

Czech University of Life Sciences Prague

**Faculty of Economics and Management
Department of Information Technologies**



Bachelor Thesis

**Health Information Technology adoption in the Republic
of Kazakhstan**

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BACHELOR THESIS ASSIGNMENT

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Thesis title

Health Information Technology adoption in the Republic of Kazakhstan

Objectives of thesis

The purpose of the study is to provide evidence about the current state and trends in adoption health information technology (HIT) among patients in the Republic of Kazakhstan.

Partial goals of the thesis are such as:

- To conduct content analysis of scientific papers on the adoption and impacts of HIT on people's life style.
- To study the attitudes and adoption factors of patients towards using HIT.
- To interpret findings and formulate conclusions.

Methodology

Methodology of the thesis is based on the literature review of academic papers, and using expert opinions. The practical part will use qualitative and quantitative methods for the result research. By synthesising theoretical findings and practical results, the final conclusions will be formulated.

The proposed extent of the thesis

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Healthcare, adoption, HIT, attitude, patients, physicians.

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ABDIKADIROVA, I. T., et al. Analysis of health professionals and patients opinions about information systems in public health through a sociological survey. *Drug Invention Today*, 2018, 10.12.

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Declaration

I declare that I have worked on my bachelor thesis titled "Health Information Technology adoption in the Republic of Kazakhstan" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break any copyrights.

In Prague on 15.03.2022

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Health Information Technology adoption in the Republic of Kazakhstan

Abstract

The Bachelor Thesis is focused on digitalization or the use of Health Information Technology in the field of Healthcare, with a focus on a specific country, Kazakhstan. The research work is developed to understand the current state of HIT in Kazakhstan and how the use of technology affects and is perceived by the patients and physicians in the country.

The theoretical background of the research covers the basic introduction to HIT in general as well as the current HIT present in Kazakhstan. It also explains the perceived benefits and the potential challenges or obstacles in adoption of digitalization in healthcare.

The thesis is finalized with the study of patients' and physicians attitudes towards HIT in Kazakhstan, as to how it affects the quality of medical services or directly the work of hospital and clinics professionals. It then discusses the possible solutions or improvements that could be proposed to build better digital or HIT experience for both patients and physicians of Kazakhstan.

Keywords: Healthcare, adoption, HIT, attitude, patients, physicians.

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List of abbreviations

HIT - Health Information Technology
HER - Electronic Health Record
CDS - Clinical Decision Support
CPOE - Computerized Provider Order Entry
HMS - Hospital Management System
RASS - Robotically Assisted Surgical Systems
AI - Artificial Intelligence

1. Introduction

In the 21st century, technology plays an indispensable role in almost every business activity, economic sector, or even in our everyday life situations. Therefore, digitalization, integration of Information Technologies and reliance on Information Systems is an unsurprising phenomenon in some of the most significant economic areas, such as national healthcare.

Health Information Technology, can be described as the use of information technology to assist physicians and other medical professionals in their work. It includes storage and maintenance of data through a central cloud database , which can then be used to make more accurate medical diagnosis and come up with more efficient treatment plans, with the help of Clinical Decision Support systems. (Alotaibi & Federico, 2017)

Aside from increased quality of medical services, integration of HIT can bring ease and convenience, cost reduction, to both patients and physicians, as more healthcare services can be accessed remotely. And it creates a better flow or cooperation between each stakeholder in the healthcare sector. (Laal, 2012)

However, before enjoying the fruits of technological advancements, one has to think what factors have to be taken into account and what are the possible obstacles that can be faced when trying to integrate IT into public healthcare. Basic social factors like public acceptance and computer literacy capacity, the hospital's organizational structure and the concerns with regards to the data safety and protection all need to be weighted when shifting towards digitalization of such an important sector. (Cresswell & Sheikh, 2013)

If all or most adoption factors are satisfied, and solutions for obstacles were found, the states that adopt HIT can become leading examples in the world. Some of the leaders of digital healthcare are Denmark, Estonia and Germany. The research will look into the current state of Kazakhstan's healthcare sector and the country's efforts in moving towards full integration of HIT into its public and private hospitals. The research will also focus on how the present HIT practices impact Kazakhstan's patients lifestyle and physicians work.

2. Objectives and Methodology

2.1 Objectives

The purpose of the study is to provide evidence about the current state and trends in adoption of health information technology (HIT) among patients in the Republic of Kazakhstan.

Partial goals of the thesis are such as:

- To conduct content analysis of scientific papers on the adoption and impacts of HIT on people's life style.
- To study the attitudes and adoption factors of patients towards using HIT.
- To interpret findings and formulate conclusions.

2.2 Methodology

Methodology of the thesis is based on the literature review of academic papers, and using expert opinions. The practical part will use qualitative and quantitative methods for the result research. By synthesising theoretical findings and practical results, the final conclusions will be formulated.

3. Literature Review

3.1 Health Information Technology

In the 21st century, the integration of Information Technology and Information Systems is necessary in almost every aspect of an individual's life. Technology has become an indispensable part of major economic areas. Therefore, with globalization, the world has witnessed the era of digitalization in industries such as retailing, education, government services, sports, entertainment, healthcare services and much more. It is no secret that the use of technological advances has brought about improved performance and better quality services to all those fields. This is why, it is essential to implement technology in hospitals and clinics, where professionals cannot afford to make any mistakes.

This brings us to the introduction of two fundamental concepts of digital healthcare, known as Telemedicine and Health Information Technology, or simply HIT. The two are closely interlinked as the existence of telemedicine depends on the use of Information technology in Healthcare. In other words, telemedicine is provision of healthcare and clinical services via the use of digital communication and information technology, allowing patients to access professional medical consultations regardless of their whereabouts. Telemedicine is often used by radiological, dermatological, pathological and cardiological professionals. However, telemedicine is not an independent profession, but it can be regarded as a tool used by medical professionals to reach out to a greater number of patients to provide remote services without facing the limitations of geographical boundaries. (The American Telemedicine Association , 2006)

The proceeding section of digital healthcare is Health Information Technology, which as it had been said before, is an important contributing component to telemedicine. HIT is essentially the use of computer systems, both hardware and software, to support information processing tasks such as storing, maintaining, updating and sharing health related data of patients for communication and decision making purposes of healthcare professionals at hospitals or clinics. The term also encompasses a number of various technologies that together make up a basic HIT system. (Alotaibi & Federico, 2017)

Despite being a relatively wide term, there are commonly acknowledged features or functionalities of a basic HIT system. And those would include the following technologies:

- **Electronic Health Record (EHR)** or as it is also known as, Electronic Medical Record (EMR) system, it is used to keep track of patient's medical history and store records in a digital form. It is an equivalent to the traditional paper-based charts. (Everson & Buntin, 2019)
- **Clinical Decision Support (CDS)** system, is another major part of HIT. It is the part of the system that is responsible for providing physicians with support and information related to the specific patient, in order to help the medical professional supply the best possible treatment. CDS is intended to organize the patient data and present it at appropriate time periods via the use of notifications, reminders, summaries of patients' symptoms, documents and diagnosis and etc. (Alotaibi & Federico, 2017)
- **Computerized Provider Order Entry (CPOE)** is a system that works side-by-side with CDS. This is because CPOE is used to manage physicians' and hospitals' orders for different kinds of pharmaceuticals, laboratory tests and results, x-ray examinations and so on. (Everson & Buntin, 2019)
- **Portals or Patient Electronic Portals** of HIT, is the part of the digitalized healthcare that serve to provide an interface to patients who wish to access and manage information related to their Electronic Health Records, medical history, clinical appointments, medical prescriptions. (Everson & Buntin, 2019)
- **Digital Sign-out or Hand-over** tools, these are used to provide a comprehensive summary of a patient's condition, prescribed medications, and overall medical history, when a patient is transferred to a different ward or may be even an entirely different hospital/clinic. This system ensures that the receiving hospital has all the updated essential patient data to provide corresponding treatment. (Alotaibi & Federico, 2017)

3.1.1 Benefits of Health Information Technology

Advancements in the digitalization of healthcare have certainly resulted in numerous positive outcomes in the work of medical professionals as well as the treatment of patients. Overall, it is understandable that integration of IT in various business processes helps automate and speed them up, which is often accompanied by reduces the chance of occurrence of man-made errors. Similar benefits can be observed in the healthcare industry with the application of HIT, as it lowers costs and expenditures of hospitals, improves quality of medical care and raises patient satisfaction. (Lee, Cain, Young, Chockley, & Burstin, 2005)

Below is a number of reasons why integration of Information Technology in medical care is necessary for both the patients and the hospitals:

1. Avoiding treatment and medication errors, is one of the major benefits of utilising technology in clinical processes. This pro point relates to the potential treatment mistakes which can be voided if the medical practitioners have complete information related to the patient's medical records, such as allergies, previous prescriptions and treatments, lab results and so on. (Shekelle & Goldzweig, 2009) For example, one study reviewed over 13,000 medication orders and concluded that the use of CPOE has reduced Rule Violations by an estimated 97% and Medication Prescription Errors were reduced by about 99%. (Potts, Barr, Gregory, Wright, & Patel, 2004)
2. Use of Cloud technology is another valid reason for hospitals and medical centres to invest in HIT. The cloud based solutions have been gaining popularity in recent years. Cloud HIT provides real-time data about patient's medical, administrative or financial records, which can be accessed from any point or an authorized connected device, making EHR portable, convenient to distribute and store. (Gordon, Perlman, & Shukla, 2017)
3. Automation and Simplification of clinical processes, is another benefit of employing HIT in a medical care environment. It can be put to use during the admission or discharge of patients to or from the clinic. HIT it known to speed up such process

because there is a reduced amount of documentation work, due to the fact that most of the relevant data is stored in the centralized cloud database systems. (Gordon, Perlman, & Shukla, 2017)

4. Cost efficiency, which is perhaps one of the most substantial gains of IT implementation in management of any business or venture. Investment in IT and IS integration can often be pricey at the start, however cost efficiency can be observed in the long run due to streamlining of processes and improved decision making. Likewise, HIT helps hospitals and patients reduce their spending. As CPOE and CDS systems help better manage the clinic's prescriptions by identifying more affordable generic alternatives to different drugs and treatment plans. Aside from that, one research has shown that HIT helped reduce the mean hospital stay duration by 5%. Thus, HIT cuts costs for clinic's management as well as its patients, without compromising the quality of the provided medical care. (Laal, 2012)

Overall, reliance on information technology in healthcare services benefits the entire industry, as it creates a better management of resources in terms of cost efficiency, improved quality, increased satisfaction and better decision making process related to both healthcare and managerial roles of clinics and medical centres. Use of cloud technology, HIT and centralised database systems to store EHR of patients, creates a more synergetic network in the healthcare industry between all involved stakeholders: healthcare providers, physicians, patients, insurance companies, government, pharmacies and so on. (Laal, 2012)

3.2 HIT Adoption factors

The previous section of the theoretical overview underlines the need for healthcare providers to integrate HIT into their daily work processes. Therefore, the next rational step would be to identify the existing factors that directly influence the adoption of HIT in clinics and hospitals.

Provision of digital training and knowledge to the healthcare professionals is an indispensable part of HIT integration. There are numerous aspects to be considered when organizing training sessions for medical staff, such as the level of computer literacy and their

perception of difficulty level, learning capabilities, individual's personality characteristics and emotions, and so on. (De Leeuw, Woltjer, & Kool, 2020)

Because all these factors can affect the training process, and it is of utmost importance to ensure that physicians and other medical staff are comfortable with the digitalized workload in their daily schedules, as it affects the overall quality of HIT and Telemedicine. (De Leeuw, Woltjer, & Kool, 2020) The sociotechnical interaction between healthcare professionals and technology is the success factor of digital health services. (Everson & Buntin, 2019)

Another factor that determines the success of HIT integration is the organizational structure and corporate culture of the hospital. This means, that any clinic or healthcare services provider should be able to embrace change and digitalization, and the organization along with its employees at all levels (management, administrative and medical staff) should be able to adapt quickly to the changing environment and express their commitment to the new HIT system, understanding that digital transformation can be a time consuming and costly process at the beginning. (Everson & Buntin, 2019)

Other requirements of establishing an HIT system include proper Data or Health Information Governance, to ensure safety and reliable protection, as well as adequate handling of patients' personal data and medical records. Aside from that, the integration process has to proceed gradually, in a step-by-step approach to achieve the smoothest possible unification of the digital and manual systems of the hospital or clinic. Additional requirement of IT implementation that is worth noting, is the constant evaluation, monitoring and control of the technological adjustments. (Alotaibi & Federico, 2017)

Therefore, we come to understand that establishment of Health Information Technology does not simply rely on the use of computers and various software, but the social aspect plays perhaps a major role in building a successful digitalized healthcare system. There has to be a right balance between financial, technological and human efforts in establishing an HIT system in health management.

3.2.1 Challenges in HIT Adoption

Certainly digitalization of healthcare is not an easy goal to achieve for a varied number of reasons from social, organizational and technological perspectives. Thus, there are some basic challenges that need to be taken into account prior to HIT integration. (Cresswell & Sheikh, 2013)

One of the most common obstacles of electronic healthcare is the lack of general computer or digital knowledge and literacy of both patients and physicians. (Cresswell & Sheikh, 2013) Aside from that a study at a Dutch university has shown that use of digital terms or jargon can be hard to understand or get used to for some medical professionals. Thus, together the lack of general understanding makes the digital transition harder for certain healthcare workers, and it can even result in avoidance of interaction with HIT system, cause stress and feeling of incompetency in their professional field. (De Leeuw, Woltjer, & Kool, 2020) Another social concern of HIT is the lack of inclusivity, as the elderly group or the aging population have difficulties adapting to the use of electronic sources in order to access medical services, therefore HIT platforms have to be designed in the most user-friendly ways to promote engagement of all age groups. (Cummins & Schuller, 2020)

On top of that, there is an increasing number of ethical concerns related to personal data collection and security. More and more digital tools collect personal data of patients or anyone who interacts with any online platform or systems. A few tech giants have been known to provide data collection services, including personal health related information of patients. Thus, some people are worried about the way their data is stored, protected and utilized or analysed. Breaches into HIT database systems are not uncommon, as well as some companies have been known to sell the collected data. Therefore, technological advancements such as HIT can often face criticism over rising privacy, consent and data governance questions. (Cummins & Schuller, 2020)

As it was briefly noted in Section 3.2 of the literature review, HIT and EMR/EHR systems can have high initial set-up or development costs, which happens to be one of the main obstacles to the spread of digital healthcare. (Shekelle & Goldzweig, 2009) Financial constrains remain one of the most substantial reasons for low HIT adoption rates, because

of considerable implementation and maintenance costs. Aside from that, training cost can often arise if there is a great number of medical practitioners who lack digital knowledge and need to be familiarized with the HIT systems. (Everson & Buntin, 2019)

The above mentioned factors can often slow down the general digital transition in healthcare, due to avoidance from both sides; as healthcare providers can be hesitant of large investments while patients or consumers have concerns over their the safety of their data and privacy.

3.3 Healthcare in Kazakhstan

Kazakhstan as the 9th largest country in the world, which is located in Central Asian and it is landlocked by its bordering states of Russia, China, Kyrgyzstan, Uzbekistan, Turkmenistan as well as the Aral and Caspian seas. Despite spanning across a massive territory, Kazakhstan is known to have a very low population density, as the estimated number of residents in 2020 was equivalent to about 18.8 million people, with an average GDP per capita amounted to USD 9,106. The GDP of the country for the same year was assessed at the total sum of USD 171.2 billion. (The World Bank Group, 2022) Meanwhile, on average healthcare accounts to about 3.4% of the total expenditures. (Ministry of Healthcare of the Republic of Kazakhstan, 2022)

After the fall of USSR, Kazakhstan as many Post-Soviet countries has seen reforms in many areas, including the country's politics and economy. Healthcare reforms, have become one of the main goals of the state's authorities. Thus, it resulted in the launch of the first framework from 2005 to 2010, the "State Program for Reforming and Development of Healthcare of the Republic of Kazakhstan". It was followed by the next two reform schemes, "Salamatty Kazakhstan" which lasted from 2011 to 2015, and "Densaulyq" program from 2016 to 2019, which means "health" in Kazakh language. (Gulis, et al., 2021)

The "Densaulyq" program helped achieve some positive results in basic medical and demographic indicators across the country. In 2016, when the framework implementation has just begun, the average life expectancy in the country was 72.4 years, and it increased to 73.15 years. Aside from that reform lowered the adult and child mortality rates by 2% and

4% respectively. And deaths caused by tuberculosis were reduced an impressive rate of 41%. (Prime Minister of the Republic of Kazakhstan, 2019)

The current reform project is known as “ State Program for the Development of Healthcare of the Republic of Kazakhstan” draws up a plan of action intended to last from 2020 to 2025. (Gulis, et al., 2021) The newly established framework has three main objectives:

1. To build people’s commitment to a healthy lifestyle and to develop public health services.
2. To improve the quality of the current medical care provided in the country.
3. To achieve sustainable development of the state’s health system,

Aside from that, the goals are said to be spread over in different directions such as modern health services, improvement in providing health care, development of a single digital healthcare platform and integration of a compulsory health insurance for universal coverage of healthcare within the country. (Prime Minister of the Republic of Kazakhstan, 2019)

Universal healthcare and medical insurance are essential elements to raise the standards of living in a country and provide improved, yet affordable medical services and facilities. The idea of standardized national insurance along with common national HIT can help make healthcare more accessible and reduce the administrative workload, as dealing with private insurance companies can be a time-consuming and complex process for physicians. (Schoen, et al., 2012)

The 2020-2025 framework aims to raise the status of medical professionals in Kazakhstan through increased doctors’ salaries, investment in healthcare related research, and attain better supply of medical drugs. (Prime Minister of the Republic of Kazakhstan, 2019) Engaging physicians in the use of IS and IT can often be a hard goal to achieve, this is why a study suggest that policymakers should provide financial incentive to compensate for their efforts and help raise prestige status of healthcare sector workers. (Hackbarth & Milgate, 2005)

Further, the government addresses the importance of digitalization in the new healthcare development plan. Funds will be directed towards integration of information systems,

business intelligence tools, further introduction of telemedicine practice. The end result would be to have 90% of Kazakhstan's medical centres or organizations to utilize an integrated digital platform. (Prime Minister of the Republic of Kazakhstan, 2019)

3.3.1 HIT in Kazakhstan

Today, integration of Health Information Technology falls under one of the directions of country's current "Digital Kazakhstan" program, which focuses on computerization in finance, public services, education, healthcare, transportation and mining industries. (Yergaliyeva, 2020) Major advancements in digitalization and Health Information Technology have been made during the "Densaulyq" scheme. However, the digital journey of Kazakhstan's medicine begun long before the past reform. The concept of eHealth became a wide discussion among Kazakhstan's government back in the early 2000s, with their first initiatives using computer registers to collect data on medical care services provided to patients suffering from conditions and such as diabetes, chronic illnesses, tuberculosis and so on. (Ministry of Healthcare of the Republic of Kazakhstan, 2022)

Later, in 2006, begun the development of the nationwide framework "Unified Health Information Systems", aiming to build a shared platform for hospitals and medical centres, in order to digitalize data collection and automate the function of quality control of medical services offered by national physicians. Unfortunately, the project was put on hold in 2012, due to technical reasons such as the lack of appropriate technology (both hardware and software) in hospitals, as well as the project lacked social approval from the intended end-users such as the medical staff and representatives of population's older generation. (Ministry of Healthcare of the Republic of Kazakhstan, 2022)

With "Densaulyq" and "State Program for the Development of Healthcare of the Republic of Kazakhstan" reorganizations, significant improvements have been made in telemedicine, maintenance of electronic medical documents and forms, and development of HIT mobile applications. More importantly, the framework allowed for the creation of a national EHR, to allow unification of IS used in hospitals for smoother flow and exchange of patient and medical data. (Abishev & Spatayev, 2019) The eGovernment portal (eGov.kz) offers a

limited number of medical services such as making doctor appointments and access individual's medical history. (Ministry of Healthcare of the Republic of Kazakhstan, 2022)

On top of that, the HIT advancements in public-private partnerships are estimated to reduce a considerable expense of over KZT 180 million on medical documentation, speed up registration time for various testing such as blood sample collection by about 60%, setting appointments with specialists, too became an easier and faster task by 7 times through the use of e-services. And a spending of over KZT 2 billion was avoided, as an outcome of lower use of material consumption on x-ray and fluorography printed results. (Prime Minister of the Republic of Kazakhstan, 2020)

As mentioned earlier, one of the critical changes is the development of phone applications to access EHR, set appointments, receive and store lab results and have personalized treatment or medical notifications and reminders. Such apps have been developed as a collaboration between public sector and private tech developers. In 2019, the ministry has estimated over 2.5 million users registered with private HIT platforms, as this number represents almost one-fifth of Kazakhstan's adult population. (Ministry of Healthcare of the Republic of Kazakhstan, 2022)

Yet, there is still a lot of ground to reach and explore for Kazakhstan in the field of digital healthcare and HIT. The major obstacle for further progression of telemedicine and HIT in Kazakhstan is problems associated with infrastructure, especially in many rural areas of the country, such as small towns and villages. Many of rural regions suffer from poor internet quality and outdated equipment in medical centres and households, which is an essential element of HIT and telemedicine sessions. (Prime Minister of the Republic of Kazakhstan, 2020) Another challenge is the guarantee of confidentiality of patients' data and provision of consent, as there is sceptic attitude towards how sensitive medical data or patients is managed and shared. Thus, the government is working on amending legislation on digitalization and data protection. (Ministry of Healthcare of the Republic of Kazakhstan, 2022)

3.3.2 Damumed

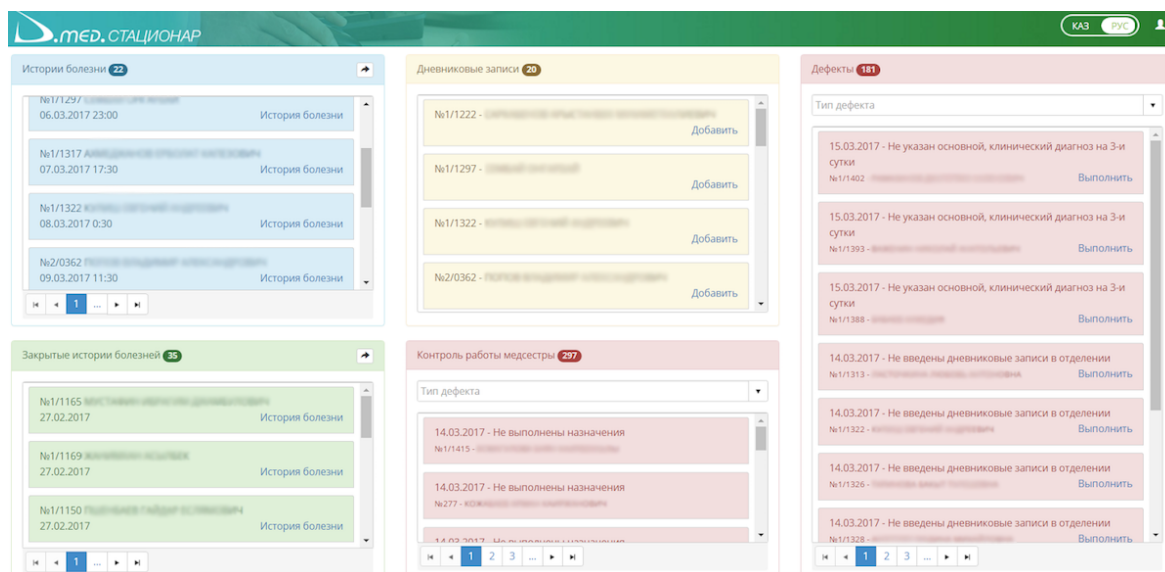
As stated earlier, major breakthrough in healthcare digitalization was the design of HIT mobile applications. One of the most successful developments in the tech field became an app developed by a Limited Liability Partnership, “Damu” Centre of Information Technology. The mobile application and the entire HIT platform, “Damumed”, became available in the market back in 2017. It offers a wide range of functions for both healthcare providers (hospitals and physicians) and patients, with different interfaces or modules for both end-users. (CIT "Damu", 2022)

Damumed, as the leading HIT platform in the country, holds the first place in Play Market, for free medical applications. As mentioned in Section 3.3.1, there was a total of 2.5 million HIT application users in Kazakhstan in 2019. However, Damumed takes this statistics even further, as in 2021, there were almost 4 million patients, who rely on the application to access the necessary medical services. Moreover, the healthcare providers model is integrated into 1,737 private and public hospital across 17 regions of the country, with a total of 118,933 medical professionals who utilize the platform to carry out their daily tasks. (Inbusiness.kz, 2021)

Module for Healthcare Providers is designed to cover a broad number of responsibilities of healthcare providers such as physicians and nurses. The service is available to hospitals and clinics on monthly membership rate of 0.5% to 0.75% of their approved budget. (Weproject.media, 2020)

The in-care module designed for physicians and nurses organizes all kinds of daily tasks displayed via their appointment schedules. Physicians can create and configure treatment plans for individual patients, the system also helps them automatically monitor the medical indicators of patients and assess the efficiency of the treatment plan. (CIT "Damu", 2022)

Figure 1: Damumed - Physicians Interface Window



Source: CIT Damu official website

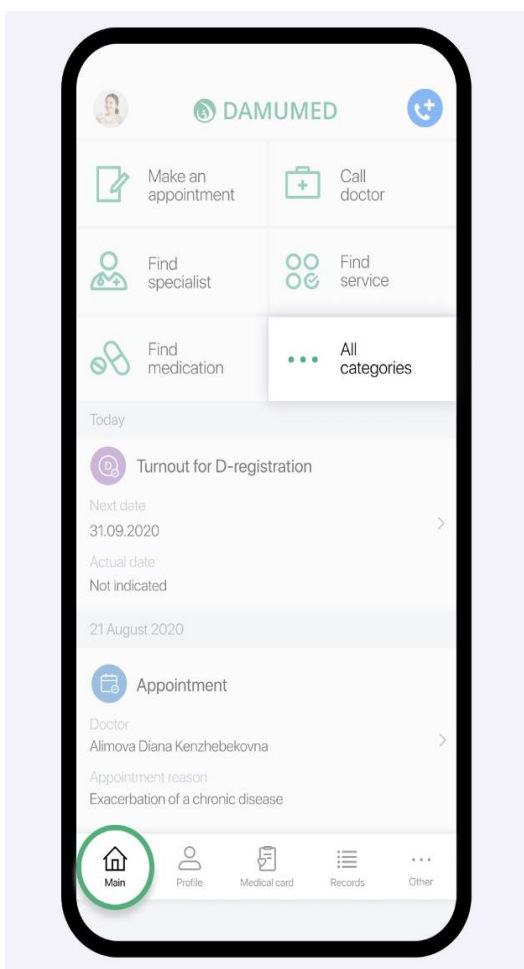
Aside from organizing the “administrative” workload of the medical staff, Damumed system can spot mistakes in the clinical database and the medical history of the patients, it can also be used to fill in any missing data related to the patients treatments and drug intakes through the real-time updated shared cloud system. And another simple benefit of Damumed is the use of voice recognition technology to speed up the process of data input. (CIT "Damu", 2022)

Damumed utilizes CDS system to automate the interpretation of lab results, assess the health status of the patients based on the results, formulate more accurate diagnosis and alternative drug prescriptions and so on. Aside from that, the HIT product benefits the clinic as to an organization in terms of management and tracking of industry statistics. Damumed analyses the number of patients in a single clinic and even the entire regions, the purpose of the hospital visits, engagement rate of telemedicine as well as its efficiency and satisfaction rates and so on. It also provides ready templates for hospital documents, and has an accounting/finance module that interprets and analyses the expenditure and cost of treatments based on the duration. (CIT "Damu", 2022)

Module for Patients fulfils creation of appointments with specialists, storing their prescriptions and lab results, organizing their treatments and taking actions through alerts

for persons with underlying health conditions such as cardiac insufficiency or diabetes. (WHO, 2019) The mobile application is the patient oriented module of Damumed, and it offers about 20 different services to residents of Kazakhstan. (Weproject.media, 2020) on top of that, CIT Damu has set another appointment registration methods, which is through the use of their separate self-service terminals and “Kassa-24” terminals located in many shopping centres, as well as in administrative Population Service Centres. (CIT "Damu", 2022)

Figure 2: Damumed App - Main Page



Source: Damumed Mobile Application for IOS

Figure 2 , is a visual representation of CIT Damu’s patient oriented product, which requires document and identity verification. The system is integrated with national permanent address registration to assign patients to their closest designated healthcare clinics. As it can be seen from above, the app offers services such as scheduling both in person and online consultation

sessions as means of telemedicine, finding medical specialists and medications. . (CIT "Damu", 2022)

Moreover, Damumed allows patients to keep track of their health with the use of Health Indicators function in the Medical Card and Records (HER) sections, which also store patient's personal data, medical and appointments history, allow condition monitoring and so on, through phone alerts and notification Patients can also leave reviews and feedback through, which helps evaluate the provision of healthcare services within private and public healthcare organizations. The mobile application is available for both IOS and Android users, with the option of three command languages, including Kazakh, Russian and English. (CIT "Damu", 2022) The popularity of Damumed app is increasing steadily along with the demand for online consultations, especially with regards to cardiology, pulmonology and neurology. (WHO, 2019)

3.4 Comparison of HIT in Kazakhstan and in Europe

The Head of the State, Kassym-Jomart Tokayev, highlighted the significance of IT and digitalization in national healthcare system. The current developments made in Kazakhstan, were influenced by examples of some of the leading countries in digital healthcare. Kazakhstan's authorities mentioned a number of European states such as Estonia, Denmark and Germany, as the country's role models in various aspects of Health Information Technology and telemedicine advancements. (Prime Minister of the Republic of Kazakhstan, 2020)

Time Factor. Despite being able to advance in field of digital health care, there is a lot of room for improvement. Kazakhstan has only begun taking critical steps in eHealth in 2013, with the Concept for the Development of E-Healthcare in the Republic of Kazakhstan of 2013-2020. Even though the topic was raised back in the early 2000s and was stopped in 2012. (Prime Minister of the Republic of Kazakhstan, 2020)

Meanwhile, Estonia, global eHealth care leader, ranked #1 in Bertelsmann Foundation 2019 Digital Health Index. (EAS Enterprise Estonia, 2022) The countries healthcare has been digitalized back in 2008, with the launch of "Estonian National Health Information System"

or ENHIS. The political commitment to the project dates back to 1992, while the EHNIS Development Plan 2005-2008, was published in 2004 by the country's Ministry of Social Affairs. (WHO, 2016)

HIT Implementation at a National Level. Another comparison can be drawn up based on how widely the HIT system is implemented in Kazakhstan and with the same case of Estonia. As it has been mentioned in Section 3.3.2, there is an estimated number of 4 million residents utilizing private HIT platforms such as Damumed. Not to mention that fact, that many rural areas in Kazakhstan have poor access to internet and many medical organizations use outdated medical and computer equipment. (Ministry of Healthcare of the Republic of Kazakhstan, 2022)

On the other hand, in Estonia over 90% of the country's population have digital Health Records and have their relevant medical documentation stored in the national, public HIT platform, ENHIS. (WHO, 2016) And over 99% of healthcare providers data is maintained in a digital format, rather than keeping an outdated paper-based documentation approach. And 99% of medications are prescribed digitally. (Lewin, 2020)

Availability of Data for Analysis Purposes, is another area where Kazakhstan might be lacking. Collection of data is essential to power HIT aspects such as CDS, AI in healthcare and to carry out assessments of nationwide illness prognosis. According to Olzhas Abishev, Vice Minister of Healthcare, within the framework of current healthcare reforms, an analysis of 16 terabytes of Ministry of Healthcare's data and 300 terabytes from different archives, will be organized for the above mentioned purposes. Once again, European states, such as Denmark have already focused on data analysis of medical and hospital records and documents dating back as far as 1980s. (The Medical Futurist , 2020)

Advanced IT developments in Healthcare. Aside from investing in telemedicine, IS in healthcare and central databases systems, Kazakhstan has to consider investments in the use of Artificial Intelligence in the medical sphere. For example, the earliest robotics-assisted surgery in the country was performed in 2018, in a gallbladder extraction surgery. (The Medical Futurist , 2020) Although, countries like Germany rely on robotic surgeries on a much larger scale. The country has an impressive number of about 40 Robotically Assisted

Surgical Systems (RASS) that are already available to private and public healthcare centres. The German RASS are known to be used in spine and neurosurgery, orthopaedics, laparoscopy and vascular surgeries. (Klodmann, et al., 2021)

Thus, it is can be generally concluded that Kazakhstan is still falling behind many developed countries in Europe, who have uncovered the importance and advancements of Health Information Technology at much earlier stages in history. Moreover, the countries like Estonia, Germany and Denmark, are much more successful at integrating HIT on a larger scale or a nationwide scale. Aside from that, they have access to larger number of medical information and data, through older medical archives filled with reports dating as far as 30-40 years back. At last, more and better progress has been achieved by European states in research and use of AI and robotics technology in healthcare and provision of medical services such as various surgeries.

4. Practical Part

4.1 Research Questions

The first research question is formulated as “ What are the important factors that support use of HIT among patients in Kazakhstan?”

The second research question is “What is the impact of health information technology among physicians?”

4.2 Research Design

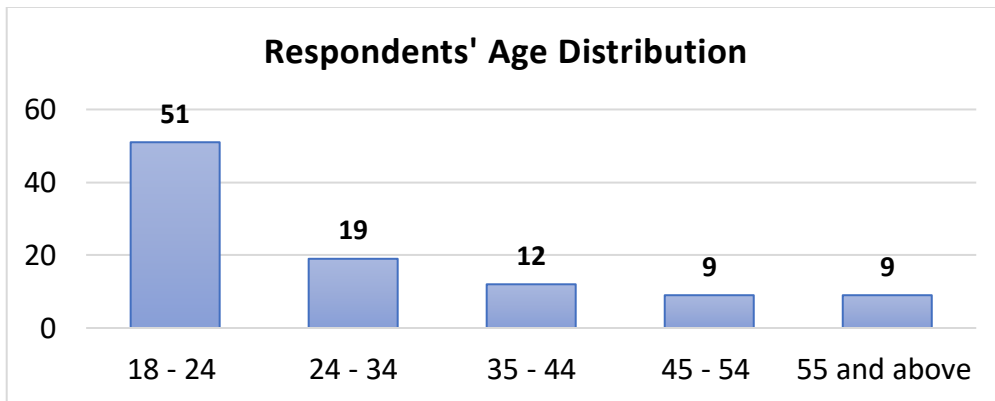
The practical part of the thesis is based on quantitative and qualitative methods to address the formulated research questions. The practical part aims to understand the perspective of patients and physicians in Kazakhstan on HIT and digitalization of healthcare in the country.

The quantitative research is organized to answer the RQ1, which consists of a patients survey to understand their attitude towards HIT and what factors support the use of apps/websites and information technology in accessing healthcare services. Meanwhile the qualitative research is designed based on the interview response of a physician, to answer RQ2 and gain an insight on what challenges medical professionals in working with HIT and how does it impact or help them individually, as well as collectively at work in a hospital.

4.3 Patients Survey

The first step of data collection was performed through a survey distributed to a convenience sample of 100 respondents, 56 of whom were female and 44 were male. The individual patients belong to different age groups, however the majority were between the ages of 18 to 24, they made up 51% of those who took part in the survey, as expressed on Figure 3.

Figure 3: Survey Age Distribution



Source: Own creation

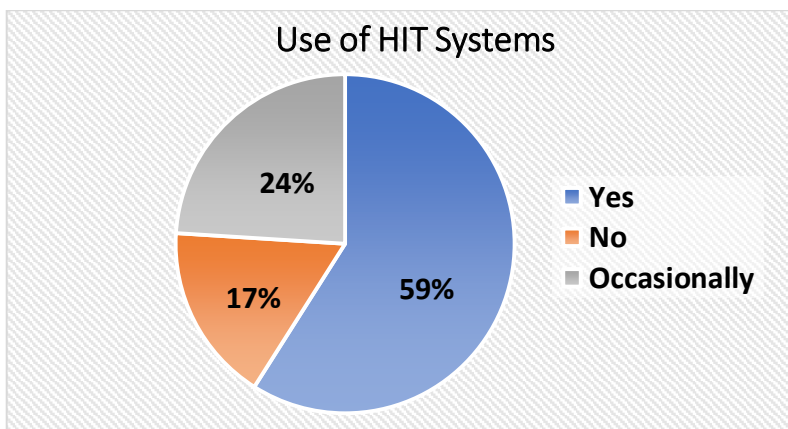
Almost one fifth (19%) of the respondents were between 24 to 34 years. Meanwhile the representatives of the older age classes have varied at about 10% , or more precisely the individuals from 35 to 44 years, have made up 12 answers. And those belonging to 45 to 54, as well as those above the age of 55, have accounted to the same count of 9 respondents in each group.

4.3.1 Patients Survey: Output

While the first two questions are aimed to gather basic demographic factors such as the gender and age of the respondents, the rest of the 8 questions were directly addressed to the topic of HIT and digitalization of healthcare in Kazakhstan.

General use of HIT systems among the patients in Kazakhstan

Figure 4: Use of HIT among patients



Source: Own creation

Among those who participated in the survey, almost 60% or 59 respondents have reported to use digital health care services or the HIT systems when accessing any clinical or hospital related needs. Meanwhile, the number of those who do not use HIT platforms at all, was significantly smaller, making up only 17 respondents. And total of 24 patients have reported to use HIT systems in healthcare sometimes or occasionally.

Table 1: Share of patients who use HIT (based on age factor)

Age Group	"Yes"	Sample Total	"Yes" Share
44 and below	49	82	59.8%
45 and above	10	18	55.6%

We can consider the age factor in the use of digital healthcare, to understand how popular is the use of HIT among the older and younger generation of patients in Kazakhstan, by dividing the respondents into two groups of those of 44 and below, as well as 45 and above. From Table 1, we can understand that although there isn't a big difference among both age groups, the respondents above the age of 45 were slightly less likely to rely on technology in the field of healthcare, as their "yes" share was 55.6%. And the number for the younger age group was higher by 4.2%. This finding can be supported by the age claim discussed in Section 3.2.1 of the Literature Review.

Aside from that, when asked if, the use of HIT applications/websites to access healthcare services is convenient? A considerable share of respondents agreed "Yes" with the convenience of digitalization, making up 71%. And only 8% have thought that HIT is inconvenient "No", and 21% were uncertain and replied with a "Maybe".

From the total of 29 respondents who either viewed HIT and digitalization in hospitals negatively or were undecided, 9 patients belonged to the 45 and above age group, and 20 people were 44 or bellow. This once again concludes that only 50% of the older respondents were satisfied with HIT, while a much bigger proportion of younger respondents were happy with applying technology in healthcare, as their share was equal to 76%.

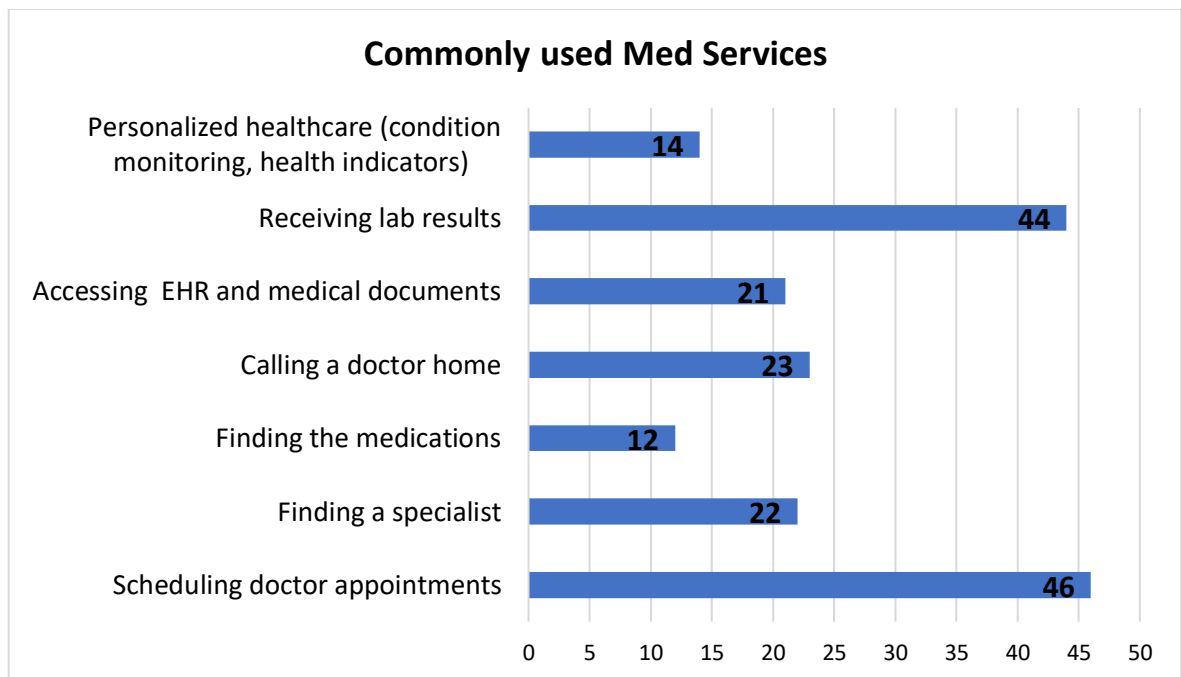
Table 2: Share of patients who are satisfied with HIT (based on age factor)

Age Group	"Yes"	Sample Total	"Yes" Share
44 and bellow	62	82	75.6%
45 and above	9	18	50.0%

Common medical services accessed through HIT and Damumed, as well as patients' attitudes towards the provided services

In question 5, the respondents were asked if they have ever used online consultation with a medical professional. Despite the ongoing pandemic, online consultations seem to remain an unpopular medical service in Kazakhstan. Less than a third of those surveyed (29%) said that they have used online consultations with a physician. While 59% said they have never used consultations through a remote digital platform and 12% responded with a “May be” answer.

Figure 5: Popular Damumed Functions



Source: Own creation

Figure 5 illustrates the commonly used functions or services available for patients through a popular HIT platform, which is known as Damumed. Those who took part in the survey, had the opportunity to select multiple options when answering this question. The following application was selected in the research due to its increasing number of users in 17 different regions of Kazakhstan, spread of 1,700 medical facilities.

The findings show that the end users or the patients, mostly utilize the system to schedule appointments with physicians, as 46 votes were cast for this function of Damumed application. The second most popular reason to use the app, with 44 votes, is the convenience of receiving laboratory results remotely, in a digital format

The other, slightly less demanded services of Damumed include the access to EHR and medical documents of the patients, use of the database as a search engine to find the best medical specialist, and the service to call a doctor directly to the house of the patient. Their overall submitted votes ranged from 21 to 23, in the respective order.

At last, the least popular tool of Damumed are the Personalized Healthcare, which allows patients to keep track of their physical well-being and various health indicators, as only 14 votes were cast for this option. And even less utilized function of the app with 12 votes is the use of the application to find the needed medications in various pharmacies listed in the database of Damumed.

The next question of the survey assesses how often does Damumed actually help fulfil the services requested by the patients. Out of the total sample, exactly 50% of the respondents stated that only “Sometimes” they successfully got the requested medical service. On the other hand, approximately one fifth or 21% have stated that they “Always” got the end result. A close ratio was observed with the success frequency of “Rarely”, where 19 respondents stated that they were mostly unsatisfied with the work of Damumed. And exactly one tenth (10%) reported to have “Never” successfully gotten the medical services that they have tried to access through Damumed. Thus we can observe, that there is a relatively low efficiency and the effectiveness of the services provided by Damumed application, as accounted by the surveyed sample.

4.4 Physicians Interview

An interview with a physician was organized as a second step of data collection for the practical section of the research work. The interview is made up of 7 questions, related to the medical specialization of the interviewed, as well as those related to the use of HIT systems in clinics and hospitals. A physician from a public / state owned hospital has

participated in the interview, however the medical professional's identity remains anonymous in the provided answers.

4.4.1 Physicians Interview: Output

1. Could you please provide a brief introduction to your medical specialization and your hospital?

The interviewee stated that she is a physician specialized in clinical pharmacology, whose main responsibilities are related to drug and medicine prescriptions. She is also responsible for coordinating and monitoring the treatment of patients who received certain drug therapy. Her job also involves early or timely detection and treatment of any side effects that can occur from the prescribed medication to the patient. She works at Public Hospital №1 in city Nur-Sultan, which is a static clinic that provides inpatient care and hospitalization to the residents.

2. Does your clinic/hospital use HIT such as eGov and Damumed?

The interviewee has responded that information technology and information systems are widely applied in various work processes of the hospital. However, systems or platforms such as eGov and the commonly used Damumed are mostly utilized for outpatient care and treatments. And as clarified by the interviewee, it is the type of treatment that does not require a patient to stay in the hospital overnight. It also covers ambulatory help or treatment / check-ups settled through an appointment with a physician.

3. Do you use other HIT systems, if yes, could you please tell me about them?

The interviewee stated that aside from relying on eGov database and Damumed system, the Public Hospital №1 uses a Hospital Management System (HMS), known as Avicenna. And this is an IS that is designed for physicians and hospital use, meaning that patients do not have access to it. Here they show the complete history of patients in the hospital such as those related to laboratory, instrumental analysis, consultations, treatments, discharges, etc.

Also, if a patient has previously been treated in their facility, we can assess / evaluate his or her previous treatment through the Archive integrated in Avicenna.

4. How does digitalization help your work personally?

The interviewee mentioned that first of all, HIT systems help reduce the time spent of daily appointments, due to the fact that less time is required for filing in any type of documents. This is due to the use of AutoFill function for medical history of the patients. Other benefits discussed by the physician, is that every day and every hour, she has access to all of the patient's data, which helps her with the counseling, and all the other doctors have to do is call and provide her with the patient's medical history number. Cross-divisional integration is possible as well, as she can evaluate the treatment and make an assessment of any department. Another advantage is optimized during the pandemic or simply in the case of a coronavirus infection: all consultations can be conducted remotely.

5. How does digitalization help your entire clinic?

The interviewee stated that the most obvious help to the clinic is the existence of shared central database for patients' analysis and monitoring of their treatments. It allows smooth transfer of patients from one physician to another, without the need for extra paperwork or verbal explanations of the patient's condition and other factors. Aside from that, the interviewee mentioned once again, that as AutoFill function helps each physicians, it benefits the hospital as a whole, through increased efficiency, which allows them to consult or check-up more patients on daily basis and helps make less mistakes in the documentation.

6. What do you think are the main problems you face with HIT systems?

As expressed by the interviewed physician, the central problem associated with the current level or use of HIT in the country, is the lack of sufficient integration possibilities between different software, systems and platforms, for example between those mostly used by patients (Damumed) and those designed for hospitals (Avicenna).

The interviewee has provided an example in the case , if an emergency patient comes in, he has no relatives, but they can find his ID in his clothes, and they will be able to find all the

information that will help with diagnosis (for example, a patient has diabetes or arterial hypertension) and they will be able to ensure the quality/timeliness of medical assistance, only in the case if the information and database of Damumed and Avicenna are aligned.

7. What do you think can be done to help improve your work with HIT?

When asked the above question, the respondents immediate answer was to design a better integration between the existing platforms utilized in the healthcare industry in Kazakhstan. Aside from that, the physician stated that there is still a lot of confusion existing among patients on how to use the system such as Damumed in a more effective way, thus the physician suggests that public awareness of such systems has to be increased, especially among the older patients.

5. Results and Discussion

The current section of the thesis aims to further analyse the findings of the quantitative research, regarding the identified benefits of HIT and digitalization of healthcare from the perspective of patients. It will then interpret the theoretical research with both the results of quantitative and qualitative research to pinpoint the areas of digital healthcare in Kazakhstan that require additional improvement and will discuss the proposed solutions from the perspective of patients and physicians.

5.1 Factors that support use of HIT among patients

Table 3: Voted share of HIT supporting factors

Supporting Factors	Frequency	Share %
Help reduce costs (affordable medication alternatives, medical charges)	23	14%
Provide more personalized and efficient healthcare	23	14%
Improved access to healthcare (clinics / hospitals)	45	27%
Helps better monitor patient's health and treatment	23	14%
Provides simple access to health records	52	31%

Table 3, is the representation of the patients' votes as to what are the main factors of digitalization and HIT, that simplify their experience with healthcare services. Once again, the surveyed had the chance to select more than one option. Thus, some of the obvious reasons for patients in Kazakhstan to adopt HIT systems such as Damumed, contributing to almost 1/3 of votes, is the fact that it provides simpler access to their health records. As revised in the Section 3.1.1, by (Gordon, Perlman, & Shukla, 2017), most of the important information and data can be stored electronically and accessed at any time, as long as you're connected to the web and have access to innovations such as the Cloud technology.

The next supporting factor in adoption of HIT in healthcare for patients, is improved access to healthcare overall, as 45 votes were submitted for this option. It provides increased efficiency in terms of time spent on registration, appointments, collection of lab results, as mentioned in Section 3.3.1 by (Prime Minister of the Republic of Kazakhstan, 2020). Aside from that, platforms list many medical institutions and offer reviews of specialists and the clinics/hospitals.

They also help provide alternatives to medications and help find the lowest prices based on the pharmacy database of the HIT system. The additional factors to integrate HIT among patients in the country, is that it creates more personalized healthcare treatment plans and allows easy and constant tracking of vital health indicators of an individual.

5.2 Impact of HIT on the work of physicians

The theoretical part of the thesis describes a number of benefits or ways in which HIT adoption impacts the work of physicians and the medical facility as an organization. Some of the discussed points, too, have been highlighted by the interviewed physicians from a public hospital in Nur-Sultan.

First and foremost, adoption of HIT and HMS systems provides the major improvements in the workflow of the hospital through automation of day-to-day tasks and reduced load of paperwork. Both points have been backed up by the statements of the interviewee. This boosts the efficiency of individual specialists as they can take in and provide check-ups for more people on daily basis.

Aside from that, she stated that a more accurate diagnosis can be drawn up with the help of archives of the HMS system such as Avicenna, as it stores the patient's medical records in an electronic format, and can utilize CDS to assess the effectiveness of the previous treatment that was assigned to the patient.

Support of cloud technology, too, plays a substantial role in HIT implementation and has great impact on the work of physicians, as it allows them to transfer a patient from one specialist to another, without unnecessary hustle of paperwork, due to the fact that that patient's EHR is stored in the shared database.

5.3 HIT related challenges in Kazakhstan

The lack of digital or computer literacy among the general public has been identified as one of the main obstacles to HIT integration in the healthcare in Section 3.2.1 by (Cresswell & Sheikh, 2013). Similarly, Kazakhstan is no exception in this case, as the country lacks social

approval of HIT and digitalization practices, especially from the side of the elder population of the country (Ministry of Healthcare of the Republic of Kazakhstan, 2022).

Overall, the survey identified three main functions that need to be improved or upgraded in applications such as Damumed. Once again, 100 respondents answered the question and more than one option was allowed to be selected. The three areas are:

- Scheduling doctor appointments, as 45% of the respondents selected this as the main function that needs improvement.
- Personalized healthcare (condition monitoring, health indicators), too, has been identified as unsatisfactory with a 41% share.
- Finding the right specialist, was the third most voted for function of HIT application that is expected to provide better performance, with 41% of surveyed selecting this option.

One response was submitted by a patient, stating that the application lag on regular basis, which makes their use very inconvenient to the intended end-users. Another comment was made by a different respondents, mentioning that the interface or the format of the apps is not inclusive or user-friendly for older people. Aside from that, a major challenge to complete HIT integration in Kazakhstan is the lack of proper internet connection in rural regions in the country. From the perspective of the second intended end-user, the physicians, the HIT platforms in Kazakhstan lack logical or proper integration between different platforms such as Damumed and Avicenna, which can complicate the admission of emergency patients.

6. Conclusion

In the concluding part of the thesis, the set objectives at the start of the research will be reviewed. The main objective was to study the current state and trends in adoption of HIT among patients and physicians in the Republic of Kazakhstan, covering aspects such as adoption factors and obstacles in achieving integration of HIT systems in healthcare sector.

Meanwhile, the partial goals were focused on conducting a theoretical study of HIT adoption and how its application impacts patients' lifestyle. At the start of the Literature review, the basics of HIT concept were explained, along with its perceived benefits for the involved parties such as the patients, hospitals/clinics and medical specialists. Those commonly include cost and time efficiency, reduction of manmade errors, automation of work processes and leverage of modern Cloud technology to create shared databases. Other discussed topics were the factors and challenges to consider in HIT adoption, which included social approval and common lack of computer literacy. Other factors to be considered are the provision of necessary training and sufficient data governance.

Over the years, Kazakhstan has been developing an HIT integration framework, which has previously been slowed down due to the common issues with the access to the internet in certain regions of the country, lack of approval from the representatives of state's older citizens, as mentioned by the Prime Minister of country. However, a bigger step was taken with the "Densaulyq" state program, under which national EHR system was developed. (Prime Minister of the Republic of Kazakhstan, 2019) Moreover, HIT platforms such as eGov and Damumed have been integrated into many hospitals in over 17 regions.

However, despite the recent advancements in Kazakhstan's telemedicine, the practice of online consultations still remains an unpopular service. Moreover, there still exists the issue with internet in rural areas and lack of computer literacy among older population. On top of that, the research shows that some functions of HIT applications such as Damumed have not been very effective in fulfilling the medical services requested through the application. As only 21% of the surveyed stated that they Always got the expected end result of their digital healthcare experience. There also exists a discrepancy in the integration of different

platforms and such as Avicenna and Damumed, which can complicate the work of physicians.

Through the survey respondents were able to vote for more than one option of proposed HIT improvement methods. Many respondents have voted that there is a need to develop simple and more user-friendly mobile application and platforms, that will make digitalization more understandable for older patients. More than half of surveyed (65%) have agreed with the proposal. The next popular solution, with votes of 48% of respondents, that the state has to resolve the internet connection issue in villages and rural areas.

Another most voted option with 49%, is to develop better integration better integration between HIT platforms and the clinics themselves, and it is crucial to note that this was the same point raised by the interviewed physician. As she mentioned the need to connect databases of inpatient and outpatient systems, like Avicenna and Damumed. For example, countries like Estonia, who has a single national HIT platform, ENHIS. (WHO, 2016)

Other factors to implement, in order to achieve smoother and more efficient integration of HIT into the healthcare sector of Kazakhstan, is the need to provide guidebooks or some form of tutorials, that would teach the general population on how to properly use the online HIT services, apps and websites.

There are of course limitations of the developed research work, mostly associated with the sample size and the sampling method utilized for the survey and interview. Because convenience sampling method was used, instead of a random sampling method. And the selected sample size may be considered small and may not reflect the population in the most accurate way. Thus, in the further research a larger random sample would be preferred.

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Appendix

Patients survey questions:

- 1) Please select your gender:
 - Male
 - Female

- 2) Please select your age group:
 - 18-24
 - 24-34
 - 35-44
 - 45-54
 - 55 and above

- 3) Do you use digital health care services / HIT systems? (ex. eGov, Damumed, etc.)
 - Yes
 - No
 - Sometimes / Occasionally

- 4) Do you think is the use of HIT applications/websites to access healthcare services is convenient?
 - Yes, it is convenient
 - No, it is inconvenient
 - Neutral, about the degree of convenience

- 5) Have you ever used online consultation with a medical professional
 - Yes
 - No
 - I don't remember

- 6) Which services do you use the most in application Damumed?
 - Scheduling doctor appointments
 - Finding a specialist
 - Finding the medications
 - Calling a doctor home
 - Accessing your EHR and medical documents
 - Receiving lab results
 - Personalized healthcare (condition monitoring, health indicators)
 - Other (specify)

- 7) How often does the use of HIT app help you successfully get the requested medical service?
 - Always

- Sometimes
- Rarely
- Never

8) How does the use of HIT in hospitals / clinics simplify your healthcare experience?

- Help reduce costs (affordable medication alternatives, medical charges, etc.)
- Provide more personalized and efficient healthcare
- Improve your access to healthcare (clinics / hospitals/ etc.)
- Helps you better monitor your own health and treatment
- Provides simple access to your health records
- Other (specify)

9) Which area of HIT is in need of improvement in your opinion?

- Scheduling doctor appointments
- Finding a specialist
- Finding the medications
- Calling a doctor home
- Accessing your EHR and medical documents
- Receiving lab results
- Personalized healthcare (condition monitoring, health indicators)
- Other (specify)

10) How can digital healthcare experience in Kazakhstan be improved?

- Develop more user-friendly apps/platforms
- Provide tutorials to patients on how to use HIT apps/platforms
- Resolve the issue with internet access in rural areas
- Use modern, better computer systems and databases in healthcare organizations
- Provide better integration between HIT platforms and the clinics themselves (eGov, Damumed, hospital's websites, etc.)