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## **A review of studies on the economic effects of the implementation of telemedicine technologies**

**Abstract.** The article presents the results of a review of Russian and foreign literature on telemedicine. With the entry into force of the law on telemedicine in Russia, the spread of technologies for remote medical consultations has been accelerated, while the question of the economic effectiveness of relevant technologies in Russian conditions remains unresolved. In this paper, 27 studies on the telemedicine economy (20 cost-benefit studies and 7 cost-utility studies) and 4 studies on the barriers to the introduction of telemedicine in practice, are analyzed. In most cases, telemedicine can reduce healthcare costs. In those cases when telemedicine is economically inefficient, but its use improves the quality of medical services, the decision to use telemedicine should be taken depending on how much society values the added years of life and the saved years of quality life.

**Key words:** telemedicine, economic effectiveness, telemedicine barriers, cost-benefit analysis, cost-utility analysis.

**JEL codes:** H51, I18

### **Introduction**

The past decade is characterized by an improvement of healthcare in Russia: the availability of medical care (including high-tech) was improved, and the average life expectancy at birth was increased by six years. Despite this, a significant gap remains between the health indicators of the population of Russia and the developed countries of the world. Moreover, the topic of the problems of the Russian healthcare system is becoming more relevant nowadays: there is a growing concern in the society about access issues and the quality of medical care. According to research data of the Russian Public Opinion Research Center (VTsIOM) of 2016, the Russian population has included the healthcare system problem in the top three problems of the country, and the share of citizens who are worried about this issue has been growing at the highest rates in recent years [VTsIOM, 2016].

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In addition, there is a low share of public health financing, compared with developed countries that have a comparable set of guaranteed healthcare services. In 2018, the share of public expenditure on health in GDP in Russia is 3.1%, while in OECD countries this figure is 6.5%, and in Western Europe — 7.9%. If we compare the per capita expenditure indicator by purchasing power parity, in Russia it is over 3 times lower. In total, taking into account private spending, the share of healthcare in the Russian economy is 5.1% of GDP. The problem of relatively low healthcare financing is aggravated by the aging of the population and the development of multiple chronic diseases. According to forecasts, in Russia, unlike most European countries, the period of accelerated growth in the proportion of older people is just beginning. By 2027, the population over the labour age will increase by about 7 million people [Healthcare ..., 2017].

Throughout the world, there is a dynamic growth in the remote medical services through video communication using smartphones, computers and the Internet of things. The penetration of information and communication technologies (hereinafter — ICT) into the healthcare sector promotes the opening of new markets for healthcare products and services. Existing trends have already made the healthcare sphere a leader in the development of knowledge-based economy and a driver of economic growth [Healthcare..., 2017].

Existing challenges and new technologies call for a new organizational model of healthcare — to 4P medicine. This model involves shifting the focus of attention from the detection and treatment of diseases to identifying predispositions to the development of diseases (P1 — predication), preventing the occurrence of diseases (P2 — preventiveness), individual approach to each patient (P3 — personalization), motivated patient participation in prevention of diseases (P4 — participativeness).

Transition to the 4P model is impossible without changes in the structure of types of care and organizational forms. In particular, one of the transition conditions should be

- Creation of a system for remote personal monitoring of the health status of chronic patients;
- Formation of people's motivation and skills of using new medical and information technologies;
- Promoting personal health monitoring through remote health monitoring devices;
- Development of teleconsultation medical services;

Telemedicine is one of the results of the global growth in the use of information and communication technologies in healthcare. The use of telemedicine will reduce geographical disparity in access to medical care and improve the effectiveness of the provision of medical services. An important argument in favor of introducing telemedicine is its economic potential — according to

BBC Research, by 2019 the global telemedicine market will reach \$44 billion with an average annual growth of 17.7% [Dranishnikova, 2017]. In addition, telemedicine will reduce healthcare costs [Bongiovanni-Delarozière, Le Goff-Pronost, 2017].

On January 1, 2018, the Federal Law of July 29, 2017 N 242-FL “On Amendments to Certain Legislative Acts of the Russian Federation on the Application of Information Technologies in the Area of Health Protection” came into effect. This law foresees provision of medical assistance with the use of telemedicine technologies through councils and consultations that ensure remote interaction between doctors, the doctor and patient or his legal representative, as well as remote monitoring of the patient’s health.

The law gives the following definitions: telemedicine is “medical assistance with the use of telemedicine technologies”, and telemedicine technologies are “information technologies that ensure the remote interaction of medical workers among themselves, with patients and (or) their legal representatives, identification and authentication of these individuals, documenting their actions during meetings, consultations, remote medical supervision of the patient’s health” [Federal Law..., 2017].

In accordance with the law on telemedicine, in Russia telecommunication technologies in health care may be applied for the following:

- interaction of doctors with each other;
- interaction of doctors and patients (or their authorized representatives);
- ensuring the identification of users of telemedicine services;
- documenting the actions of health professionals and patients (or their representatives);
- holding councils and/or consultations;
- remote monitoring of patients’ health [Federal law..., 2017].

The introduction of ICT in medicine is not the introduction of a new method of treatment — it is a new way of transferring patient data. Based on this data, doctors and nurses also diagnose and make decisions about treatment, just as before the use of modern ICT.

ICTs played an important role in achievements in medicine and healthcare. There are different approaches to understanding the history of telemedicine, in the broadest version telemedicine appeared as early as the end of the 19th century, when the newly invented telephone was used to provide medical advice at a distance. Doctors were among the first to use the phone in their work [Zundel, 1996].

The inventions of the first commercial computer and the Internet provoked drastic changes in healthcare through new ways of delivering medical services, telemedicine has become an alternative method of providing medical assistance [Turner, Thomas, Reinsch, 2004]. Today, telemedicine is spreading to an

increasing variety of tools, including personal computers, smartphones, other gadgets and applications.

According to experts from the healthcare sector, A. L. Tsaregorodtsev [2017] and A. A. Karpunov [2018], in Russia, under existing conditions of strong geographical inequality in access to medical services, telemedicine can expand the population's opportunities to receive qualified medical care. The prospects for the development of telemedicine in the Russian Federation are due to a number of factors, among which are the following:

- Low population density in most regions, remoteness of settlements from district and regional centers;
- Limited ground communication between some localities, the irregularity and high cost of passenger transportation;
- Severe climatic conditions in the northern regions of the country;
- Lack of qualified medical personnel in sparsely populated and remote regions of the country [Begiev et al., 2015].

Geographical remoteness and poor development of the transport system do not allow many residents of our country, in particular the inhabitants of rural areas, to make the necessary number of visits to polyclinic institutions with curative and preventive purposes. Residents of a number of regions are often “cut off” from access to specialist services because of geographical or socio-economic conditions. The share of people who did not apply in 2011 for outpatient care and who did not receive it because of the lack of the necessary specialist was 29.9% in urban areas and 64.8% in rural settlements. Thus, rural residents were more than twice as often unable to obtain the necessary medical assistance because of the lack of the necessary specialist [Rosstat, 2011]. Nevertheless, in subsequent years, according to statistics, the situation has changed radically. In 2014, 35.5% of urban residents and 37.9% of rural residents did not receive outpatient care because of the lack of a necessary specialist [Rosstat, 2014]. In 2016, the share was 33.4% and 37.5% for city residents and settlements/villages, respectively [Rosstat, 2016]. Thus, there was a positive dynamic.

The State proclaims the principle of universal access to medical care for all citizens of the country regardless of place of residence. In this context, an important advantage of telemedicine is that it can support the emerging positive dynamics, as one of its most important functions is to overcome geographical disparity in access to medical care, increased and in future full availability of qualified medical care for rural residents and remote and hard-to-reach regions of Russia.

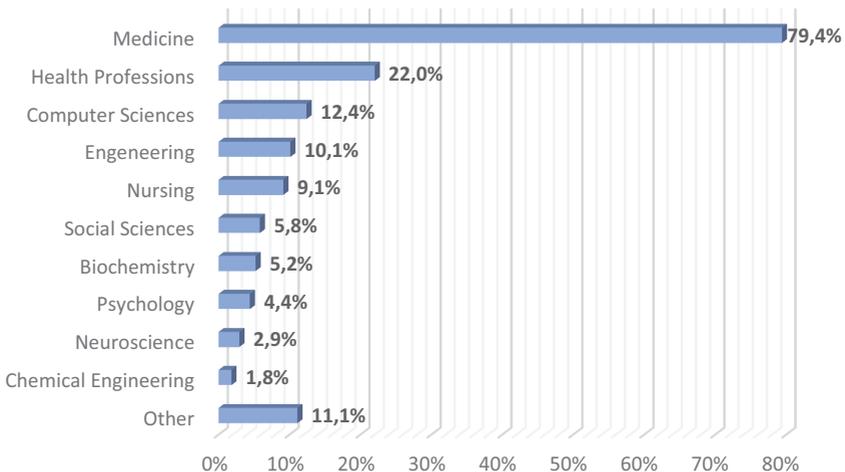
Another important function of telemedicine in addition to overcoming geographical disparity is to reduce the costs of the healthcare system. Information and communication technologies in healthcare are potentially able to reduce the need for consultations of outpatient hospitals and, as a result, to lower public healthcare costs [Isaev, 2012]. Remote video consultation is about 20 times

cheaper than a patient traveling from the Urals to Moscow, for Yakutia and Transbaikalia — 40 times, and in case of necessity of accompanying the patient by a medical employee the cost of the trip is doubled [Begiev et al., 2015].

In modern conditions of economic development, efficiency from the introduction of new information technologies into the healthcare system, such as telemedicine, is the focus of both scientists and healthcare organizers. Telemedicine is a promising direction in healthcare from the viewpoint of overcoming the costly mechanisms in the industry [Isaev, 2012]. With regard to this, telemedicine should become one of the strategic steps towards creating modern “digital healthcare”, compliant with world trends [Baistulatov et al., 2016].

As part of the literature review, the task was to study the experience of introducing telemedicine in different countries in the context of reducing costs for healthcare systems in these countries. The task was more specifically formulated in the following questions:

1. Do existing studies enable making conclusions about the economic feasibility of using telemedicine? If yes, under what conditions is telemedicine economically justified?
2. Are there barriers to the introduction and use of telemedicine? If so, which ones?

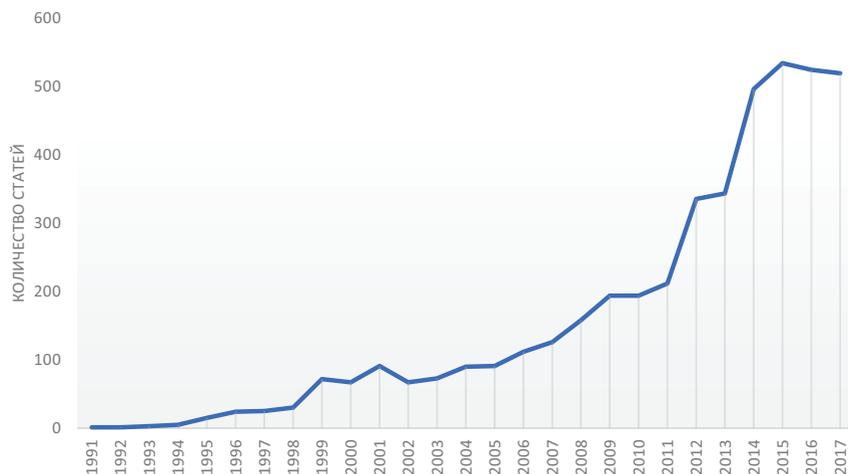


**Fig. 1.** “The structure of the Scopus database articles, in which telemedicine is mentioned, relevant for 10.10.2017.

The topic of telemedicine is well studied in other countries, as evidenced by the number of articles in the Scopus database: it contains 5580 articles, in

the headlines of which there are words such as “telemedicine”, “telecare”; and “telehealth”. All the set of found articles belongs to the field of medicine except for “engineering”, “computer sciences”, “social sciences” and “other”.

When looking at the dynamics of the number of articles in the “Medicine” category in the Scopus database, it is apparent that interest in telemedicine started to grow rapidly since the mid-1990s and has recently stabilized at around 500 articles per year (Fig. 2):



**Figure 2.** Dynamics of growth in the number of articles in the “Medicine” category of the Scopus database, in which telemedicine is mentioned, by year

## Methodology for literature review

The academic databases ScienceDirect, Academic OneFile, Business Source Complete, Expanded Academic ASAP, Scopus, General OneFile and Complementary Index have been studied for articles with the terms “telemedicine”, “telecare”, “telehealth”; with the terms “cost-effectiveness”, “cost-benefit”, “cost-analysis”, “cost-saving” and “cost-utility”, and also “barriers”, “difficulties”, and “challenges”. All search results were studied except for some cases when combinations yielded more than 500 articles — then the first 100 articles were reviewed. The search conditions included only articles in English and in Russian and only those works where the full text is available and which were published in the peer-reviewed scientific publication. Taking into account the search conditions, 6231 articles were found.

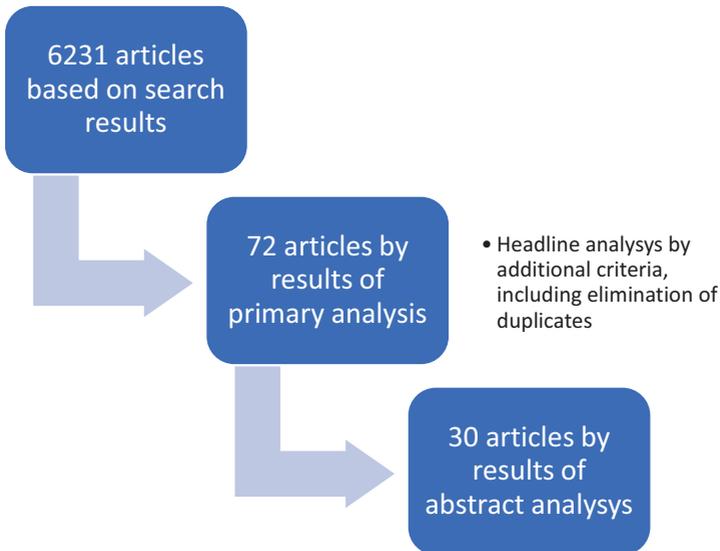
Also, two mandatory inclusion criteria for articles on economic efficiency were applied, including:

1. An empirical, longitudinal, controlled, randomized research was performed;
2. The article examines the economic efficiency, taking into account direct and indirect costs (the cost of telemedicine equipment, operating costs, telecommunication costs, personnel costs and transportation costs for patients);

For descriptive studies of institutional barriers, one inclusion criterion was used:

1. A qualitative or quantitative study was conducted on the barriers to the introduction and use of telemedicine.

After removing the duplicates and analyzing the headings within the additional inclusion criteria, the number of articles was reduced to 72. A review of the abstracts reduced the number of articles studied to 30, which were included in this review (Fig. 3):



**Fig. 3.** Selection of articles for review of literature on economic efficiency and institutional barriers to telemedicine.

## Results of the literature review

For purposes of analysis all selected studies on the economic effectiveness of telemedicine (a total of 27 articles) were divided into two groups:

- 1) Cost-benefit analysis;
- 2) Cost-utility analysis.

24 of 27 studies were conducted for high-income countries (USA, Australia, Germany, United Kingdom, Canada, Italy, France, Finland, Norway, New Zealand, Denmark, Hong Kong), 3 for middle-income countries (Russia, Mali). Most often, there were studies from the US — 8 articles overall. In five studies, patients in rural areas were studied, in nine studies patients were in urban areas, in three studies, telemedicine was studied in remote areas of the country, in the remaining 10 there was no clear division between urban and rural populations.

20 of 27 articles are “cost-benefit” analysis, 7 articles are “cost-utility” analysis. For the purposes of review of the literature, further analysis will be made in accordance with the presented classification.

In studies of the economic effectiveness of telemedicine, direct and indirect, fixed and variable costs were calculated, as well as marginal and total costs. In addition, in some studies, the break-even threshold was calculated, the economic result was based on net present value (NPV), social benefits were estimated through externalities and the probability of social benefits was estimated [Loane et al., 2001; Kildemoes, Kristiansen, 2004; Eminovic et al., 2010].

### **Cost-benefit analysis**

20 articles of this literature review were categorized as “cost-benefit” analysis. Almost all of the selected articles are devoted to the study of telemedicine in two areas: cardiology and dermatology, 11 of them having telecardiology as their subject and the remaining 8 — teledermatology. In the last article, the study was conducted on patients suffering from various diseases — the sample was randomized.

All studies describe the methodology, and all are randomized, that is, different groups of patients participate in the observation, which is the criterion for selecting articles. Most often, the works are based on comparing patients treated with telemedicine to patients undergoing traditional treatment delivery methods, for example, Dowie R., Mistry H., Rigby M., Young T. A., Weatherburn G., Rowlinson G., and Franclin R.C.G. [1997] conducted within their work a fifteen-month longitudinal cohort study in which the results of treatment of two groups of patients were compared — representatives of one group were treated in the traditional way, and patients of the second group received telemedicine consultations. In a study of Loane M., Oakley A., Rademaker M., Bradford N., Fleischl P. and Kerr P. [2001] in 10 months of follow-up, 54% of patients were treated with telemedicine, 46% visited the doctor personally during treatment.

The selected articles can also be divided into two groups according to the approach used: in part of them, only the costs of the healthcare system are taken into account, in others, the societal approach is applied when social costs are considered.

The “cost-benefit” analysis assumes the calculation of the economic feasibility of a project, therefore, studies of this group can be divided into three subgroups based on their results (see table 1). In sixteen studies, the authors concluded that telemedicine is cost-effective (papers 1-16 in table 1), in four articles, telemedicine consultations proved to be more expensive than traditional ones (papers 18-20 in table 1), in one study (paper 17 in table 1) telemedicine was not economically feasible at the time of the study, but the authors indicated that new technologies will potentially be more profitable in comparison with traditional analogs when certain conditions are met.

The main factor in achieving the economic effectiveness of telemedicine is the frequency of using telemedicine equipment. In this context, the number of in-person consultations with a doctor that did not happen due to tele-consultation is important. According to a study by Seto E. [2008], cost reductions are mainly due to a reduction in hospitalization costs. For example, Rendina M. C., Carrasco N., Wood B., Cameron A. and Bose C. [2001] demonstrated that telemedicine in pediatric cardiology reduced the number of patient transportations by 58%. In a similar study of pediatric cardiology conducted by Sicotte C., Lehoux P., Van Doesburg N., Cardinal G., Leblanc Y. [2004], 42% of transportations were avoided. In addition to reducing the number of hospitalizations, an important parameter affecting the telemedicine economy is the average cost of traveling from home to the medical facility and indirect costs associated with excommunication from home/work, etc. [Dowie R. et al., 2009].

Vincent J. A., Cavitt D.L. and Karpawich P.P. [1997] compared the cost of telemonitoring children with a pacemaker with the cost of a traditional monthly visit to the doctor. 96 patients were observed for three years, during which the average monthly outpatient costs per child were about \$ 200 in case of using telemedicine, while the traditional observation of a patient averaged \$260 per month.

Levanov V.M. [2013] in a study of the telemedicine system of the Nizhny Novgorod region, based on the results of six-year observations, concluded that telemedicine reduced the costs in the study group by 5.9%. The economizing consisted in reducing the number of days of hospitalization for patients in the control group. The difference in the duration of hospitalization, calculated by comparing the average values, was  $1.36 \pm 0.09$  days (7.58%).

In their work, Rendina et al. [2001] studied the possibilities of reducing the cost of carrying out an echocardiogram to newborns using telemedicine: for three medical institutions, the reduction in the number of transportations to the nearest medical centers was 58%, which resulted in cost savings of about \$150,000.

Myriam Le Goff-Pronost and Claude Sicotte [2017] demonstrated in a longitudinal four-year study of pediatric telecardiology that the break-even threshold of the project had not been achieved after four years of research. However, the authors managed to identify alternatives that could make this

service economically viable. They included: a longer period of use of telemedicine infrastructure, expansion of the network to other telemedicine specialties or the inclusion of other hospitals in the existing telemedicine network.

A total of 15 studies showed a reduction in costs in the case of using telemedicine in comparison with traditional methods. The amount of cost-savings ranged from 2% to 73%. Most studies indicate that patients noted improvements in care and treatment, as well as increased access to healthcare, but there was no decline in medical effectiveness. For example, Finley J. P., Sharratt G. P., Nanton M. A., Chen R. P., Bryan P. and Wolstenholme J. [1997] noted that the medical outcomes of the treatment were identical for the two compared groups within the permissible error.

Many authors noted the limited evidence, caused primarily by their heterogeneity and frequent inability to compare medical results of treatment, which reduces the ability to formulate clear conclusions about economic efficiency. Thus, Bongiovanni-Delarozièrea and M. Le Goff-Pronost (2017) point out in a systematic literature review that a cost-benefit analysis can give an incomplete economic assessment, since we can judge the economic effectiveness only if the medical results of different telemedicine projects can be brought into a comparable form, which imposes restrictions on this method. Such an approach can be used to estimate the costs of an activity, but it is not suitable for formulating conclusions about profitability.

**Table 1.** Analysis of articles in the “costs-benefits” category;

№	Author(s)	Country	Result
1	Finkelstein S.M. et al. (2006)	USA	Reduction of costs by 54%
2	Giordano A. et al. (2009)	Italy	Reduction of costs by 35%
3	Loane M. et al. (2001)	New Zealand	Reduction of costs by 2%
4	Pak H.S. et al. (2009)	USA	Reduction of costs by 9%
5	Van Os-Medendorp H. et al. (2012)	Germany	Reduction of costs by 73%
6	Seto E. (2008)	Canada	Reduction of costs by 68%
7	Bagayoko et al. (2014)	Mali	Patients on average received savings of \$25
8	Finley J.P. et al. (1997)	Canada	Reduction of costs by 21%
9	McCue M.J. et al. (2000)	USA	Reduction of costs by 26%
10	Vincent J.A. et al. (1997)	USA	Reduction of costs by 23%
11	M. A. Loane et al. (2001)	New Zealand	Reduction of costs by 1%
12	David Moreno-Ramirez (2009)	Spain	Reduction of costs by 38%
13	Bergmo T.S. (2000)	Norway	Reduction of costs by 47%
14	Burgiss S.G. et al. (1997)	USA	Reduction of costs by 52%

**The end of table 1**

<b>№</b>	<b>Author(s)</b>	<b>Country</b>	<b>Result</b>
15	Dowie R. et al. (2009)	United Kingdom	Reduction of costs by 12%
16	Rendina M.C. et al. (2001)	USA	During the 18 months of research, 30 transportations were avoided, which resulted in cost-savings of \$150,000
17	M. Le Goff-Pronost et al. (2017)	France	The project's NPV remained negative after 4 years of research
18	Lamminen H. et al. (2000)	Finlyadnia	Increase in costs by 3%
19	Eminovic N. et al. (2010)	Germany	Cost-savings would be possible if the average distance to the nearest dermatologist was over 75 km or the number of teleconsultations increased by 38%
20	Sicotte C. et al. (2004)	Canada	The average cost per patient increased by \$1,500

### Cost-utility analysis

7 articles were categorized as “cost-utility” analysis. Almost all of the selected articles are devoted to the study of telemedicine in two areas: cardiology, pulmonology and ophthalmology. Of these, 5 articles are devoted to telecardiology, 1 to telepulmonology and 1 to telethophthalmology.

The cost-utility analysis is a type of study based on a cost-effectiveness criterion used to understand whether a particular treatment should be financed. The essence of this method is to compare the cost of the project with its utility. For example, utility analysis will help determine how much a saved year of quality life (QALY) will cost in the case of implementation of a telemedicine project, so this method is used in some countries to plan healthcare policy. Performance analysis by calculating QALY is applicable to most diseases and medical interventions.

The “cost-utility” analysis is of interest for two reasons. First, telemedicine can significantly affect the quality of life of patients, especially those with chronic diseases. Secondly, the evaluation of the effectiveness of medical intervention is very often hindered due to the heterogeneity of results expressed in different units of measurement, which makes it impossible to choose treatment methods until the data is translated into a comparable form. However, this approach is rarely used to assess the economic efficiency of healthcare because of the difficulty in calculating the monetary value of health [Bongiovanni-Delarozière, Le Goff-

Pronost. 2017]. In medical practice, according to Zarubina T.V.<sup>1</sup>, the principle freelance expert in the implementation of modern information systems in the healthcare of the RF Ministry of Health, in making decisions on allocating funding for health care, medical efficiency should always be the first priority, while economic efficiency is seen not as an end in itself, but as a necessity to be reckoned with. In this regard, the issue of finding the most cost-effective solution in the health sector is non-trivial.

The QALY parameter shows how much a saved year of quality life will cost society. For the possibility of making a decision on the economic feasibility of a project, there is a threshold value of QALY, in case of overcoming which the healthcare event is considered to be economically inefficient. This parameter is called the “cost-effectiveness threshold” (CET). According to the recommendations of the WHO Commission on Macroeconomics, the CET indicator is considered to be equal to three GDP per capita:

$$\text{CET} = (3 \times \text{GDP} / N),$$

where: CET — cost-effectiveness threshold, GDP — gross domestic product (for a specific country), and N is the population of the country, the number of people [Yagudina, Sorokovikov. 2012].

The QALY indicator for the USA is \$50,000 [Grosse, 2008]. If we take this indicator as a guide, only 3 out of 6 telemedicine projects studied in the selected articles are within the effective value ( $\text{cost} < \text{QALY}$ ) [articles 22, 24, 26, 27 in table 2], in the three remaining costs were above the effective value ( $\text{cost} > \text{QALY}$ ) [articles 21, 23, 25 in table 2].

**Table 1.** Analysis of articles of the “cost-utility” category.

№	Author(s)	Country	Result
21	Kildemoes H.W. et al. (2004)	Denmark	QALY = DKK 854700 (\$ 142450)
22	Achelrod D. et al. (2016)	Germany	QALY = €34432 (\$ 43030)
23	Nelson R.E. et al. (2008)	France	QALY = \$108363
24	Ehlers L. et al. (2008)	Denmark	QALY ~ \$ 50000
25	Liu Sheena Xin et al. (2016)	USA	QALY = \$ 250200
26	Brunetti et al. (2014)	Spain	QALY = €1927 (\$ 2409)

## Barrier analysis

Four articles were categorized as descriptive analysis, their subject being the study of barriers to the introduction of telemedicine. The analysis of the works examining

<sup>1</sup> Interview with Zarubina T.V. (The N.I. Pirogov Russian National Medical Research University of the Ministry of Health of the Russian Federation, Moscow), 12.01.2018.

the barriers to the use of telemedicine has shown that apart from technical difficulties of implementing telemedicine projects, issues of confidentiality, culture and trust, as well as the specific features of the healthcare system that exist in the country, are of great importance. For example, the study by Peddle K. [2007] concludes that in addition to technical barriers to the introduction of telemedicine, data security, culture and trust in new technologies issues have an important meaning.

The articles can be conditionally divided into 3 groups by barriers, on which the emphasis is placed in each work:

1. Technical (article 30 of table 3);
2. Cultural (article 31, 32 of table 3);
3. Organizational (article 29 of table 3).

Technical:

- Inequality of the country's regions in the development of the information and communication infrastructure;
- The need to equip telemedicine studios with expensive computer equipment;
- Ensuring the protection of personal information;
- The need for staff training.

Cultural:

- Conservatism of doctors;
- Mistrust of the population to telemedicine.

Organizational:

- Legal aspects of telemedicine care, including the lack of flexibility in health systems, which is due to country-specific features of healthcare systems and healthcare financing schemes.

Political barriers in the form of a lack of necessary regulations are fundamental difficulties in introducing telemedicine, so governments should pursue policies to legislatively stimulate and plan the development of appropriate technologies, and include telemedicine in health insurance programs (article 29 of table 3). In addition, the legislation of different countries in the field of health should be harmonized to ensure cross-border telemedicine consultations. Telemedicine is fundamentally a technology without borders, since it is never known beforehand in which country the best specialist in the disease of a particular patient works.

**Table 3.** Analysis of articles in the “descriptive analysis” category;

№	Author(s)	Country	Result
27	Chiang et al. (2015)	Taiwan	Legal issues are the major obstacle to the development of telemedicine
28	Sanders C. et al. (2012)	United Kingdom	When planning telemedicine projects, special attention should be paid to confidentiality issues

**The end of table 3**

<b>№</b>	<b>Author(s)</b>	<b>Country</b>	<b>Result</b>
29	Nguyen L. et al. (2017)	Canada	Applied technologies should be simple and understandable for the elderly
30	Peddle K. (2007)	Canada	The problems of telemedicine development are mainly related with issues of culture and trust in new technologies.

## Conclusion

This review demonstrates that in most cases, telemedicine can reduce healthcare costs. The main factor in achieving the economic effectiveness of telemedicine is the frequency of using telemedicine equipment. In this context, the number of in-person consultations with a doctor that are avoided through tele-consultation is important. In addition to reducing the number of hospitalizations, an important parameter affecting the telemedicine economy is the average cost of traveling from home to a medical facility and indirect costs associated with excommunication from home/work, etc.

Telemedicine is not always economically effective, however, when its use improves the quality of medical services, the decision to use telemedicine should be taken depending on how much society values the added years of life and the preserved years of quality life.

The analysis of the works examining the barriers to the use of telemedicine has shown that apart from technical difficulties of implementing telemedicine projects, issues of confidentiality, culture and trust, as well as the specific features of the healthcare system that exist in the country, are of great importance.

In Russia, under existing conditions of strong geographical disparity in access to medical services, telemedicine can become an important vector for the development of the healthcare system. The results of the Comprehensive Survey of the Population's Living Conditions by Rosstat prove that there are no significant differences between the urban and rural population in the number of visits to general practitioners, but significant differences in the number of visits to narrow specialists.

On January 1, 2018, the law on telemedicine came into force. For a long time the topic of telemedicine has been highlighted in the media.. However, there is a shortage of empirical studies of telemedicine in Russia, which has been identified in this study. A request using “telemedicine” as a keyword in the scientific digital library eLIBRARY.RU resulted in 3125 articles, 94 of them are related to the subject of “economics”, and only three papers provided empirical data on the economic effectiveness of telemedicine, two of which were included in the final sample. Several theoretical articles were also found on methods for calculating the economic efficiency of telemedicine. Nevertheless, no studies were

found on the prospects of telemedicine in the context of reducing the costs of the compulsory medical insurance (CMI) system of Russia, which is the subject of this work. Thus, there is a shortage of economic studies of telemedicine in Russia.

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