POINT OF VIEW

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EFFECTIVENESS OF 3D-MODELLING LABORATORY IMPLEMENTATION INTO THERAPEUTIC AND DIAGNOSTIC MEDICAL INSTITUTIONS

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The article presents the analysis of 3D modeling laboratory efficiency after its introduction in the departments of radio diagnostics. Prospects and risks of the work of this unit is presented in the study. The calculation of economic indicators shows that the payback is around 2 years, the breakeven point is 60 – 70 clients per month. Results obtained economically and technologically justify active deployment labs 3D simulation in medical institutions.

Keywords: healthcare, economy, 3D modeling.

Using of 3D-modeling in medical institutions has not yet become a routine procedure, but it is in this direction that a qualitative breakthrough in the field of personalized medicine is the most likely [11, 16] since a technological basis has already been formed for this and in the process of its practical testing it should additionally take shape relevant organizational, economic and ethical standards. In this regard, a systematic analysis of the effectiveness of the implementation of these decisions in medical practice is necessary [7, 8].

The department of radiation diagnostics, which is standard for Russian medical institutions [2], could be the most suitable unit for the implementation of 3D modeling and printing. Firstly, a 3D modeling group is better positioned as an independent technological unit bearing in mind its transformation into a separate laboratory in the event of a significant increase in the volume of work [8, 13, 14]. It should be noted that the trend of increasing volumes of medical activity using medical imaging, and data processing technologies with an ever-growing consumer market has been observed everywhere in the last decade [18]. For example, steady increase in mortality from malignant neoplasms of the brain and spinal cord recorded in Russia requires significant optimization of their diagnosis and treatment [1]. Due to the rapidly improving Big Data technologies, increasing the productivity of electronic computing power, it is possible to overcome the lack of radiation diagnostic data and accelerate digital processing [15]. High quality hardware / software complex, management and good work organization aimed at achieving continuous improvement of preanalytical, analytical, and postanalytic phases in diagnosis are an integral guarantee of making a correct diagnosis (Table 1).

Today, it has already become possible to qualitatively supplement and improve the differentiation of diseases of various genesis with the help of slicer programs that convert 2D data of radiation diagnostics into full-fledged three-dimensional models, so the doctor has a chance to carry out preliminary surgical preparation and choose the most effective and optimal tactics for performing surgical operations with minimal risk for the patient and a decrease in the trauma of healthy tissues. Successful high-quality recognition of diseases of various origins in the radiation laboratory complex also reduces the need for repetition of studies and time saving, leading to an increase in the efficiency of staff and the medical institution as a whole [3, 10, 12, 17].

The main threats to the work of the 3D modeling laboratory are hacking and theft of information by hackers (Table 1). This problem can be solved by using more advanced cryptography algorithms, using specialized security software, Blockchain technologies and integrated security systems for user authentication [4, 5, 9].

The introduction of the laboratory with the addition of information processing of data can improve the organization of labor, save time and more carefully control of the research process [6, 19]. At the first stage, this new technology requires additional investments, the financial viability

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Table 1

Analysis of prospects for the implementation of 3D modeling laboratory

	Opportunities	Threats
Strengths	Increased productivity and lower costs resulting from using of machine learning, categorization, artificial intelligence algorithms	Certified software and integrated security systems
Weaks	Dependence on electronic computing power and access to specialized databases	Imperfection of authentication and personification systems when working with databases

of which can be characterized by comparing the expected costs and revenues [13]. The time variation of these economic values in relation to the economic conditions of the Primorsky Krai is presented in Fig.: for the 3D modeling laboratory, the payback period is about 2 years, the break-even point is 60-70 clients per month; the net present value with a rate of 10% and an investment of 500,000 rubles is 187,734 rubles (Table 2).

The creation of a 3D modeling laboratory in medical institutions as an additional module to the department of radiation diagnostics or autonomous education allows us to significantly expand existing methods of non-invasive examination and use them in the areas of preoperative planning and prosthetics. The results obtained during the work economically substantiate the creation of this laboratory in hospitals and clinics to improve the quality of medical services to the population.

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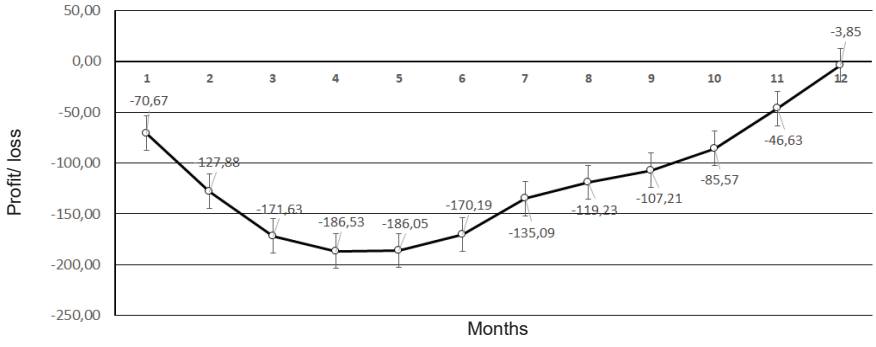
Table 2

Economic indicators (rubles) for the 3D modeling laboratory

Indicator	Months											
	2	4	6	8	10	12	14	16	18	20	22	24
Profit from 1 client	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
Number of customers per month	63	56	70	43	73	73	53	63	73	43	73	73
Total revenues	157500	140000	175000	107500	182500	182500	132500	157500	182500	107500	182500	182500
Payment of utility services	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000
Salary	75200	75200	75200	75200	75200	75200	75200	75200	75200	75200	75200	75200
Payment for communication services	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Taxes	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Cost of raw materials	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Capital expenses	565000	0	0	0	0	0	0	0	0	0	0	0
Equipment depreciation costs	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
The total cost of production	711700	146700	146700	146700	146700	146700	146700	146700	146700	146700	146700	146700
Hospital net profit	-554200	-6700	28300	-39200	35800	35800	-14200	10800	35800	-39200	35800	35800
Discounted flow	-511530	-6180	26120	-36180	33040	33040	-13110	9970	33040	-36180	33040	33040
Amount of initial investment	250000	0	0	0	0	0	0	0	0	0	0	0
Profit / loss for an individual entrepreneur	-1473230	-1333230	-1158230	-1050730	-868230	-685730	-553230	-395730	-213230	-105730	76770	259270
The total cost of production	656700	91700	91700	91700	91700	91700	91700	91700	91700	91700	91700	91700
Hospital net profit	-499200	48300	83300	15800	90800	90800	40800	65800	90800	15800	90800	90800
Discounted flow	-460760	44580	76890	14580	83810	83810	37660	60730	83810	14580	8381	83810
The amount of secondary investment	250000	0	0	0	0	0	0	0	0	0	0	0
Profit / loss for the hospital	-1367460	-1227460	-1052460	-944960	-762460	-579960	-447460	-289960	-107460	40	182540	365040



Profit / loss dynamics in the process of introducing a 3D modeling laboratory in state medical institutions

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ETHNIC AND AGE-RELATED CHARACTERISTICS OF NEUROLOGICAL SYMPTOMS AND FUNCTIONAL STATE OF THE KIDNEYS IN ELDERLY AND SENILE AGE PEOPLE OF YAKUTIA

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The study was conducted in patients of elderly and senile age, representatives of the indigenous and non-indigenous ethnic group. It has been established that the development and progression of chronic cerebral ischemia occurs in parallel with the progression of chronic kidney disease. At the same time, representatives of the non-indigenous population showed more severe neurological symptoms due to structural changes in the cerebral vascular bed due to hypertension and atherosclerosis, as well as severe renal dysfunction. Evens had milder clinical symptoms of chronic cerebral ischemia and lower renal abnormalities.

Keywords: ethnos, elderly and senile age, chronic brain ischemia, chronic kidney disease.

The problem of cerebro-renal interactions in elderly and senile age patients suffering from chronic cerebral ischemia (CCI) in modern medicine is relevant primarily due to the large medical and social significance. This is due to the fact that impaired renal function plays a significant role in accelerating the development and progression of CCI associated with atherosclerosis and arterial hypertension [1]. The high prevalence of CCI is explained not only by demographic changes in modern society with an increase in the proportion of elderly and senile age people, but also by an increase in the prevalence of risk factors, which include arterial hypertension, atherosclerosis, diabetes and obesity [3]. It is known that each ethnic group of the population determines its own characteristics in the epidemiology of a disease. CCI in combination with chronic kidney disease (CKD) is no exception.

The aim of the study was to research the ethnic and age-related characteristics of neurological symptoms and functional state of the kidneys in elderly and senile age people of Yakutia.

Materials and research methods.

This study was performed in the confines of the neurological department of the Geriatric Center of the Republican Hospital of Sakha (Yakutia) "Republican Hospital №3". 522 patients from 60 to 89 years, of comparable age and sex, were examined. CCI was diagnosed according to the Classification of Vascular Brain Lesions of the Institute of Neurology, Russian Academy of Medical Sciences (1985), the diagnosis was worded in accordance with ICD-10. The criterion for the diagnosis was instrumentally con-

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