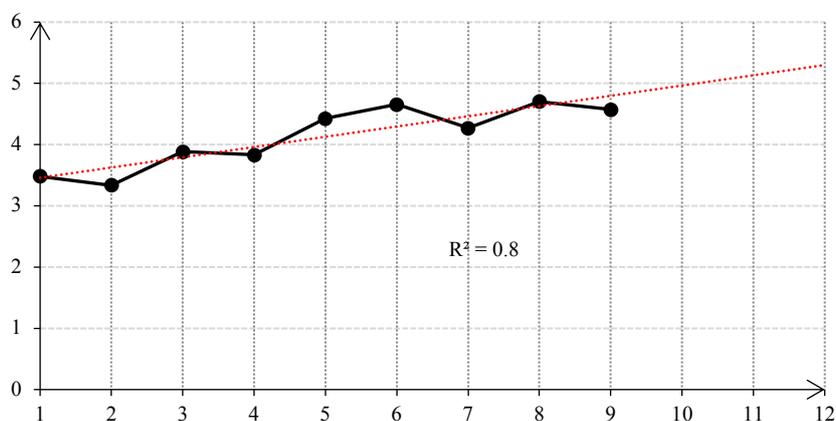


Figure 02. Time series and trend of indicator “average number of prescriptions of drugs per person”

The trend equation has the form: $y = 3.2914 + 0.1673t$ at $R^2 = 0.8$. The coefficient at t , equal to 0.1673, shows the annual growth of the indicator. Predicted indicator values: 2019 – 4.964 prescriptions; 2020 – 5.132 prescriptions; 2021 – 5.299 prescriptions. Thus, every year, on average, the consumption of drugs per patient should increase with a statistically significant increase in the indicator. The results of multiplying the growth value of 0.1673 by the number of people receiving medications show for how many units the number of prescriptions should increase compared to the previous year with the same number of beneficiaries receiving medications. For example, for 502 people, who received basic drugs of the first row in 2018, 2,492 prescriptions would be required in 2019, 2,576 prescriptions – in 2020, and 2,660 prescriptions – in 2021.

The annual increase in the number of prescriptions due to the growth of their average number is 84 units with a constant number of patients. At the same time, the average number of prescriptions per person of INN Leflunomide decreases from 7.08 in 2014 to 5.90 in 2018, INN Methotrexate increases from 3.94 in 2015 to 4.33 in 2017, INN Sulfasalazine - from 4.47 in 2015 to 4.56 in 2018. Since the share of INN Methotrexate and INN Sulfasalazine among the basic drugs of the first row is almost 69%, their trends prevail in the combined group. Considering the different prices of these drugs, one can calculate (predict) the individual costs of them, taking into account the growth over the years. Based on the quantitative forecast of drug prescriptions and the current (or forecasted) price on the pharmaceutical market, it is possible to present a forecast in monetary terms.

7. Conclusion

An increase in the total number of prescriptions of medicines is an objective need, caused by an increase in both the number of patients (including those belonging to the preferential category) and the average number of prescriptions per person.

The growth of patients with rheumatoid arthritis in the region in 2019-2021 is predicted for two reasons. Firstly, the age structure of the population of the Novgorod region is changing, namely, it is “aging”; while the incidence of diseases of the musculoskeletal system, including rheumatoid arthritis, is known to be more common in older age groups. In (Tokmachev, 2006) corresponding models of the dynamics of the growth of morbidity with increasing age of the population are presented. Thus, the planned increase in the average life expectancy of the population announced in Russia also plans, in fact, for these growing levels of morbidity rates. Secondly, along with an increase in the average number of prescriptions, tendencies of increasing or decreasing the incidence of rheumatoid arthritis among the entire population of the region are of great importance. So, an increase in the incidence is possible due to the “legalization” of latent incidence. According to the results of the analysis of morbidity data and materials of a sample survey of the population health of the Novgorod region in 2005-2006 (Tokmachev, 2010), the true incidence of diseases of the musculoskeletal system is on average 1.78 times higher for the male population, and 2.0 times higher for the female population than the incidence according to medical appointments.

However, the graph of the time series and the trend of the indicator “the number of people receiving drugs” tend to decrease, which does not contradict the current situation in the country. The fact is that patients who have the right to receive free medicines can choose between monetary reimbursement or prescription services. The number of beneficiaries choosing drug provision is decreasing (Analytical report. Pharmaceutical market of Russia. Results of 2014, 2015; Remedium, 2015). At the IX All-Russian Congress “The Right to Medicine”, May 23, 2019, Deputy Head of the Federal Service for Supervision of Healthcare D. Parkhomenko said that the share of beneficiaries who left the Federal Drug Provision Program reached 79% in 2019. The number of prescribed preferential recipes not provided with drugs is not reduced (Sokolova, Orlov, & Romyanceva, 2013]. In addition, the patient is forced to pay from his pocket for drugs for the treatment of concomitant diseases that are not subject to preferential provision. This leads to a loss of treatment adherence among low-income seniors, which may worsen their health (Hernández-Izquierdo, González López-Valcárcel, Morris, Melnychuk, & Abásolo-Alessón, 2019; Robinson, Whaley, & Brown, 2017).

The problem of high prices for original medicines is solved by switching to generics (cheaper similar medicines) (Huang, 2019; Kesselheim, Avorn, & Sarpatwari, 2016), which requires the investment of financial and other resources in additional studies regarding their effectiveness. In the medical institutions of the Novgorod region, patients are mainly prescribed generic drugs made in Russia, since maintaining preferential provision of medicines to those in need is vitally important against the background of declining real incomes and increasing in the share of the poor.

The results of the forecasting made should be taken into account, when planning the expenditure of the regional budget for the coming periods in order to ensure the efficient spending of budget funds and improve the quality of medical care for the population of the region.

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