THE FINANCING MODEL OF THE REGIONAL HEALTH SYSTEM

Oksana M. KULIKOVA
Novosibirsk Research Hygiene Institute of the Russian Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing, Novosibirsk, Russian Federation
ya.aaaaa11@yandex.ru
https://orcid.org/0000-0001-9082-9848

Elena V. USACHEVA
Therapeutics Department, Municipal Outpatients' Clinic № 4, Omsk, Russian Federation
elenav.usacheva@yandex.ru
https://orcid.org/0000-0002-6134-1533

Corresponding author

Vitalii A. SHAMIS
Siberian State Automobile and Highway University (SibADI), Omsk, Russian Federation
vitaliy1999@mail.ru
https://orcid.org/0000-0003-4950-6072

Anastasiya V. NELIDOVA
Omsk State Medical University of the Ministry of Healthcare of the Russian Federation (OmSMU MOH Russia), Omsk, Russian Federation
avnelidova@mail.ru
https://orcid.org/0000-0003-0149-6119

Galina D. BOUSH
Omsk F.M. Dostoevsky State University, Omsk, Russian Federation
gboush@yandex.ru
https://orcid.org/0000-0002-3277-5543

Abstract
Subject The research devises the healthcare spending model in line with types and scope of medical aid, assesses indicators of the current and future planned periods.

Objectives The research is an attempt to optimize healthcare spending by improving the way it is earmarked in line with the region's demand for certain types of medical aid and reallocating financial resources.

Methods We use the conceptual modeling and Python 3.

Results We devised the model to optimize expenditures in order to increment resources available for health care purposes by reallocating them in accordance with the analysis of the financial situation, classes of patients. Our model builds on the type of total medical expenditures on patients with certain diseases and adjustment of healthcare spending against the current year's plans.

Please cite this article as: Kulikova O.M., Usacheva E.V., Shamis V.A., Nelidova A.V., Boush G.D. The Financing Model of the Regional Health System. Digest Finance, 2018, vol. 23, iss. 4, pp. 384–394. https://doi.org/10.24891/df.23.4.384

JEL classification: H51, I15, R13
Keywords: medical treatment, healthcare, resources, economic efficiency, cognitive modeling

Conclusions and Relevance Expenditures could be optimized through their reallocation in line with the type of total spending, financial effectiveness class and adequacy of their planning for promising and effective medical interventions.

© Publishing house Finance and Credit, 2018

The editor-in-charge of this article was Irina M. Vechkanova
Authorized translation by Irina M. Vechkanova

Introduction

Many countries model certain aspects of their healthcare systems [1–4]. They strive to make their national health systems more effective in light of the existing social needs and goals 1.

However, despite the highly elaborate approach to this issue as seen in the scholarly literature, there are still no versatile models allowing to plan and allocate healthcare resources as the region and/or country would really need. As a result, it is difficult to substantially upgrade the health system by lowering the public morbidity rates, curb a growth in medical spending [5–9]. The above effects are indispensable and unattainable without optimizing the mechanism for planning and allocating healthcare resources in line with the region's local distinctions. To ensure further development of the regional healthcare management theory and practices, resource planning and allocation processes should be modeled. In this respect, the appropriate methodological tools should be selected.

Looking through bibliographic sources, we found out that researchers from many countries had attempted to model some healthcare processes for the recent years. In particular, some of them suggested forming interdisciplinary teams and practicing systems approaches to chronic disease treatment [1, 2, 10, 11], analyzing the incidence of chronic non-infectious diseases and risks of their occurrence [12–14]; front-end medical assistance [15] and vertical equality [16], optimization of planning, designing and financing of health systems in accordance with the number of population. These models accommodate for sociopolitical circumstances and determinants of the health system [2, 17–21]; healthcare finance through the public-private partnership mechanism [22], spatial and time development of the health system [23–25]. The above studies involved correlation and regression analysis [13, 17, 19], Poisson lognormal mixed model in the Bayesian framework fitted to the INLA efficient estimation procedure [23], cost effectiveness estimation method [14], decision tree, Markov chain, micromodels, discrete and dynamic event modeling [24, 26], descriptive statistics, forecasting and simulation [19–21, 24, 25], market research [10].

Russia's health system is restructured to increase the cost effectiveness of medical aid to the public. The analysis reveals that optimization of resource planning, allocation and use is still pending in this sector [27–31]. Currently, human rights for health protection and medical aid are widely pronounced and specified. To exercise the declared rights, the State needs to form, effectively allocate and use as much financial resources as needed to perform specific tasks and attain healthcare goals. Accessible medical aid and its quality require to integrate various types of medical assistance. The health system shall be organized on the basis of a comprehensive approach to managing all its constituents [32].

Medical aid in case of a certain disease implies a combination of healthcare services varying by disease or a group of diseases. Available resources and financial resources, in particular, become a cornerstone of the quality and effectiveness of such medical care.

Nowadays healthcare services are financed in accordance with the State guarantee program for public healthcare and special-purpose programs for priority healthcare aspects. However, such finance is considered to be insufficient and unbalanced since funds are mainly spent on the priority needs.

The situation determines the purpose of this research. We devise and test an algorithm to build a healthcare spending model and optimize it by

1 For the source article, please refer to: Куликова О.М., Усачева Е.В., Шамис В.А., Нелидова А.В., Буш Г.Д. Модель финансового обеспечения регионального здравоохранения. Региональная экономика: теория и практика, 2018. Т. 16. № 10. С. 1823–1840. URL: https://doi.org/10.24891/re.16.10.1823

1 Dahabreh I.J., Chan J.A., Earley A. et al. Modeling and Simulation in the Context of Health Technology Assessment: Review of Existing Guidance, Future Research Needs, and Validity Assessment. Rockville, Agency for Healthcare Research and Quality (US), 2017. URL: https://www.ncbi.nlm.nih.gov/books/NBK424024/
- classifying types of medical care by level of financing;
- classifying patients by type and scope of medical care they need;
- estimation of indicators for the current and planned periods in accordance with the morbidity trend in the Russian regions, and analysis of observed scenarios.

**Methodology**

The research employs methods of logic and statistical analysis. We devised a special algorithm to optimize healthcare spending in the Russian regions. The regional healthcare spending algorithm is based on the assumption that the optimal structure of expenditures is the principal driver of healthcare effectiveness and high quality. In the Russian regions, the structure of healthcare funds is expressed with the set \( CR = (C_1, C_2, ..., C_m) \), which encompasses financial expenditures \( C_1, C_2, ..., C_m \) on various types of medical care. When planning and allocating financial resources of the national health system, authorities consider the delivery of primary health and sanitary care (outpatient clinics), specialized healthcare (inpatient and high-tech healthcare facilities), emergency and palliative care. Financial spending on the delivery of \( i \)-type of medical care is expressed with the formula:

\[
C_i = c_i n_{i}^d
\]

where \( c_i \) is the unit cost of \( i \)-type of medical care, thousand RUB; \( n_i \) is the number of patients awaiting \( i \)-type of medical care in the region, people.

The following condition determines whether healthcare spending in the national health system is optimal or not: \( CR \) is optimal only if \( C_i = C_i^{nd} \), where \( C_i^{nd} \) is healthcare institutions' needs for financial resources to deliver \( i \)-type of medical care. The needs are expressed with the following formula:

\[
C_i^{nd} = c_i n_{i}^{nd}
\]

where \( n_{i}^{nd} \) is the number of patients who need \( i \)-type of medical care in the region.

As part of the model for optimizing healthcare spending in the Russian regions, healthcare financing is viewed from perspectives of public needs. Funds may be sufficient or scarce. Financial funds for healthcare can be classified into the following types by scarcity/insufficiency:

1) excessively funded (contributing constituents), where \( C_i > C_i^{nd} \);
2) optimally funded (normal constituents), where \( C_i = C_i^{nd} \);
3) insufficiently funded (recipient constituents), where \( C_i < C_i^{nd} \).

Therefore, expenditures can be classified as follows depending on the structure of financial resources earmarked for medical care:

- **Sponsor set**: all respective constituents are excessively funded and can be viewed as potential sponsors of other types of total expenditures;
- **Optimum set**: the structure is optimal, i.e. all respective constituents are optimally funded and cannot be viewed as sponsors of other types, and recipients;
- **Chimera set**: there are both excessively and insufficiently funded items;
- **Recipient set**: all respective constituents are insufficiently funded.

The financing of the national health system is optimized by reallocating financial resources among types of medical care and hereby transforming ineffective spending schemes into effective ones. If it is impossible to generate the Optimum set, the financial priority is assigned to those types of medical care which are in the highest demand in terms of the risk and emergency theory.

In pursuit of optimization and more effective finance of medical care in the regional health system, patients can be classified by disease, severity and stability of their disease.

As part of a certain disease or a group of diseases, the model of healthcare spending and its optimization is built in the following coordinates:

- **X-axis** denotes the ratio of finance needed to finance planned in the current year, percent, determining to what extent the current expenditures correspond with the available (earmarked) funds;
- **Y-axis** denotes the type of a set of medical care expenditures for a group of patients.

The ratio of finance needed to finance planned in the current year, percent \( (D_i) \) is assessed with the formula:
The metric, Type of Medical Care Expenditures for a Group of Patients, is inscribed into the ordinal scale and has the following values: 1 corresponds to the Sponsor set; 2 is for the Optimum set; 3 is for the Chimera set; 4 is for the Recipient set. The scale reflects the complexity of managerial decision on the optimization of healthcare spending.

The model can be configured As–Is/To–Be\(^2\) with or without regard to classes of patients and the State guarantee program. Let us observe how the models are set. As part of the As–Is model, healthcare expenditures on each class of patients are indicated in the given coordinate system as a pie chart. In the case of the As–Is model, a table can be made to define what rules and results the optimization process shall produce. They shall be determined on combinatorial principles and optimization aspects. The table may provide for changes in the scope of healthcare services. Thus, patients may be reclassified. The To–Be model can take two forms:

- without overlapping with the As–Is model to reveal only optimized aspects of healthcare expenditures per each class of patients;
- overlapping with the As–Is model to show pre-optimization structures in addition to those ones which were optimized.

The healthcare spending optimization model in the Russian regions is built in accordance with the algorithm below.

1. Predetermining input parameters for modeling a disease class as per the International Classification of Diseases 10 (ICD-10) (one or several diseases); form of the model (As–Is, To–Be with or without overlapping).
2. Setting up the As–Is model.
   2.1. Predetermining input parameters for setting the As–Is model.
   2.2. Assessing values for the As–Is model.
   2.3. Setting up the As–Is model.
   2.4. Analysis of results from the model. If the healthcare spending structure is optimal, paragraph 2.6 is relevant. If the structure is not optimal, paragraph 2.5 shall be referred to.

\(^2\) Modern Business Management Technologies.

The As–Is Model. URL: http://pitersoft.ru/automation/more/glossary/process/as-is-model/ (In Russ.)
2.5. Determining aspects of healthcare spending structure to be optimized with respect to classes of patients.

2.6. Visualization of estimates through the graphical presentation of the model.

2.7. Conclusions on the modeling results.

If the healthcare spending structure is optimal with respect to classes of patients, paragraph 4 becomes relevant. If the structure is not optimal and the As-Is model is chosen only, paragraph 4 shall be referred to again. If the structure is not optimal and the To-Be model is chosen, paragraph 3 shall be referred to.

3. Setting up the To-Be model.

3.1. Setting the table of optimization opportunities (the table can be embedded into the algorithm and run by default).

3.2. Apply limits to modeling.

3.3. Optimization of the healthcare spending structure with respect to classes of patients through the exhaustive search method.

3.4. Setting up the To-Be model, with or without overlapping.

4. Cognitive visualization of results.

The algorithm is implemented via Python 3.

The model was tested while healthcare expenditures were structured and optimized with respect to patients with ischemic heart disease. The unit cost of a certain type and statutory scope of medical care is assessed per person holding a compulsory medical insurance policy by type and form of health care in accordance with the State guarantee program for free medical aid\(^3\) as earmarked for 135 thousand patients with ischemic heart disease.

**Results**

The regional healthcare spending optimization model treats the finance of healthcare services in terms of the public needs. The State guarantee program sets forth statutory rates of healthcare services per person holding a compulsory medical insurance policy. The established rates and norms are used to plan and substantiate financial resources. If we refer to the statutory scope of healthcare services stipulated in under the Statutory guarantee program as a percentage, the breakdown below of key healthcare services will be the most cost effective per person holding a compulsory medical insurance policy:

- services of outpatient clinics (healthcare services delivered out of hospital due to a disease) – 78%;
- emergency healthcare – 13%;
- specialized healthcare in twenty-four hour hospitals (inpatient care) – 7%;
- high tech healthcare – 2%.

We point out four classes of patients by severity and stability of ischemic heart disease, specifics of their treatment, needs for some type of healthcare services. **Rosebush** patients. Treatment is very effective and inexpensive as it results in a protracted remission of a disease so that patients may keep an ordinary lifestyle and continue working. Outpatient care prevails in the rosebush class spending. It is cost effective, very accessible and inexpensive.

**Camelthorn** patients. High-tech medical services are predominant in the camelthorn spending structure. The treatment is sustainably effective but it requires expensive medical interventions. Such patients seldom suffer from acute conditions of their chronic disease and continue to work given high-tech healthcare services are delivered to them. High costs of this healthcare type stems from the use of innovation and gradually rising indications.

**Quicksand** patients. Treatment efficacy is not stable, though being rather costly. The disease is severe, with frequently reoccurring acute conditions making patients unable to work as they used to and become physically limited in everyday life. Emergency care and twenty-hour inpatient care make the substantial part of expenditures on such patients.

**Severe winter** patients. This class is associated with the highest costs of twenty-four hour inpatient care and ambulance service. Unplanned costs for high-tech medical care are also incurred. The patients are mostly disabled, thus requiring additional payments for temporary or full loss of ability to work.

Table 1 and 2 present input data of the As-Is model in the case of patients with ischemic heart disease, which

---

\(^3\)Resolution of the RF Government of November 28, 2014 № 1273, On The State Guarantee Program for Free Healthcare Services for 2015 and the 2016 and 2017 Planning Period (with amendments and additions). URL: [http://base.garant.ru/70812574/](http://base.garant.ru/70812574/) (In Russ.)
we obtained as a result of the clinical test research and reassessed the entire population of patients with ischemic heart disease in the region.

*Fig. 1* depicts the As-Is healthcare spending model, which is based on input data, with respect to classes of patients with ischemic heart disease.

Having analyzed the results, we concluded that the analyzable classes of patients with ischemic heart disease pertain to the *Chimera set* of healthcare expenditures since each class of financial efficiency has the sponsor constituents and recipient constitutes, namely:

- expenditures of the *Rosebush* class include ambulatory and outpatient care as the recipient constituent (additional funds of RUB 28.32 million are required) and sponsor constituents (excessive funds of RUB 563.8 million);

- expenditures of the *Camelthorn* class include such sponsor constituents as ambulatory and outpatient care and emergency care with excessive funding of RUB 3.9 and 13.9 million respectively, and two recipient constituents – inpatient care and high-tech medical care, which require additional RUB 53.5 million and RUB 348.4 million respectively;

- expenditures of the *Quicksand* class include the sponsor constituent – ambulatory and inpatient care – with excessive funding of RUB 6.1 million and recipient constituents – ambulance care (additional funding of RUB 1.42 million), inpatient care (additional RUB 74.85 million), high-tech medical care (additional funding of RUB 297.23 million);

- expenditures of the *Severwinter* class include the sponsor constituent – ambulatory and outpatient care (excessive funding of RUB 9.9 million) and recipient constituents – ambulance care (additional funding of RUB 247 million), inpatient care (additional funding of RUB 61.48 million), high-tech medical care (additional funding of RUB 302.38 million).

Therefore, healthcare spending on patients with ischemic heart disease cannot be considered as optimal. Hence, measures should be taken to qualify it as such. *Fig. 2* shows the healthcare spending optimization model without overlapping with respect to patient with ischemic heart disease (*To–Be* model). The utilization of financial resources was optimized by reallocating them among types of healthcare services within a class of patients.

As seen in *Fig. 2*, after financial resources were streamed from the sponsor constituent to recipient constituents within the same class, the *Rosebush* expenditures could be reclassified from the *Chimera set* into the *Optimum set*. The structure of the other classes remained unchanged. As the next step, all the sets of expenditures shall be brought to the *Optimum* type, which is feasible only if additional financial resources of RUB 1.12 billion are allocated annually. Most of the funds (RUB 948 million, i.e. 84.6%) should be earmarked for high-tech medical care. We should note that this regional healthcare development course is in accord with departmental special-purpose programs, *The 2014–2020 Health System Development*.

**Discussion**

The optimal structure of healthcare spending is modeled to get a more comprehensive and accurate view of resources needed to implement primary goals of healthcare, i.e. substantially reduce the morbidity and mortality rates, cut unplanned healthcare expenditures. Creating the effective mechanism for resource planning, allocation and use in health care, it is necessary to consider the volume and composition of resources needed to deliver healthcare services depending on a disease since the Russian regions have different morbidity trends.

The algorithm we propose allows to consider the morbidity trends in the region and subsequently configure healthcare spending in each region and Russia as a whole. If costs are planned in accordance the financial efficiency classes, there will be sustainable cash flows. Insufficient funding restricts the delivery of healthcare services as needed under the compulsory medical insurance program. In this respect, it is not enough to prioritize expenditures and choose the type, volume of free healthcare services and categories of citizens who are eligible to them. There should be a new understanding of possible rearrangement of financial flows within the sector. The proposed model has the following advantages.

1. It raises the public awareness about the existing financial situation with respect to every disease.
2. It shows how the financial situation may develop in the future.
3. It clarifies financial challenges and their causes.
4. It paves the way for increased efficiency of the regional health system.
5. It contributes to the regional allocation of healthcare resources.

6. It enhances the way expenditures are controlled.

Referring to these findings, regional authorities may enhance the management of the regional health system, deciding on each class of diseases and choosing those types of healthcare services which definitely reduce morbidity rates.

**Conclusion**

Regionally and nationally, challenges of the health system include not only lack of funds but also the effective use of available financial resources. Public healthcare, quality and timeliness of healthcare services will lower morbidity rates, prolong the ability to work and raise labor productivity. The above factors will foster a growth in the national income and public wellbeing.

**Table 1**

Baseline data on the classes and number of patients, and the need for medical care

| Class of patients | Demand for outpatient care, % | Demand for ambulance care, % | Demand for inpatient care, % | Demand for high-technology medical care, % | Number of patients within the class |
|-------------------|-------------------------------|-----------------------------|-----------------------------|-------------------------------------------|-----------------------------------|
| Rosebush          | 90                            | 7                           | 2.997                       | 0.003                                     | 88,152                            |
| Camelthorn        | 75                            | 12                          | 10                          | 3                                         | 27,124                            |
| Quicksand         | 65                            | 15                          | 15                          | 5                                         | 13,562                            |
| Severwinter       | 50                            | 20                          | 20                          | 10                                        | 6,781                             |

Source: Authoring

**Table 2**

Baseline data on the key indicators of healthcare services

| Indicators                                      | Outpatient care | Ambulance care | Inpatient care | High-tech medical care |
|-------------------------------------------------|-----------------|----------------|----------------|------------------------|
| Statutory rate of key healthcare services per one policyholder, % | 79.628          | 12.985         | 7.22           | 0.167                  |
| Unit cost of a healthcare type, thousand RUB    | 1.265           | 2.124          | 28.968         | 185.193                |

Source: Authoring
Figure 1
The healthcare spending model by class of patients and type of Expenditure set

Source: Authoring
Figure 2
The healthcare spending optimization model with respect to patients with ischemic heart disease, without overlapping (the To–Be model)

Source: Authoring

References

1. Lane R., Russell G., Baroel E.A. et al. When Colocation Is not Enough: A Case Study of General Practitioner Super Clinics in Australia. *Australian Journal of Primary Health*, 2017, vol. 23, iss. 2, pp. 107–113. URL: https://doi.org/10.1071/PY16039

2. Lawn S., Lloyd A., King A. et al. Integration of Primary Health Services: Being Put Together Does not Mean They will Work Together. *BMC Research Notes*, 2014, vol. 7, p. 66. URL: https://doi.org/10.1186/1756-0500-7-66

3. Santosa A., Rocklöv J., Högberg U., Byass P. Achieving a 25% Reduction in Premature Non-Communicable Disease Mortality: The Swedish Population as a Cohort Study. *BMC Medicine*, 2015, vol. 13, p. 65. URL: https://doi.org/10.1186/s12916-015-0313-8

4. Song X., Quek R.G.W., Gandra S.R. et al. Productivity Loss and Indirect Costs Associated with Cardiovascular Events and Related Clinical Procedures. *BMC Health Services Research*, 2015, vol. 15, p. 245. URL: https://doi.org/10.1186/s12913-015-0925-x

5. Maru S., Byrnes J., Carrington M.J. et al. Economic Implications of Cardiovascular Disease Management Programs: Moving beyond One-Off Experiments. *Expert Review of Pharmacoeconomics & Outcomes Research*, 2015, vol. 15, iss. 4, pp. 657–666. URL: https://doi.org/10.1586/14737167.2015.1046842

6. Atehortúa S., Ceballos M., Gaviria C.F., Mejía A. Evaluación de la Calidad Metodológica de la Literatura en Evaluación Económica en Salud en Colombia: una Revisión Sistemática. *Biomedica*, 2013, vol. 33, no. 4, pp. 615–630. URL: https://doi.org/10.7705/biomedica.v33i4.1536

Please cite this article as: Kulikova O.M., Usacheva E.V., Shamis V.A., Nelidova A.V., Boush G.D. The Financing Model of the Regional Health System. *Digest Finance*, 2018, vol. 23, iss. 4, pp. 384–394. https://doi.org/10.24891/df.23.4.384
7. Ngalesoni F., Ruhago G., Norheim O.F., Robberstad B. Economic Cost of Primary Prevention of Cardiovascular Diseases in Tanzania. *Health Policy and Planning*, 2005, vol. 30, iss. 7, pp. 875–884. URL: https://doi.org/10.1093/heapolicy/ezu088

8. Dong G.N. Performing Well in Financial Management and Quality of Care: Evidence from Hospital Process Measures for Treatment of Cardiovascular Disease. *BMC Health Services Research*, 2015, vol. 15, no. 1, p. 45. URL: https://doi.org/10.1186/s12913-015-0690-x

9. De Gruyter E., Ford G., Stavreski B. Economic and Social Impact of Increasing Uptake of Cardiac Rehabilitation Services – A Cost Benefit Analysis. *Heart, Lung and Circulation*, 2016, vol. 25, iss. 2, pp. 175–183. URL: https://doi.org/10.1016/j.hlc.2015.08.007

10. Gilfillan R.J., Tomcavage J., Rosenthal M.B. et al. Value and the Medical Home: Effects of Transformed Primary Care. *The American Journal of Managed Care*, 2010, vol. 16, no. 8, pp. 607–614. URL: https://www.ajmc.com/journals/issue/2010/2010-08-vol16-n08/ajmc_10auggilfillan607to614

11. Spann S.J. Task Force Report 6. Report on Financing the New Model of Family Medicine. *Annals of Family Medicine*, 2004, vol. 2, suppl. 3, pp. 1–21. URL: https://doi.org/10.1370/afm.237

12. Nahhas G.J., Daguise V., Ortaglia A., Merchant A.T. Determinants of Major Cardiovascular Risk Factors Among Participants of the South Carolina WISEWOMAN Program, 2009–2012. *Preventing Chronic Disease*, 2014, vol. 11. URL: https://doi.org/10.5888/pcd11.140044

13. Hendriks M.E., Bolariwma O.A., Nelissen H.E. et al. Costs of Cardiovascular Disease Prevention Care and Scenarios for Cost Saving: A Micro-Costing Study from Rural Nigeria. *Journal of Hypertension*, 2015, vol. 33, no. 2, pp. 376–384. URL: https://doi.org/10.1097/HJH.0000000000000402

14. Muka T., Imo D., Jaspers L. et al. The Global Impact of Non-Communicable Diseases on Healthcare Spending and National Income: A Systematic Review. *European Journal of Epidemiology*, 2015, vol. 30, iss. 4, pp. 251–277. URL: https://doi.org/10.1007/s10654-014-9984-2

15. Rutman L.E., Migita R., Woodward G.A., Klein E.J. Creating a Leaner Pediatric Emergency Department: How Rapid Design and Testing of a Front-End Model Led to Decreased Wait Time. *Pediatric Emergency Care*, 2015, vol. 31, no. 6, pp. 395–398. URL: https://doi.org/10.1097/PEC.0000000000000455

16. Joseph K.T., Rice K., Li C. Integrating Equity in a Public Health Funding Strategy. *Journal of Public Health Management and Practice*, 2016, vol. 22, suppl. 1, pp. 68–76. URL: https://doi.org/10.1097/PHH.0000000000000346

17. Elf M., Fröst P., Lindahl G., Wijk H. Shared Decision Making in Designing New Healthcare Environments – Time to Begin Improving Quality. *BMC Health Services Research*, 2015, vol. 15, no. 1, p. 114. URL: https://doi.org/10.1186/s12913-015-0782-7

18. Penno E., Gauld R., Audas R. How Are Population-Based Funding Formulae for Healthcare Composed? A Comparative Analysis of Seven Models. *BMC Health Services Research*, 2013, vol. 13, p. 470. URL: https://doi.org/10.1186/1472-6963-13-470

19. Lantz P.M., Alexander J.A., Adolph C., Montgomery J.P. State Government Organization of Health Services, 1990–2009: Correlates and Consequences. *Journal of Public Health Management and Practice*, 2014, vol. 20, iss. 2, pp. 160–167. URL: https://doi.org/10.1097/PHH.0b013e31829ff709

20. Hecht R., Bollinger L., Stover J. et al. Critical Choices in Financing the Response to the Global HIV/AIDS Pandemic. *Health Affairs*, 2009, vol. 28, no. 6, pp. 1591–1605. URL: https://doi.org/10.1377/hlthaff.28.6.1591

21. Yuen E.J., Louis D.Z., Di Loreto P., Gonnella J.S. Modeling Risk-Adjusted Capitation Rates for Umbria, Italy. *The European Journal of Health Economics*, 2003, vol. 4, iss. 4, pp. 304–312. URL: https://doi.org/10.1007/s10198-003-0193-2

Please cite this article as: Kulikova O.M., Usacheva E.V., Shamis V.A., Nelidova A.V., Boush G.D. The Financing Model of the Regional Health System. *Digest Finance*, 2018, vol. 23, iss. 4, pp. 384–394. https://doi.org/10.24891/df.23.4.384
22. Barlow J., Roehrich J., Wright S. Europe Sees Mixed Results from Public-Private Partnerships for Building and Managing Health Care Facilities and Services. Health Affairs, 2013, vol. 32, no. 1, pp. 146–154. URL: https://doi.org/10.1377/hlthaff.2011.1223

23. Librero J., Ibañez B., Martínez-Lizaga N. et al. Applying Spatio-Temporal Models to Assess Variations Across Health Care Areas and Regions: Lessons from the Decentralized Spanish National Health System. PLOS ONE, 2017, vol. 12, no. 2. URL: https://doi.org/10.1371/journal.pone.0170480

24. Cardoso T., Oliveira M.D., Barbosa-Póvoa A., Nickel S. Modeling the Demand for Long-Term Care Services under Uncertain Information. Health Care Management Science, 2012, vol. 15, iss. 4, pp. 385–412. URL: https://doi.org/10.1007/s10729-012-9204-0

25. Tufts J.B., Weathersby P.K., Rodriguez F.A. Modeling the United States Government’s Economic Cost of Noise-Induced Hearing Loss for a Military Population. Scandinavian Journal of Work, Environment & Health, 2010, vol. 36, no. 3, pp. 242–249. URL: https://doi.org/10.5271/sjweh.2911

26. De Soárez P.C., Soares M.O., Novaes H.M.D. Modelos de Decisão para Avaliações Econômicas de Tecnologias em Saúde. Ciência & Saúde Coletiva, 2014, vol. 19, no. 10, pp. 4209–4222. URL: https://doi.org/10.1590/1413-812320141910.02402013

27. Andreeva O.V., Takmazyan A.S., Otrishko M.O. [Main trends in healthcare financing in the region in response to a reinforced fulfillment of insurance principles of healthcare arrangement]. Finansovey issledovaniya = Financial Research, 2016, no. 4, pp. 171–181. URL: https://cyberleninka.ru/article/v/osnovnye-napravleniya-finansirovaniya-zdravoohraneniya-regiona-v-usloviiyah-usileniya-realizatsii-strahovyh-printsipov-ego (In Russ.)

28. Baranovskii G.V., Badyukov V.F. [Model of regional decision-making of health care funding under full and part uncertainty]. Perspektivy nauki = Science Prospects, 2013, no. 9, pp. 116–119. URL: http://moofrnk.com/assets/files/journals/science-prospects/48/science-prospect-9(48).pdf (In Russ.)

29. Baranovsky G.V. [Regional model of financial and economic security of health care system]. Nauka i biznes: puti razvitiya = Science and Business: Development Ways, 2013, no. 9, pp. 99–102. URL: http://globaljournals.ru/assets/files/journals/science-and-business/27/s-a-b-9(27).pdf (In Russ.)

30. Guseva S.V., Ivanova N.G. [Programs budgeting in healthcare at the regional level]. Izvestiâ Sankt-Peterburgskogo gosudarstvennogo èkonomičeskogo universiteta, 2016, no. 1, pp. 32–41. URL: https://cyberleninka.ru/article/v/programmnoe-byudzhetirovanie-v-sfere-zdravoohraneniya-na-regionalnom-urovne (In Russ.)

31. Murzaeva O.V. [Regional aspects of financing of the health care (on example of Republic of Mordovia)]. Biznes. Obrazovanie. Pravo = Business. Education. Law, 2012, no. 2, pp. 188–197. URL: http://vestnik.volbi.ru/upload/numbers/219/article-219-373.pdf (In Russ.)

32. Lobkova E.V., Petrichenko A.S. [Managing the effectiveness of the regional health system]. Regional’naya ekonomika: teoriya i praktika = Regional Economics: Theory and Practice, 2018, vol. 16, iss. 2, pp. 274–295. (In Russ.) URL: https://doi.org/10.24891/re.16.2.274

Conflict-of-interest notification

We, the authors of this article, bindingly and explicitly declare of the partial and total lack of actual or potential conflict of interest with any other third party whatsoever, which may arise as a result of the publication of this article. This statement relates to the study, data collection and interpretation, writing and preparation of the article, and the decision to submit the manuscript for publication.