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Digital transformation of the healthcare sector as a factor in improving the quality of medical services (using the example of the East Kazakhstan region)

Abstract

Object: The purpose of this study is to examine the variables influencing the growth of healthcare digitalization in the East Kazakhstan region using the correlation and regression analysis method.

Methods: The traditional methods of economic (comparison, detailing) and econometric analysis (correlation-regression analysis) were used in the work. As a performance measure, the number of organizations in the East Kazakhstan area that employ experts in information and communication technology in the field of healthcare is used.

Findings: The results obtained during the study made it possible to identify weaknesses in the functioning and regulation of the healthcare sector in the East Kazakhstan region, to assess the quality of medical services provided and to identify promising areas in the implementation of digital technologies in the healthcare system. The need to modernize digital healthcare, its state regulation and support is shown.

Conclusions: According to the report, the degree of information and communication technology adoption in the health care system has an impact on both the growth of the medical industry and the standard of services offered. Digital technologies make it possible to improve the relationships, guarantee comfortable access to medical services and recreate two-way ties for a long period of time. Also, digital technologies help to develop "smart health" methods to improve quality and reduce costs, support the efforts of the healthcare system to move to new models of patient-centered care. But on the path of striving to facilitate the work of healthcare and the relationship with the patient, one should not forget about the possible risks of leakage of personal data, cyber attacks, etc. In this regard, the development of this direction will require high costs and investments.

***Keywords*:** medicine, healthcare, medical services, digitalization, digital technologies, information and communication technologies, e-health.

Introduction

The methods used in this article are based on the study of theoretical literature on the issue. Qualitative and quantitative analysis of mathematical and statistical data helped to select the most suitable factors influencing the development of digitalization of healthcare in East Kazakhstan. The variables with the most effects on the effective indicator were chosen using correlation and regression analysis. With the help of built-in formulas in MS Excel, a forecast of the development of the market condition of medical services in the East Kazakhstan region for the next four years was made.

The goal of this research is to identify and examine the factors that most significantly affect the number of healthcare organizations in East Kazakhstan with information and communication technology specialists.

The results obtained during the analysis will help in solving the issues raised by the Government regarding the introduction of digital technologies into the healthcare system. Will reveal the key factors influencing information and communication technology development in healthcare in East Kazakhstan. Forecast indicators based on statistical data from previous years on the indicator of changes in the number of organizations having information and communication technology specialists of medical services in the East Kazakhstan region. The revealed level of development of digitalization of medical services will allow maintaining a stable situation in healthcare in the East Kazakhstan region.

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Literature review

The full redesign of the processes of contact between government agencies in business, medical organizations, and patients is the goal of the ongoing digital revolution of healthcare. The goal of individual services that come together to form an integrated ecosystem is to continuously monitor health and provide medical services (Primbetova, Khamzeyeva, 2020). Patient orientation and health promotion are the main priorities. High standards of service are ensured by the adoption of new digital technology, and the transition to the "4P medicina" model (Deloitte, 2021), (Flores et al., 2013).

Telemedicine is a completely new model for the mandatory supply of medical services that is being developed on the foundation of information and communication technology (OECD, 2018), (Lebedev et al., 2021). Patients can now get medical care by remote control, even in situations that formerly required human contact between a doctor and a patient. Nearly all sectors of medicine are heavily reliant on modern digital technologies.

Thus, the wait time for medical care is decreased by the artificial intelligence technology. Systems based on artificial intelligence are already being used for diagnosing illnesses, dispensing medications, reading genomes, and other medical processes (Fogel, Kvedar, 2018). Nearly two-thirds of medical organizations in the USA and Europe employ artificial intelligence-based solutions in some capacity (Accenture, 2020).

Wireless communication technologies are the driving force behind the introduction of medical Internet broadcasting, which allows devices and sensors to be connected to a single network in order to monitor critical changes in the parameters of the patient's body in a timely manner and inform doctors about it. Internet-based technology can also be used to keep tabs on hospital and laboratory conditions, drug dose, and hygiene, etc. (OECD, 2018).

Medical decision support systems are being created employing technologies that will not only improve diagnosis accuracy but also expedite the process of obtaining medical care and prescribing therapy based on massive amounts of medical data collected. The quality of monitoring results, medication development, and other processes can all be improved with AI. (KPMG, 2020). With distributed registry technology, security can be maintained without compromising the collection, storage, or transfer of medical data.

Virtual and augmented reality have significant potential for the treatment of dementia and pain relief. In addition, VR and AR systems can be used for training medical personnel, as well as for drawing up a plan for surgical interventions, radiation therapy, etc.

A decrease in sickness and mortality, a rise in life expectancy, and an increase in children's activity are the primary results of the adoption of digital technologies in healthcare. The use of health monitoring technologies will allow not only to detect pathologies in the first at an early stage, but also to prevent the development of diseases (Morozova, 2019). As a result, the financial strain on the healthcare system will be greatly reduced. Additionally, some required remote monitoring technologies raise competence (adherence to treatment) by 44 %, enabling you to track and monitor requirements compliance, medication timing, and dosage (Consumer Technology Association, 2019).

Methods

Based on the correlation and regression analysis method, the factors impacting the growth of the digitalization of healthcare in the East Kazakhstan region are examined in this paper. Indicators of an effective feature include the number of organizations in the East Kazakhstan region that employ experts in information and communication technologies for healthcare.

The official statistical reporting of health care activities and medical services in the Republic of Kazakhstan, in the East Kazakhstan region for the period from 2016 to 2021, as well as scientific publications, news articles in journals and Internet resources were used. The following research techniques were employed: scientific techniques, quantitative statistical techniques, causal and comparative analyses.

To determine the influence of factors on the development of digitalization of the medical services market in the East Kazakhstan region, a model based on mathematical statistics was built.

When using this method, the calculations obtained by the model and the analysis of the results obtained are presented in the form of correlation and regression analysis of data.Correlation analysis is a method of mathematical statistics that studies correlations between phenomena. The main task is to identify the relationship between random variables and assess the closeness of the relationship between them.

For analysis, it is necessary to select a number of factors affecting economic processes, but not all factors are random variables.In this case, the analysis of economic phenomena considers the relationship be-

tween random and non-random variables. Such relationships are called regression, and the method of mathematical statistics that studies them is regression analysis.

Results

The results obtained during the work will help to determine the directions in the development of health care and medical services. To identify weaknesses in the functioning and regulation of healthcare in the East Kazakhstan region. Determine the quality of medical services provided. And the main goal of this study is to provide an understanding of the need for regulation of health care activities by the state, the need and dependence on state support.

To study the influence of factors on the digitalization of medical services in the East Kazakhstan region using correlation and regression analyses, financial, economic and statistical indicators for the period from 2016 to 2021 were taken. To study the influence of factors on the digitalization of medical services in the East Kazakhstan region using correlation and regression analyses, financial, economic and statistical indicators for the period from 2016 to 2021 were taken.

The main selected indicators characterizing the development of digitalization of medical services in East Kazakhstan region are: the level of computer literacy of the population, %; the number of employees with computer literacy in healthcare, people; provision of health services, million tenge; health ICT costs, million tenge; mortality rate, % per 1000 people; the number of computers in organizations health care, units; number of ICT specialists in healthcare, person; diseases of the circulatory system (BSC), per 100 thousand people; malignant diseases, per 100 thousand people; gross regional product (GRP) for East Kazakhstan region, billion tenge; investments in fixed regional capital, million tenge.

These indicators in the analysis act as factor signs (x1, x2, x3, etc.). And the effective sign (Y) is the number of organizations with specialists in the field of healthcare ICT in East Kazakhstan region.

The primary indicators used in correlation and regression analysis were chosen based on the works of S.I. Syrcova, who suggests specific indicators that have an impact on various planning and management circumstances(Syrcova, 2019).

The initial data for the analysis are provided in Table 1, taken from the Bureau of Statistics of the Republic of Kazakhstan for the period from 2016 to 2021.

Table 1. The main factors affecting the number of organizations with specialists in the field of healthcare ICT in East Kazakhstan region

Period	Number of organizations with specialists in the field of healthcare ICT, units	The level of computer literacy of the population, %	The number of employees with computer literacy in healthcare, people	Services rendered in the field of healthcare, million tenge	Healthcare ICT costs, million tenge	Mortality rate, % per 1000 people.	Number of computers in healthcare organizations, units	Number of ICT specialists in healthcare	Diseases of the circulatory system (BSC), per 100 thousand people	Malignant diseases, per 100 thousand people.	GRP of East Kazakhstan region, billion tenge	Investments in fixed assets, million tenge
	У	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11
2016	34	74,0	12 234	56 218,6	1 062	10,47	5 203	34	5 451	366	2 793,9	411 930
2017	43	77,2	17 000	73 483,1	354,9	10,32	5 794	76	4 970	348	3 174,8	436 751
2018	33	76,7	17 979	82 952,8	750,5	10,29	6 341	83	4 635	322	3 589,3	436 107
2019	40	81,9	18 953	85 696,4	211,9	10,36	6 888	87	3 671	295	4 025,0	494 597
2020	47	83,8	22 249	90 365,8	284,6	12,06	7 430	108	3 650	286	4 605,5	621 913
2021	38	87,9	25 546	116 737	523,5	12,80	9 877	77	3 340	277	4 375,[illegible]	606 145

Note — compiled by the authors according to the data of the source (Ofitsialnyi sait Byuro natsionalnoi statistiki Agentstva po strategicheskomu planirovaniiu i reformam RK, 2021, available at:https://stat.gov.kz)

The correlation-regression model's factors are chosen in a variety of ways: The reliability of correlation coefficients is evaluated using a matrix of paired linear correlation coefficients, by the Student's t-criterion,

Fisher's F-criterion, average approximation error, multiple correlation coefficients, and determination coefficients. Multiple correlation is calculated with a 5 % level of accuracy, which corresponds to a probability of P = 0.05.

The analysis of the matrix of paired correlation coefficients indicates a close connection between the studied phenomena. The pair correlation coefficient, which takes into consideration the interrelationships of factors impacting the effective indicator, describes the closeness of the relationship between the two indicators in general. The correlation coefficients vary from -1 to 1. The analysis is applicable only in the case of a linear relationship between the features. The closer the values of the correlation coefficient are to -1 or to 1, the higher the degree of correlation of the corresponding random variables. The relationship is considered strong if the correlation coefficient is $\geq \pm 0.6$.

Table 2. Matrix of paired correlation coefficients

	У	*X1*	*X2*	*X3*	*X4*	*X5*	*X6*	*X7*	*X8*	*X9*	*X10*
У	1										
X1	0,452	1									
X2	0,421	0,958	1								
X3	0,230	0,935	0,975	1							
X4	-0,805	-0,597	-0,582	-0,479	1						
X5	0,348	0,857	0,837	0,795	-0,219	1					
X6	0,197	0,950	0,944	0,973	-0,367	0,883	1				
X7	0,667	0,597	0,698	0,581	-0,818	0,343	0,435	1			
X8	-0,437	-0,955	-0,918	-0,893	0,678	-0,710	-0,867	-0,721	1		
X9	-0,396	-0,935	-0,930	-0,904	0,632	-0,716	-0,865	-0,758	0,990	1	
X10	0,529	0,909	0,913	0,842	-0,655	0,744	0,805	0,820	-0,959	-0,977	1
X11	0,585	0,927	0,898	0,810	-0,531	0,913	0,842	0,647	-0,879	-0,881	0,932
Note — The selection of the main indicators involved in the correlation and regression analysis was compiled by the authors based on the records of S.I. Syrtsova											

The metrics Y and X4 and X7 in Table 2 have the strongest correlations, with Y representing the number of organizations in the East Kazakhstan region that have ICT specialists and X4 representing the cost of healthcare ICT (-0.805) and X7 representing the number of ICT specialists in healthcare (0.667). However, it should be noted that the indication X7 is simultaneously multicollinear with the indicator X4, therefore it must be removed from the system and further study.

The calculation of paired correlation coefficients revealed a weaker relationship between Y and X6 — the number of computers in healthcare organizations (0.197) and X3 — the number of healthcare services rendered (0.230).

Further, according to the outcomes of the correlation analysis, the collinear factors x1, x2, x3, x5, x6, x7, x8, x9, x10 and x11 were excluded. After that, using the least squares method, a multivariate regression dependence (regression equation) of the resulting indicator is constructed from the factor indicators remaining after the previous steps of analysis, presented in Table 1, is Y and X4.

You can calculate the regression parameters and get detailed regression statistics using the analysis package built into Microsoft Excel, using the tool that obtained the results. Using the Regression analysis package tool, we will perform a regression analysis of the selected factor features and the resulting indicator. The results of regression statistics are reflected in Table 3.

Table 3. Regression statistics

Indicators	Values
Multiple R	0,805
R-square	0,647
Normalized R-square	0,559
Standarderror	3,548
Note — compiled by the authors	

As a result of the analysis of 6 observations (annual values) a multiple correlation coefficient of 0.805 was obtained. This coefficient reflects the closeness of the relationship between the effective indicator (Y) and the whole set of factor features.

We might therefore say that on the Cheddock scale, the relationship between the signs is estimated as very high. The company's productivity is 80.5 % due to changes in the factors included in the model, and 19.5 % of other unaccounted-for features. The calculated coefficient of determination (R-squared) shows the degree of compliance of the initial data with the regression equation. The value of the determination coefficient equal to 0.805 indicates the high quality of the revealed relationship.

The significance and reliability of the regression equation and its coefficients are evaluated by the indicators of Fisher's F-test and Student's t-test. The calculated Fisher coefficient is obtained from the table of variance analysis presented in Table 4.

Table 4. Analysis of variance

	df	SS	MS	F	Significance F
Regression	1	92,483	92,483	7,347	0,054
Remains	4	50,351	12,588		
Total	5	142,833			
Note — compiled by the authors					

The column shows the calculated Fisher criterion (Significance F) obtained during the analysis of the model. This coefficient must be compared with the table value. The tabular value of this criterion is calculated using the MS Excel function “FSPOBR”. With a probability of 55.9 %, Fischer's tabular criterion is 73.37. The calculated F-criterion has a value of 7.347. Since the calculated value of this indicator is several times less than the tabular one, it is necessary to state the low reliability of the regression equation. Since the calculated value of the indicator “Significance F” (0.054) has reached the maximum allowable (0.05), the equation can be considered relatively reliable.

As a result, the following regression equation is obtained:

$$У = 46{,}226 — 0{,}0133x1.$$

The results of the regression equation show that, for every 1 % increase in healthcare ICT costs in the East Kazakhstan region, there is a 0.0133 increase in the number of organizations with healthcare ICT experts in that region.

Correlation and regression analysis showed a high correlation of the factors included in the model, the reliability of the constructed regression equation and allowed us to draw conclusions about the relationship and the influence of factor features on the result. From which it follows that the number of organizations with ICT specialists depends on the cost of ICT.

Forecasting is a method of scientific foresight, which uses both the experience accumulated in the past and current actions about the future in order to determine it. The result is a forecast, or a scientifically based judgment about the possible states of the object or objects in the future, about alternative ways and terms of its existence.

Short-term forecast analysis is carried out using the MS Excel application in accordance with Chetyrkina E. M.'s formula (Chetyrkina, 2000). The initial data is Y, which represents the number of organizations (in units) in the East Kazakhstan region that have healthcare ICT specialists. All data are displayed in Table 1 for the study period (t), which is 6 periods of 6 years, from 2016 to 2021.

Table 5 shows the least squares curvilinear alignment for each equation.

Table 5. Curvilinear least squares alignment

№	Curve view	Coefficient of determination	A	B	Fisher 's Criterion
1	Y=A+(B*X)	0,152	35,3	1,1	0,18
2	Y=A*EXP^(B*X)	0,160	35,1	0,0	0,19
3	Y=A*(X^B)	0,189	35,2	0,1	0,23
4	Y=A+(B/X)	0,198	42,3	-7,6	0,25
5	Y=1/(A+B*X)	0,167	0,029	-0,001	0,20
6	Y=X/(A+B*X)	0,210	0,005	0,024	0,27
7	Y=A+B*LOG(X)	0,182	35,4	3,4	0,22
8	Y=EXP(A+B/X)	0,205	3,740	-0,196	0,26
9	Y=1/A+B*LOG(X)	0,195	0,028	-0,002	0,24
Note — compiled by the authors					

From the analysis carried out, the largest values according to the Fisher criterion were observed for three equations (4, 6 and 8). Accordingly, the coefficients of determination coincide in size with the selected

equations. Further, a more detailed analysis of the obtained equations is carried out, according to these values of output at the enterprise.

Predicting the output of the enterprise for the next 4 years, we received the following data on the three equations listed in Table 6.

The following equations are obtained using the least squares method based on the short-term forecast computation results:

Table 6. Forecast value of the number of organizations with specialists in the field of healthcare ICT in East Kazakhstan region for the next 4 years

t	Y=A+(B/X)	Y=X/(A+B*X)	Y=EXP(A+B/X)
2022	41	41	2
2023	41	41	2
2024	41	42	2
2025	42	41	2
Note — compiled by the authors			

For the correct choice of the three equations obtained, Table 7 will help, with tabular values and acceptable errors.

Table 7. Acceptable errors in forecasting the number of organizations with specialists in the field of healthcare ICT in East Kazakhstan region

	Y=A+(B/X)	Y=X/(A+B*X)	Y=EXP(A+B/X)
Average absolute percentage error	9,176	8,930	8,977
Standard error, billion tenge	19,095	19,414	19,195
Correlation coefficient	0,445	0,458	0,452
Fisher Coefficient	0,247	0,266	0,257
Note — compiled by the authors			

Thus, according to the above indicators, the optimal suitable equation for the forecast was the equation:

$$Y=X/(A+B*X)$$

Since it has the smallest average absolute percentage error — 8.93 %, the mean square 19.414, the Fisher coefficient was 0.266. Therefore, the forecast values of this equation are the most favorable for the forecast.

Taking into account the standard error of this equation, the graph shown in Figure was constructed with forecast values for the next 4 years (2022–2025).

Figure. Forecast figures for the dynamics of changes in the number of organizations in the East Kazakhstan area with experts in the field of healthcare ICT

Note — compiled by the authors

A reduction of 36.6 % (9 units) was seen in the dynamics of the number of firms in East Kazakhstan in 2021 that employed experts in the field of healthcare ICT. In 2022, the number was predicted to grow by

26.3 %, according to the report. In East Kazakhstan, there are 41 organizations with ICT experts, which is a consistent number for the healthy development of digital healthcare. It should be emphasized that the forecast does not account for macro and microeconomic factors that may have an impact on this direction's development. The forecast is based solely on the indicators of previous years.

Discussions

In order to do this, factors influencing the growth of the digitalization of healthcare in the East Kazakhstan region were examined using the approach of correlation and regression analysis. As a consequence, the number of businesses in the East Kazakhstan region with experts in information and communication technology in the field of healthcare was determined.

The dynamics of changes in the number of organizations with specialists in the field of healthcare ICT in East Kazakhstan in 2021 showed a decrease in the rate by 36.6 % (9 units). The forecasts obtained during the analysis showed a 26.3 % increase in the number in 2022. A stable level for the healthy development of digitalization of healthcare is 41 organizations with specialists in the field of ICT in East Kazakhstan. It should be noted that the forecast does not take into account macro and micro political and economic influences on the development of this direction. The forecast is based solely on the indicators of previous years.

The results obtained during the analysis will help to solve the tasks set for the state in the issue of introducing digital technologies into the healthcare system. Identifies the key variables that affect how information and communication technologies are developed in healthcare in East Kazakhstan. Forecast indicators for changes in the number of organizations in the East Kazakhstan region with specialists in information and communication technologies for medical services are based on statistical data from previous years. The revealed level of development of digitalization of medical services will allow maintaining a stable situation in healthcare in the East Kazakhstan region.

Conclusions

The results of the work revealed the greatest impact on the development of digitalization of the medical services market in the East Kazakhstan region from the costs invested in the development of health ICT, and there is also an impact from investments in the regional budget. The influence of these factors is directly proportional, with an increase in investments in the development of digitalization by 1 %, the level of development increases by 0.013 (i.e., to increase the number of organizations with healthcare ICT specialists in East Kazakhstan region, it is necessary to increase investments by about 76.9 % by 1 unit.

The forecast indicators, based on statistical data from previous years on the indicator of changes in the number of organizations with specialists in the field of healthcare ICT in the East Kazakhstan region, amounted to 41 organizations. This level of development of digitalization of medical services will allow maintaining a stable situation in healthcare in the East Kazakhstan region. But in order to implement this forecast, regulation by economic and political influences (both internal and external) is necessary.

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Ж.С. Абдрахманова, Э.С. Нурекенова, Н.А. Косарев, А.Т. Карипова

Денсаулық сақтау саласын цифрлық трансформациялау медициналық қызметтер сапасын арттыру факторы ретінде (Шығыс Қазақстан облысының үлгісінде)

Аңдатпа:

Мақсаты: Зерттеудің мақсаты корреляциялық-регрессиялық талдау әдісін пайдалана отырып, Шығыс Қазақстан облысындағы денсаулық сақтауды цифрландырудың өсуіне әсер ететін айнымалыларды зерттеу.

Әдісі: Мақалада экономикалық (салыстыру, егжей-тегжейлі) және эконометрикалық талдаудың (корреляциялық-регрессиялық талдау) дәстүрлі әдістері қолданылды. Тиімділік көрсеткіші ретінде денсаулық сақтау саласындағы ақпараттық-коммуникациялық технологиялар бойынша мамандар жұмыс істейтін Шығыс Қазақстан облысының ұйымдарының саны пайдаланылды.

Қорытынды: Зерттеу барысында алынған нәтижелер Шығыс Қазақстан облысы бойынша денсаулық сақтау саласының жұмыс істеуі мен реттеудегі әлсіз жерлерді анықтауға, көрсетілетін медициналық қызметтердің сапасын бағалауға және денсаулық сақтау жүйесіне цифрлық технологияларды енгізу мәселелерінде перспективалық бағыттарды айқындауға мүмкіндік берді. Цифрлық денсаулық сақтауды жаңғырту, оны мемлекеттік реттеу және қолдау қажеттілігі көрсетілген.

Тұжырымдама: Есепке сәйкес, денсаулық сақтау жүйесіне ақпараттық және коммуникациялық технологияларды енгізу дәрежесі медицина өнеркәсібінің өсуіне де, ұсынылатын қызметтер деңгейіне де әсер етеді. Цифрлық технологиялар қарым-қатынасты жақсартуға және жетілдіруге, медициналық қызметтерге ыңғайлы қол жеткізуге кепілдік беруге және ұзақ уақыт бойы екіжақты байланыстарды қалпына келтіруге мүмкіндік береді. Сондай-ақ, цифрлық технологиялар сапаны жақсарту және шығындарды азайту үшін «ақылды денсаулық» әдістерін әзірлеуге көмектеседі, денсаулық сақтау жүйесінің пациентке бағытталған көмектің жаңа үлгілеріне көшу жөніндегі күш-жігерін қолдайды. Бірақ денсаулық сақтау жұмысын және пациентпен қарым-қатынасты жеңілдетуге ұмтылу жолында дербес деректерді кибершабуылдардан қорғауымыз керек және ақпараттың тарап кету қаупінен сақтануымыз керек.

Кілт сөздер: медицина, денсаулық сақтау, медициналық қызметтер, цифрландыру, цифрлық технологиялар, ақпараттық-коммуникациялық технологиялар, электрондық денсаулық сақтау.

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Цифровая трансформация сферы здравоохранения как фактор повышения качества медицинских услуг (на примере Восточно-Казахстанской области)

Аннотация:

Цель: Целью данного исследования является изучение переменных, влияющих на рост цифровизации здравоохранения в Восточно-Казахстанской области, с использованием метода корреляционно-регрессионного анализа.

Методы: В работе были использованы традиционные методы экономического (сравнение, детализация) и эконометрического анализа (корреляционно-регрессионный анализ). В качестве показателя эффективности используется количество организаций Восточно-Казахстанской области, в которых работают специалисты по информационно-коммуникационным технологиям в сфере здравоохранения.

Результаты: Полученные в ходе исследования результаты позволили выявить слабые места в функционировании и регулировании сферы здравоохранения по Восточно-Казахстанской области, оценить качество предоставляемых медицинских услуг и определить перспективные направления в вопросах внедрения цифровых технологий в систему здравоохранения. Показана необходимость модернизации цифрового здравоохранения, его государственного регулирования и поддержки.

Выводы: Согласно отчету, степень внедрения информационных и коммуникационных технологий в систему здравоохранения оказывает влияние как на рост медицинской промышленности, так и на уровень предлагаемых услуг. Цифровые технологии позволяют улучшать и совершенствовать отношения, гарантировать комфортный доступ к медицинским услугам и воссоздавать двусторонние связи на длительный период времени. Также цифровые технологии помогают разрабатывать методы «умного здоровья» для повышения качества и снижения затрат, поддерживают усилия системы здравоохранения по переходу на новые модели пациентоориентированной помощи. Но на пути стремления облегчить работу здравоохранения и взаимоотношения с пациентом не следует забывать о возможных рисках утечки персональных данных, кибер-атак и т.д. В связи с этим развитие этого направления потребует высоких затрат и инвестиций.

Ключевые слова: медицина, здравоохранение, медицинские услуги, цифровизация, цифровые технологии, информационно-коммуникационные технологии, электронное здравоохранение.

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