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- МЕТОДОЛОГИЧЕСКИЕ ОСНОВЫ АНАЛИЗА ЭФФЕКТИВНОСТИ МЕДИЦИНСКИХ ТЕХНОЛОГИЙ ПРИ ПРОВЕДЕНИИ ФАРМАКОЭКОНОМИЧЕСКИХ ИССЛЕДОВАНИЙ
- IX НАЦИОНАЛЬНЫЙ КОНГРЕСС С МЕЖДУНАРОДНЫМ УЧАСТИЕМ «РАЗВИТИЕ ФАРМАКОЭКОНОМИКИ И ФАРМАКОЭПИДЕМИОЛОГИИ В РОССИЙСКОЙ ФЕДЕРАЦИИ» – «ФАРМАКОЭКОНОМИКА – 2015» 16-17 марта 2015 г., УФА, AZIMUT ОТЕЛЬ УФА

PRACTICE OF PHARMACOECONOMIC ANALYSIS USAGE FOR OPTIMIZATION OF HOSPITAL PROCUREMENT OF SURGICAL GLOVES

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Abstract: The choice and procurement of surgical gloves on the Russian hospital market were experience-based until now. In most cases, the determining factor is their purchase cost. So functional traits of gloves are not covered, the factors of eligibility defined by direct consumers on all characteristics are not taken into account, the additional costs arising from the use of low-quality goods are also not taken into account. Model of surgical gloves choice and procurement optimization designed by Medcom-MP allows to change situation by taking into account such factors as: as the limit of the expenditure, the amount, type and duration of operations and other surgical procedures, the number of users (surgeons, operating and dressing nurses), individual tolerance of different glove materials, etc. Results obtained using this model can be used for can be used to support state and municipal procurement.

Key words: pharmacoeconomic analysis, budget impact analysis, procurement optimization model, surgical gloves, support of state municipal procurement, Medcom-MP, assessment of demand, structure of procurements, prevention of healthcare-associated infections, double gloves, estimated demand, gap of medical organizations budget, prevention of bloodborne infections.

Introduction

Modernization of Russian healthcare and solid changes in legislation provided paying more attention of medical organizations (MO) to the cost optimization. The direction is very important as the choice of goods based on such kind of analysis, allows to optimize the allocation of healthcare resources, ensures transparency of decision-making and has a direct impact on patient outcomes.

Pharmacoeconomic analysis (PA) is used as a new tool of pharmaceutical marketing [1] in health care, in most cases, is used in the drugs.

However, it is applicable to one of the indispensable attributes of the diagnostic and treatment process - consumable materials. Including their significant share in hospital costs, and importance in ensuring proper working conditions for physicians, the use of pharmacoeconomic approaches in relation to surgical gloves, ligation material or syringes, it is no less important element in the development of applied areas of pharmacoeconomics.

A number of new provisions of the Law on the contract system [2], which entered into force in January 2015, was focused in higher extent on the practical application of pharmacoeconomic analysis in relation to consumables. In conditions of the unsaturated market, it allows to save high quality products niche, because it provides relevant regulatory requirements: rationing of objectives, the need to purchase and nonredundancy of the properties of each expensive product.

The largest supplier of medical consumables in the hospital market - company Medcom-MP is one of the active conductors of the implementation of the decision-making algorithm based on pharmacoeconomic analysis of consumables in everyday medical organizations' practice.

During the process of building partnerships with hospitals' procurement

specialists are assisted in during the transition from empirical selection of consumables for economically and functionally scientific and reasonable one. While the effectiveness of budget spending is indicated as the main along with their safety and quality.

Using designed interactive cost optimization models the unbiased estimation of each hospital demands was performed, budget impact on the overall procurement costs was calculated, optimal supply was formed oriented at the functional, individual and economic factors. There is a necessity for conduct of analysis of missed opportunities and social and economic factors including delayed effects and costs.

In this article one of the practical pharmacoeconomic algorithms was covered - optimization of approaches for surgical gloves choice and procurement. Interactive calculations with consequent visualization of obtained results provide clear and unbiased assessment of surgical gloves demand and show it as a concrete procurement structure taking into account specific features, organizational and economic aspects of medical organizations.

Materials and methods

Calculation algorithm is based on the methods of pharmacoeconomic analysis: cost analysis and budget impact analysis. Data for calculations are statistical and financial indicators of specific hospitals and generalized current estimates of the number of parameters of surgical gloves obtained from surveys of surgeons, operating and dressing nurses. Information on prices of earlier bought and proposed for procurement at this moment surgical gloves is obtained using price-lists of MO and supplier consequently.

Cost analysis

Cost analysis of consumables has certain features compared with one of medicinal drugs. Thus, during the cost analysis of surgical gloves the calculation is performed for each type of gloves, summarizing that the proposed structure of procurement is formed.

While quantitative volume and, accordingly, the cost of each item depends on a number of factors that are considered during the analysis. In addition, the possibility of correcting the already formed structure of surgical gloves procurement by the specialists of medical organizations may exclude certain factors with subsequent recalculation of the total expenditure.

Budget impact analysis

In the context of the described model calculations, a budget impact analysis implies the estimation of the annual volume and the corresponding patterns of surgical gloves with regard to possible meet the functional, individual and specialized needs of core employees of the hospital. The final result is expressed as an amount of money that can be saved or additionally requested to ensure procurement of the calculated volume and structure of gloves.

Considering the fact that the working model suggests the possibility of multiple data conversion, all adjustments in the procurement structure allow



in real-time regime to assess the impact of any settlement options of annual consumption volume of surgical gloves on hospital budgets.

Costs description

Pharmacoeconomic optimization model of surgical gloves choice and procurement provides the solution of several objectives:

- the compliance assessment of current procurement of surgical gloves with the estimated medical needs of the organization;
- calculation of functionally justified volumes and formation of procurement structure of surgical gloves oriented for its maximally high quality;
- the optimal allocation of funds planned in MO for the purchase of surgical gloves.

Main features, needed for calculations, are summarized in several groups:

- financial resources;
- material, technical and human resources;
- epidemiological situation with bloodborne infections (BI) – HIV, hepatitis B and C;
- the operational activity and other surgical procedures;
- the practice of using surgical gloves.

Because of the scope of gloves usage by surgeons, operating and dressing nurses may vary, the calculation of the total consumption is made for all possible combinations:

- the surgeons - surgical intervention;
- the surgeons - surgical procedures (including ligation);
- the operating nurses - surgical interventions and surgical procedures;
- the nurses for ligations – ligation.

The algorithm of calculation of surgical gloves demand (scheme at the figure 1) consists of six sequential steps, which in the present article are presented using the example of the surgeons and one of the areas of their activity - surgeries.

At the first stage, annual basing (minimal) consumption of surgical gloves is calculated. The choice of this temporal period is explained with the need to enhance the visibility of calculations during planning budgets of MO, which, as a rule, are compiled on a calendar year. This implies that each surgeon uses one pair of gloves during the operation.

Formulation: $BQG = Nopm * Ns * 11$, where:

- *BQG* – basic consumption surgical gloves;
- *Nopm* – monthly average amount of surgeries, made by one surgeons
- *Ns* – amount of surgeons in medical organization
- *11* – average annual number of working months of one surgeon.

At the second stage, basic annual amount is distributed proportionally to the ratio of profiles of the operations performed in MO during the year. The estimated model provides the possibility of selecting specific operations in 23 surgical departments: their features affect on the duration of surgeries and requirements to the gloves' characteristics estimated during calculations.

Due to mechanical and chemical stimulation the possibility of gloves damage increases with the duration of the operation [3,4], and therefore, according to the manufacturer's recommendations, gloves should be changed at least every 2 hours. Taking into account the gloves used by each surgeon for replacement during prolonged operations, at the third stage, the base amount increases in proportion to the multiplying co-efficient:

- $k = 1$ (duration of surgery not more than 2,5 hours);
- $k = 2$ (from 2,5 to 4,5 hours);
- $k = 3$ (from 4,5 to 6,5 hours).

In the fourth stage structure of the procurement is formed. The previously calculated volume of gloves is distributed by a number of parameters. Therefore, for physicians with protein allergies and/or allergic contact dermatitis the required number of gloves made of synthetic materials is provided [4]. According to the frequency of the routine and urgent surgical interventions in patients with BI, as well as with unknown infectious status of the latter, in general structure are included double gloves with puncture indication which can reduce the risk of blood borne infection of doctors to the greatest extent in case of hand injuries during operations [6].

High-tech operations and surgeries in patients with diabetes are gathered in special group: these cases have increased requirements from the viewpoint of prevention healthcare-associated infections (HAI), as their effects greatly

increases the risk of life-threatening complications. To avoid falling resistant microbial flora from the hands of the surgeons in the operating wound due to the damaged gloves, for surgeries in this group of patients surgical gloves with inner anti-bacterial coating are provided. [7].

Surgeons with allergic reactions to latex, which operate on patients with bloodborne infections are payed attention to. For them the necessary amount of double gloves with puncture indication where the synthetic glove used as internal one are provided.

Amount remained after separation of four groups of gloves, in accordance with the specified medical practice, is distributed between the standard latex and specialized gloves, which are divided into:

- obstetric (with long cuff);
- high sensible (for microsurgery, ENT, vascular surgery)
- high tenacity (for traumatology and orthopedics);
- solid surface structure (for a secure grip of tools).

After formation of the structure, on the fifth stage the additional adjustment of each group of gloves is performed as additional amounts of gloves are to be changed due to its damage, since the frequency different groups of gloves damage is different and it depends on the quality of the material and other parameters. In this case, according to preference of MO, the calculation can be made either based on estimates of hospital staff or constant values defined by generalized research results of the model's developer [5].

At the last step, formed structure of procurement taking into account all calculated earlier demands and current prices is compared with the prescribed budget expenditures of MO on surgical gloves. In case of the shortage of funds, it is recalculated in accordance with the priorities and wishes of the persons responsible for procurement. So, if for some reason it is decided to not to consider the factors of allergies, bloodborne infections and in case of HAI, in the fourth stage the entire volume of the gloves will be assigned to the standard latex gloves (Figure 2).

Scheme of the volumes' calculations and structure of gloves for surgeons per annual amount of operations is repeated, with some exceptions, in the calculations for surgery and ligation nurses and in relation to surgical manipulations. In particular, in the case of surgical nurses specialized gloves and ones with internal anti-bacterial coating are not considered. The necessity of replacing them every two hours and prevention of HAI are excluded in the calculations of gloves for manipulation. A list of recommended specialized gloves different types of manipulation by surgeons is much shorter: only calculations for the use of gloves with increased strength and of obstetric ones. The specialization factor of ligation nurses are not taken into account.

Model of interactive calculations

The model is developed using a scripting language of general-purpose programming PHP and prototype-oriented scenario-based programming language JavaScript. Relevant data obtained earlier is entered into the appropriate cells (figure 3). Their recalculation is done automatically in real time when moving from section to section as described at the stages above (figures 4,5). The results of the calculations are presented in the form of charts and tables.

The model of interactive calculations is the application tool that allows you to quickly analyze in an unbiased way, to evaluate the reserves and to optimize the structure of procurement of surgical gloves in the context of minimizing the annual costs of MO and increasing the share of high quality goods. The ability to save and unload the result in the form of a short report is provided for model users.

Results of model application

The results of the analysis and comparison of planned expenditures on surgical gloves with the estimated demands of the 53 health care institutions from 18 cities of the Russian Federation are divided into three groups:

1. 32% of MO with sufficient financial funds (the cost of the final structure is within a budget); in this case, costs optimization means their rational distribution; maximum deviation from the planned budget is $\pm 15\%$
2. 30% of MO with the lack of budgetary funds for the purchase of surgical gloves; in this case, costs optimization is means meeting the most important needs and rationing for the revision of the budget during planning for the next year; exceeding the planned budget by more than 15%
3. 38% of MO, where the structure of procurement provides significant budget savings; in this case, cost optimization means assessing previously produced disproportionate to the needs of procurement and revision of the budget for the following year; the cost of the proposed structure is less than 85% of the planned budget.

It is noteworthy that in all three groups of MO there are not significant differences in the volume of funds allocated for the purchase of surgical gloves (figure 6). That means that adequacy of hospital purchases of this consumables group does not depend on the volume of allocated funds. This confirms once again that the only criterion of choice should be the estimated need for gloves taking into account all influencing factors.

Figure 1. Algorithm for calculating the volume and structure of surgical gloves consumption for use by surgeons in surgical interventions

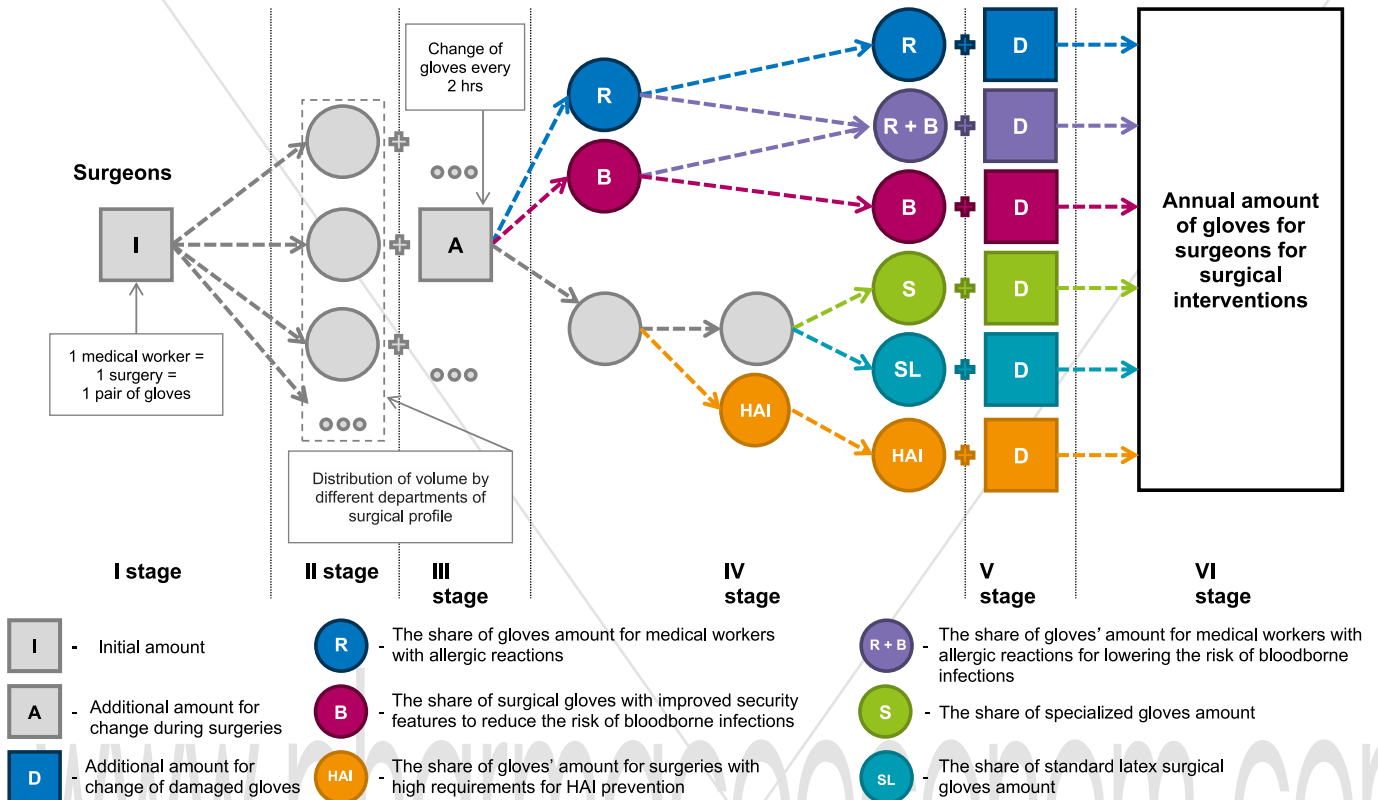


Figure 2. Algorithm for calculating the volume and structure of surgical gloves consumption only in case of factors of lengthy surgeries and the probability of damages

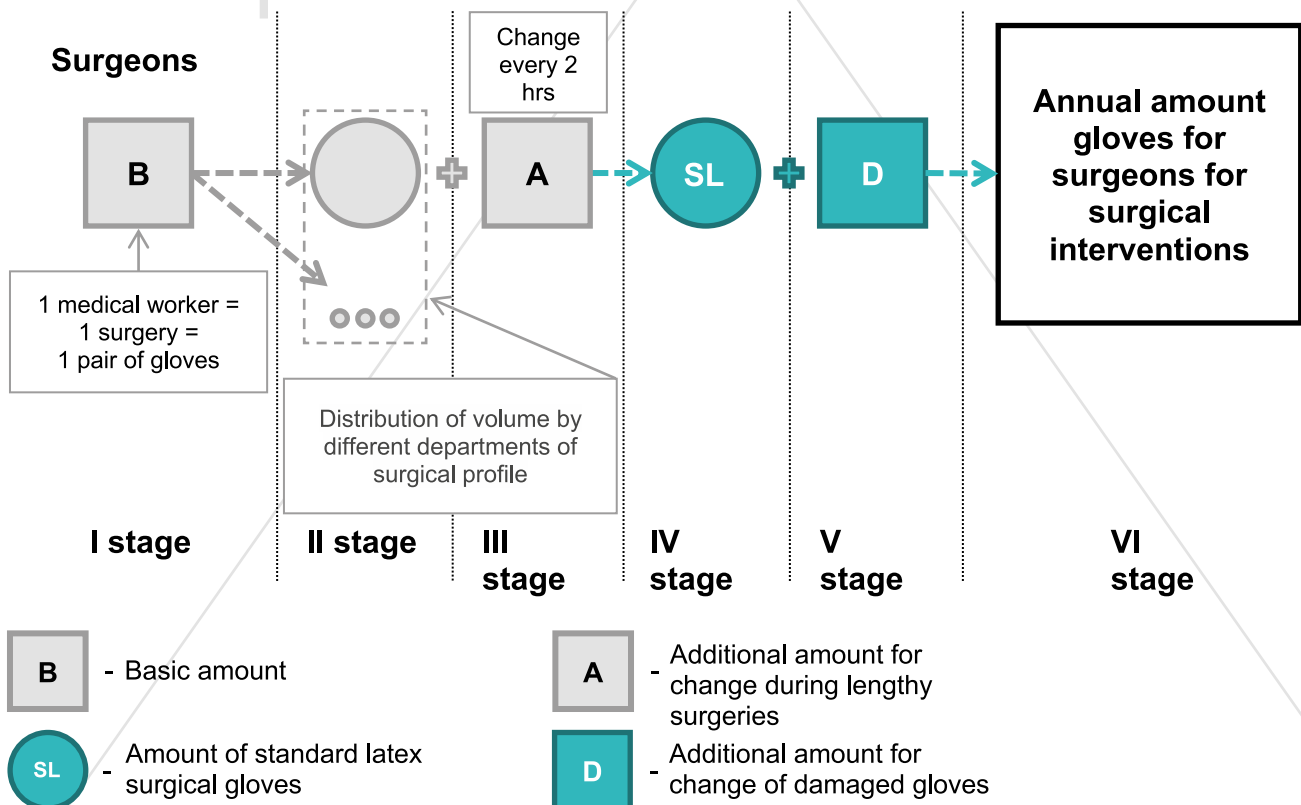


Figure 3. Division of model – general information on medical organization

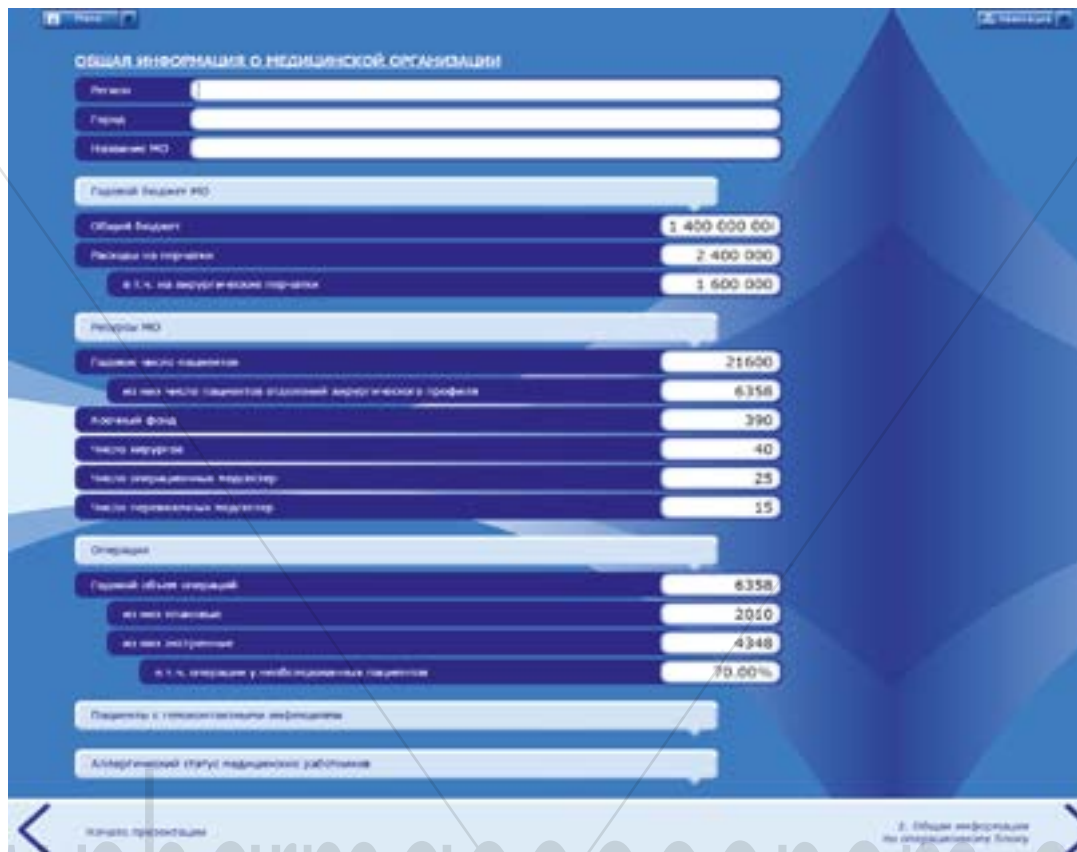


Figure 4. Division of model – assessment of medical organization needs with previous and future purchases

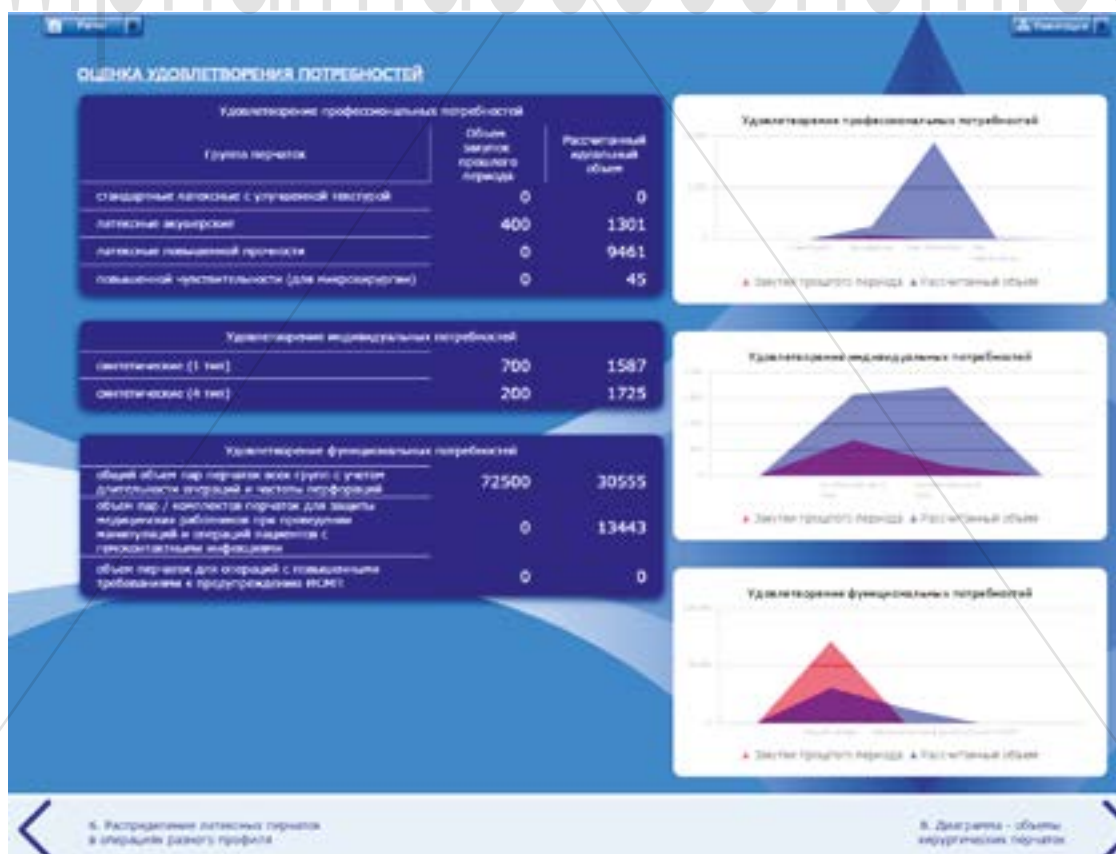
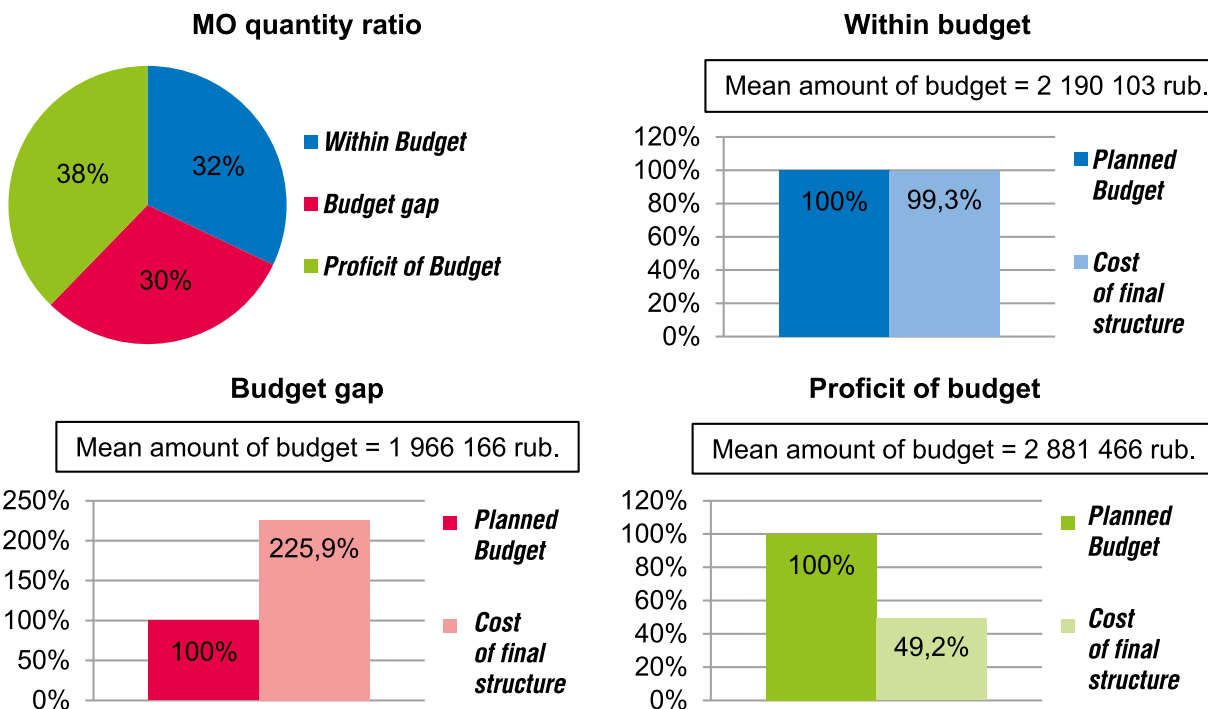


Figure 5. Division of model – choice of factors influencing on the final structure of procurement



Figure 6. Comparison of planned budget of medical organization for surgical gloves with the cost of final structure





Conclusion

Application of the model of surgical gloves choice and procurement optimization based on the pharmacoeconomic analysis methods allows you to take full account of the basic needs of hospitals and medical staff of surgical profile, to evaluate the rationality of spending and to make informed budgeting.

The importance of putting the model into practice of medical organizations is increased in conditions of limited health resources, when become highly important to determine right priorities and to predict organizational and economic consequences of each decision.

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