

# SOCIAL ASPECTS OF INNOVATIONS IN HEALTHCARE: THE RISKS OF STRENGTHENING OF THE SPATIAL INEQUALITIES OF REGIONAL DEVELOPMENT

## СОЦИАЛЬНЫЕ АСПЕКТЫ ИННОВАЦИЙ В ЗДРАВООХРАНЕНИИ: РИСКИ УСИЛЕНИЯ ПРОСТРАНСТВЕННОГО НЕРАВЕНСТВА РАЗВИТИЯ РЕГИОНОВ

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**Abstract:** *The main issues considered in this paper are: spatial spread of innovations during a healthcare reform; social results of disproportions in healthcare development and their impact on human capital; capabilities of spatial redistribution of innovations.*

**Keywords:** INNOVATION, HIGH-TECH MEDICAL SERVICES, HUMAN CAPITAL, REGIONAL DEVELOPMENT, SOCIAL INFRASTRUCTURE, SPATIAL INEQUALITY

### 1. Introduction

In connection with the crisis phenomena in the Russian economy, the resource base of the social sphere is reduced at both the national and regional levels, and it worsens the conditions of formation of human capital. In addition, spatial inequality of these conditions is increasing that, in particular, is associated with the transfer of functions of social sector financing to the regions and the corresponding rise of regional expenditure commitments. In the context of chronic shortage of most regional budgets, the amount of financial resources is insufficient for the functioning of social infrastructure.

A well-developed social infrastructure contributes to the improvement of the migration attractiveness and provides inflow of human capital to the economies of inhabited locations [1, 2, 3]. Human capital management in a region means joint development of health capital, educational capital and cultural capital [4, 5]. The basis of human capital is health capital, so the most important for the economy of regions, in this respect, are the services provided by healthcare and educational organizations. Access to high quality medical services, including high-tech ones, is the most important factor which determines people's quality of life.

Because of limited budgets, the basic ideology of the Russian reforms of the social sphere, including health, is the fiscal efficiency. The main instrument for the implementation of the reforms is to improve the health organizations in the regions through active use of innovation and spatial concentration of high-tech medical services.

The optimization of primary medical care – first-aid stations and village clinics – was based on the hypothesis that innovative capabilities of modern medicine, communications and transportation can provide the population with essential health services. However, in practice, spatial inequality in access to services increases. This calls for a change in the paradigm of funding the healthcare reforms and innovations.

The *objective* of the theoretical research is to reveal the problem of the increasing of spatial inequality of social and economic advancement of the regions in the context of human capital development and suggest possible ways to solve it.

### 2. Prerequisites and means for solving the problem

During the last few years in the Russian socio-economic system there is the implementation of the healthcare reform, which is

accompanied by contradictory tendencies and phenomena. Significant changes in the health care system were launched in January 2014.

Today there is a state program called "Healthcare Development" [6]. The state program implies two stages – the first one from 2013 to 2015, the second one from 2016 to 2020, with total volume of funding about 33 trillion rubles. The need for reforming is predetermined by several reasons, among which one should note an task of a more efficient use of the budget funds, including ones allocated for new equipment and technologies. The experience of the previous years showed that bigger amounts of money was spent on the purchase of advanced medical equipment and its provision to health institutions but it did not result in better medical services within the existing system. In some cases, the equipment was idle, not used for their intended purposes still either because there were no trained personnel or due to insufficient demand. Medical equipment and technologies were used effectively, as a rule, in multi-field hospitals having all sorts of departments.

The paradigm of the reform is: optimizing health institutions, eliminating inefficient institutions, reasonable reducing the number of medical staff, raising salaries of medical workers, on the basis of using the budget funds by more efficient way. The final goal of the reform is to make medical services better and more available as the most important constituents of the people's quality of life.

Innovations in the reform are developing in several areas related to modernization of the healthcare system. The steps of realisation of innovation processes include forming big regional centers which provide hi-tech medical services, purchasing modern medical equipment, and wide introducing information technology in practical activity. Medical information systems are being more broadly used as the basis of electronic document flow. In spite of these facts, one can notice not only some absolutely positive results but some aspects of a growing social risk.

Regarding innovations, they have been spatially concentrated in large health centers, which provide hi-tech medical services. Financial resources of the country have also been focused in this field. Consequently, capacities for complex surgery and rehabilitation have grown noticeably.

However, the first outcomes of the reform in the social aspects cannot be recognized as unambiguous since they have demonstrated contradictory social results. This is an opinion of medical experts, state auditors, and it is confirmed by the official statistics.

According to the auditors of the Accounts Chamber of the Russian Federation, about 90000 medical workers were made redundant, 350 healthcare institutions were reorganized during 2013, 26 hospitals were closed in 2014. More than 33000 hospital beds were eliminated. At the same time, hospital death rate increased by 3.7% (61 regions showed the growth). 17500 rural settlements do not have health institutions (over 11000 of them are located more than 20 km away from the nearest medical aid station), the volume of the fee-based services have grown by 24%. In 49 regions (more than 50%) the number of hospitalized patients decreased and the number of deaths grew [7].

The budget funds allocated for the reform, including those allocated for innovative modernization, are used ineffectively in a number of cases. The problem of using the medical equipment has not been settled. According to the All-Russian People's Front, 9000 units of the high-tech medical equipment purchased in the context of modernization are not used. According to the Foundation "Zdorovie" (rus. Health), 32 billion rubles (about 400 million euro, exchange rate 80 rubles per euro) was spent on IT processes. However, only about 14% of the Russians have electronic medical charts. Also regional differentiation of expenses is not quite understandable. For example, the cost of 1 square meter of floor in a perinatal center in Nizhny Novgorod Region in comparison with Pskov Region are more than twice different, and the cost of one bed is more than 3 times different. The purchase prices of the same medicines, that welfare beneficiaries are provided free of charge, can be dozens of times different depending on the region [8].

A well-known spatial problem is the difference in the conditions of human capital development in urban and rural areas, which causes migration processes. Concentration of healthcare facilities in large hi-tech centers with simultaneous reduction of first-aid stations in rural areas and small towns in the conditions of considerable scatter of populated locations and low development level of transport infrastructure (poor road quality, fewer number of public transport routes due to unprofitability) results in poorer quality of life in smaller locations and brings about growing spatial disproportions. In addition, medical services are becoming more and more available for those living in large cities.

In special issues of mass media and analytical reviews there are numerous examples proving that medical services are getting worse in rural areas [9]. The number of round-the-clock beds in hospitals diminishes. It is expected that medical services will be given in outpatient facilities. However, this is impossible given very low transport availability of medical institutions. If the plan of hospitalizations was fulfilled until the end of a year (planning is done in the system of compulsory medical insurance), hospitals are virtually become unable to function. As a result, patients, for instance, with heart diseases have to be treated in outpatient clinics. This contributes to advancement of illnesses and growing demand for high-tech medical care [10]. The newspaper "Rossiiskaya Gazeta" notes that since 2015 all outpatient clinics have been financed according to the "per capita" principle – the more patients they have, the more funding they get [11].

One can say that the outcomes of innovation development are paradoxical: on the one hand, availability of high-tech services has expanded, on the other hand, insufficient level of first-aid led to a decrease in the quality of life in rural areas and small towns. Thus, as a result, the economic and social disparities in the regions have increased. Furthermore, differentiation of medical services availability depending on the point of residence is growing unreasonably. Thus, according to the Accounts Chamber, the number of rural residents who were provided with health services decreased in 2014 by 32000 people. The death rate was 13.1 per 1000 people (the planned figure was 12.8) [12]. According to the Independent Monitoring Foundation "Zdorovie" due to the poorer access to first aid, reduction in the number of outpatient clinics and nurse's stations, patients tend to end up in medical institutions with aggravated stages of diseases or even just die from them at home [13].

The idea of distance medical consulting for those living in remote locations, which is expected to be provided due to the development of Internet facilities, seems doubtful. Due to the absence of "intermediaries" (doctors, nurses) when getting such information there is a problem related to interpretation of the consultation, medical errors are more likely to appear, and information channels can be overloaded with unnecessary information.

Very low position of Russia in international rating of the effectiveness of health systems confirms the negative trends in health care (the ranking prepared by the agency of Bloomberg, it includes 55 countries with population over 5 million people) – 54, last but one, position for the year 2015 [14].

The concept of concentration of the resources and innovations in "growth points" of the healthcare system under conditions of the lack of efficient mechanisms for spatial diffusion of innovations and ill-conceived practice of pseudo-optimization falls short of expectations in terms of equal conditions for human capital formation. It is necessary to review the paradigm of spatial spread of results of innovative activity in provision of medical services.

### 3. Solution of the examined problem

The conceptual bases for reforming the healthcare system can be revised from several positions in terms of spatial spread of innovations. First, it is reassessment of the role of the primary chain, even in case medical institutions don't have the necessary quality equipment and personnel. Partially innovations have to be made closer to a patient by providing basic equipment to the existing medical stations and, if needed, staff training. We see that first-aid stations and rural clinics are closed exclusively because of the necessity of budget cost restriction, but it is unacceptable to ignore social risks. Some of the money has to be redistributed from exclusively hi-tech medical services, provided by innovative centers, towards to nets of primary healthcare.

Secondly, the idea of distance medical aid has to be elaborated further. It is reasonable to review an idea of using medical expert systems, which help to take decisions at the primary level, and use distance consulting facilities at the same time.

This will allow identifying in due time the needs for medical care, shortening the time for dealing with patients, and reducing a possible information flow which is sent for consulting. Expert systems must be based on the capabilities to use synergy properties of a council of doctors, which will reduce chances of medical errors. For using expert systems it is necessary to keep the primary chain of healthcare with relevant specialists. These specialists must be trained to work with such systems. The main objective should be to reveal cases which require additional distance consulting and further medical care in hi-tech centers.

The world practice includes ideas related to development of medical expert systems. Expert diagnostic systems were first developed in the USA in 1967 (MYCIN) based on propositional connections. MYCIN is a diagnostic system that identifies infectious blood diseases and generates recommendations to cure them. The system is based on a medical knowledge base about microorganisms causing diseases and symptoms of diseases. The MYCIN system has sustained competition with consultations of highly-qualified medical experts. A knowledge engineering language called EMYCIN was developed based on this system for working out other expert systems. Thus was developed a medical system named PUFF oriented on diagnostics of lung diseases. Further development implied a capability to get a line of reasoning which makes the system come to conclusions (TEIRESIAS). The world experience proves that for successful operation of expert systems it is necessary to use intermediaries between experts and a system itself, who enable to formalize effectively expert opinions [15]. In the USSR there were also attempts of similar development

in the All-Russian Scientific Research Institute of System Research (academician Larichev, O.) [16]. There are prospects for self-learning intelligent systems (SLIS). In this case a doctor can share their own experience and that of their colleagues and use an effect of a council of doctors. Successful examples include using an automated information system of medical decision support TAIS developed under supervision of Prof. A. G. Ustinova (Russia, Pirogov Russian National Research Medical University (RNRMU)); computer express diagnostic system "DIAKOMS" (developer – V.V. Lakin RNRMU, Russia), etc. Some modern research about development in various fields and branches of medical knowledge is dedicated to the problems of using expert systems in healthcare as well as issues concerning obtaining effective results and ensuring conditions for using this approach [17].

Since 2012 the IT company of Socmedia, resident of the innovative center of Skolkovo (since 2014) has been working in the field of healthcare, specializing in developing expert systems in healthcare. This company creates the UMKB – the United Medical Knowledge Base – through a medical knowledge modeling technology. Medical experts and scientific centers are involved and a tool for remote modeling of medical knowledge is being created. The company, in particular, is involved in developing expert systems for predicting risks of disease progress, complications and therapy efficiency, early disease detection, therapy planning, patient condition monitoring, automated systems for analysis and statistic processing of clinical material. The system "Electronic GP" is being developed on the principles of AI [18].

From the financial standpoint, the suggestions above mean redistribution of the money allocated by the government for solving healthcare problems from the positions of the primary chain. As for spatial spread of innovations, it is, in essence, distribution of innovative solutions in the all settlements. The social effect of innovations in healthcare in this case will be distributed more fairly between urban and rural areas, between big cities and small towns. Improvement of first aid organizations will be ensured both in terms of the quality of medical services (in particular, consulting) and in terms of their availability (spatial, time and economic ones). In the long run, it can be expected that disease and death rates will decrease, while loads on the centers providing expensive hi-tech medical care will be reduced, which will ensure a more efficient use of the budget money. Moreover, the local territories of a region will be more evenly developed, since, as it is shown in the research by A.A. Gorovoy [1], there is correlation dependence between the balance of migration and the degree of social infrastructure development, including healthcare organizations providing medical services.

#### 4. Results and discussion

The urgency of correcting the concept of the healthcare reform is confirmed by objective statistics and expert opinions, general public surveys. The identified problem of the negative social aspects of innovations implemented in the Russian healthcare system can be settled through transformation of organizational solutions without substantial change in financing.

The essence of the proposed changes includes supporting the primary chain of healthcare in order to provide a minimal standard of basic medical services and using the capabilities of medical expert systems.

Let us identify the problems of managerial and economic nature, which emerge in implementing the decisions taken.

First, it is need for changing the paradigm of the healthcare reform. This is bound to cause resistance of the healthcare government bodies (most probably, of the middle line ones, which took part in developing specific mechanisms of the reform).

Second, it is insufficient advancement of the medical expert systems, which must be based on a range of opinions, like a council of doctors.

Third, it is need for training medical staff to use the expert systems.

Fourth, it is absence of actual experience in distance consulting in Russia, which creates an illusion of a simple solution to the medical care problem in remote locations and prevents seeing into alternative approaches.

Fifth, it is prevalence of conceptual, "growth points" based approaches in the positions of the decision-makers.

Sixth, serious economic difficulties noticeably reduce capabilities of solving any social problems and the easiest way to save money is to cut the number of organizations and staff.

Research in these fields can be continued and their results may be the basis for a new concept of the healthcare reform.

#### 5. Conclusion

Health services, their quality, volume and availability build up the foundations for the quality of life, basis of human capital. An effective healthcare system is a long-term factor ensuring sustainable well-balanced development of national and regional social and economic systems.

The reform of the Russian healthcare system was aimed at comprehensive enhancement of all the elements of the system based on the use of innovation results.

Practical implementation of the reform revealed a number of negative social effects, development of social risks related to uneven spatial spread of innovations. Results of innovation in healthcare are accessible through hi-tech medical aid centers. At the same time the number of first-aid organizations are reduced. Consequently, the population in rural and urban environment, big cities and small towns end up in unequal conditions and the quality of life in smaller locations is getting worse. The idea of diffusion of innovations thanks to distance consulting is not going to pay off.

So, obtaining the services of high-tech medical care in specialized medical centres is not always available to inhabitants of remote settlements. The practice of counseling patients in the remote access mode is associated with high risk of medical errors. Transportation costs associated with obtaining medical care are increased for patients from rural areas. Thus, the fiscal performance of the reform is achieved by shifting part of the costs on the population.

Due to innovations in health care, the relative accessibility of high-tech medical care in the big cities and the relatively low private costs of patients - residents, the attractiveness of cities for residents of rural areas increases, stimulating the increase of migration moods. This can lead to the acceleration of urbanization and the depopulation of vast territories.

Thus, the effective spatial organization of innovation in health care is necessary for the formation of human capital.

The reasons above make it necessary to change conceptual approaches to the healthcare reform.

The proposed changes are about shifting emphasis to the primary chain of healthcare and simultaneous use of the innovation results in the form of expert systems.

The expected outcomes of these changes will be lower disease and death rates, more even spatial development of territories, lower demand for hi-tech services.

To implement the suggested approaches it is necessary to solve the emerging implementation problems related to redistribution of

finances and innovations, change in the positions of decision-makers, staff retraining and improvement of expert systems.

In consequence of the suggested changes, the improving of conditions of human capital formation related to the healthcare system will stop worsening and will create some pre-requisites for their steady improvement.

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