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THE ROLE OF DIGITALIZATION IN ENHANCING THE EFFECTIVENESS OF THE MANDATORY HEALTH INSURANCE SYSTEM IN KAZAKHSTAN

Annotation. Digitalization plays a pivotal role in modernizing healthcare systems, especially in Kazakhstan's mandatory health insurance (OHI) framework. This paper explores the potential of digital technologies to enhance the effectiveness of OHI by ensuring financial transparency, improving access to healthcare services, and building public trust. The current state of OHI in Kazakhstan is examined, identifying key challenges in implementing digital solutions and their impact on healthcare management quality.

Particular attention is given to using digital platforms like eGov and DAMUMED, alongside the prospects of integrating advanced technologies like artificial intelligence and blockchain. The paper offers recommendations for overcoming digitalization barriers, such as improving internet infrastructure, raising digital literacy, and ensuring better integration of information systems. Ultimately, the study emphasizes how digital transformation can create a more robust, transparent, and efficient OHI system that meets citizens' needs and enhances healthcare service quality.

Keywords: Digitalization, mandatory health insurance, Kazakhstan, eGov, DAMUMED, healthcare system, transparency, access to healthcare.

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РОЛЬ ЦИФРОВИЗАЦИИ В ПОВЫШЕНИИ ЭФФЕКТИВНОСТИ СИСТЕМЫ ОБЯЗАТЕЛЬНОГО МЕДИЦИНСКОГО СТРАХОВАНИЯ В КАЗАХСТАНЕ

Аннотация. Цифровизация играет ключевую роль в модернизации систем здравоохранения, особенно в рамках системы обязательного медицинского страхования (ОМС) в Казахстане. В статье исследуется потенциал цифровых технологий для повышения эффективности ОМС за счет обеспечения финансовой прозрачности, улучшения доступа к медицинским услугам и укрепления общественного доверия. Рассматривается текущее состояние ОМС в Казахстане, выявляются основные проблемы внедрения цифровых решений и их влияние на качество управления в здравоохранении. Особое внимание уделено использованию цифровых платформ, таких как eGov и DAMUMED, а также перспективам интеграции передовых технологий, таких как искусственный интеллект и блокчейн.

В работе предлагаются рекомендации по преодолению барьеров цифровизации, включая улучшение интернет-инфраструктуры, повышение цифровой грамотности и обеспечение лучшей интеграции информационных систем. В конечном итоге исследование подчеркивает, как цифровая трансформация может создать более устойчивую, прозрачную и эффективную систему ОМС, соответствующую потребностям граждан и повышающую качество медицинских услуг.

Ключевые слова: цифровизация, обязательное медицинское страхование, Казахстан, eGov, DAMUMED, система здравоохранения, прозрачность, доступ к медицинским услугам.

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ҚАЗАҚСТАНДАҒЫ МІНДЕТТІ ӘЛЕУМЕТТІК МЕДИЦИНАЛЫҚ САҚТАНДЫРУ ЖҮЙЕСІНІҢ ТИІМДІЛІГІН АРТТЫРУДАҒЫ ЦИФРЛАНДЫРУДЫҢ РӨЛІ

Аннотация. Цифрландыру денсаулық сақтау жүйесін жаңғыртуда, әсіресе Қазақстандағы міндетті әлеуметтік медициналық сақтандыру (МӘМС) шеңберінде маңызды рөл атқарады. Бұл мақалада

цифрлық технологиялардың қаржылық ашықтықты қамтамасыз ету, медициналық қызметтерге қолжетімділікті жақсарту және қоғамдық сенімді нығайту арқылы МӘМС тиімділігін арттыру әлеуеті қарастырылады. Қазақстандағы МӘМС-тің қазіргі жағдайы зерттеліп, цифрлық шешімдерді енгізудегі негізгі қиындықтар және олардың денсаулық сақтау менеджментінің сапасына әсері анықталады. eGov және DAMUMED сияқты цифрлық платформаларды пайдалану, сондай-ақ жасанды интеллект пен блокчейн сияқты заманауи технологияларды интеграциялау мүмкіндіктеріне ерекше назар аударылады. Мақалада интернет инфрақұрылымын жақсарту, цифрлық сауаттылықты арттыру және ақпараттық жүйелердің интеграциясын қамтамасыз ету сияқты цифрландыру кедергілерін жою бойынша ұсыныстар беріледі. Зерттеу нәтижесінде цифрлық трансформация азаматтардың қажеттіліктерін қанағаттандыратын және медициналық қызметтердің сапасын арттыратын, тұрақты, ашық және тиімді МӘМС жүйесін құрудың маңыздылығы көрсетіледі.

Түйінді сөздер: цифрландыру, міндетті әлеуметтік медициналық сақтандыру, Қазақстан, eGov, DAMUMED, денсаулық сақтау жүйесі, ашықтық, медициналық қызметтерге қолжетімділік.

Introduction.

In recent years, digitalization has emerged as a crucial factor in transforming healthcare systems worldwide, including Kazakhstan's mandatory health insurance (OHI) system. OHI, introduced to ensure broader access to medical care and to improve the financial sustainability of healthcare services, has encountered several challenges. These include issues of transparency, limited access to services, and insufficient public trust. The integration of digital technologies offers a promising solution to address these concerns by streamlining administrative processes, improving service delivery, and enhancing data management.

Digital platforms, such as Kazakhstan's eGov and DAMUMED, represent key innovations in the digitalization of healthcare. These platforms allow citizens to manage their insurance status, access medical services, and make payments online, which reduces bureaucracy and makes healthcare more accessible. Despite the progress, there remain barriers, including technical issues, low digital literacy, and underdeveloped infrastructure, particularly in rural areas.

This paper explores the role of digitalization in improving the efficiency of the OHI system in Kazakhstan. By examining the current state of digital tools in healthcare and identifying existing challenges, the study aims to offer solutions for leveraging technology to make the system more efficient, transparent, and accessible. Ultimately, this research highlights how digital solutions can play a transformative role in achieving the goals of Kazakhstan's OHI, ensuring better health outcomes and more equitable access to healthcare services.

1. Research on Financial Transparency in the MHI System in Kazakhstan

Financial transparency in Kazakhstan's Mandatory Health Insurance (MHI) system has been a longstanding concern. Insured individuals and employers struggle with understanding how their insurance contributions are being utilized by healthcare providers and the Social Health Insurance Fund (SHIF). This lack of transparency undermines trust in the system and complicates the efficient allocation of resources. By addressing this issue, the MHI system can become more accountable, thereby improving public confidence and overall system performance.

Problem Description

The absence of clear and accessible information about the distribution of MHI funds is one of the most significant barriers to its success. While the MHI system aims to ensure equitable healthcare coverage, users often find it difficult to track the allocation of their contributions. This issue stems from the following factors:

1. *Complexity of the Financial Flow:* The flow of funds is often fragmented, involving multiple entities such as the SHIF, healthcare providers, and insurance companies, each with their own reporting systems. The lack of integration between these systems makes it difficult for individuals to track their contributions in real time.
2. *Limited Public Access to Financial Data:* Insured individuals and employers often do not have access to detailed reports on how their contributions are being spent. Current platforms provide limited visibility, and there is no clear mechanism to ensure that the funds are being used efficiently.

3. *Dissatisfaction Among the Population:* According to a 2023 *FORBES.KZ* survey, about 40% of the population expressed dissatisfaction with the transparency of MHI funds. This statistic points to the significant gap between the expectations of the insured population and the current reality of financial transparency within the system. The lack of trust in the system is one of the factors contributing to lower compliance rates and overall dissatisfaction. [3]

2. Redundancy of Functions and Inefficiency in Management Systems

Another significant issue is the fragmentation of information systems across healthcare institutions and the Social Health Insurance Fund (SHIF). This lack of integration leads to data loss, higher administrative costs, and reduced operational efficiency. [1]

Digitalization can address these challenges by establishing a unified information system that connects all stakeholders in the process, including healthcare providers, insurance companies, and government agencies. A centralized database for patient and financial records would ensure seamless data exchange, minimize administrative overhead, and eliminate redundancy.

- Statistical Data: According to a 2022 SHIF report, over 25% of data is lost or duplicated due to lack of integration between various platforms[1]:

3. Accessibility to Healthcare Services

In Kazakhstan, particularly in rural and remote areas, access to quality healthcare services remains a significant challenge. Many individuals face difficulties in finding specialists or scheduling appointments promptly, and they are often required to travel long distances to access necessary healthcare.

Digital technologies, such as telemedicine and mobile health apps, can help overcome these barriers by allowing patients in remote areas to access medical consultations online. Telemedicine, in particular, can offer virtual consultations with specialists, eliminating the need for travel and providing timely healthcare services to underserved populations.[5][6]

Statistical Data: In 2023, more than 15% of rural residents reported that they could not access adequate healthcare without traveling to larger cities [9]:

4. Research Findings and Practical Solutions

To address these challenges, digitalization presents a key opportunity to improve financial transparency. Through the development of comprehensive digital platforms, the MHI system can become more accountable and efficient. Below are practical solutions that can be implemented based on successful examples from other countries and digital advancements already underway in Kazakhstan.

1. Real-Time Tracking of Contributions and Allocations

- One of the most effective solutions is the development of real-time tracking platforms that allow individuals to monitor the flow of their contributions. By enhancing existing digital platforms like *eGov* and *DAMUMED*, the government can offer a more transparent system for tracking funds. [5] [6]
- The existing *eGov* platform, which is widely used for various government services, can be enhanced to allow individuals to access detailed records of their contributions. A dedicated section within the platform could display the contributions made by individuals, how much has been allocated to healthcare services, and how the funds are being distributed across various healthcare providers. [5]
- *DAMUMED*, a digital health record platform, could integrate a financial tracking module that allows users to see how their contributions are being used to cover medical expenses. This integration would not only benefit the insured individuals but also help healthcare providers and insurance companies ensure the correct allocation of funds. [6]

Equation for Fund Allocation

Let:

- C_i : Contribution from individual i (indexed by contributors).
- A_j : Allocated funds to healthcare provider j .
- T_f : Total available funds in the system.

The real-time balance of funds in the system can be calculated as:

$$T_f = \sum_{i=1}^N C_i - \sum_{j=1}^M A_j$$

Where:

- N : Total number of contributors.
- M : Total number of healthcare providers.

This equation ensures that the system tracks the net balance of funds at any given time,

linking individual contributions directly to allocated services.

2. Blockchain for Transparency

Integrating blockchain technology could provide an innovative and highly secure solution for tracking financial transactions. Blockchain’s decentralized nature makes it ideal for recording all financial flows related to MHI contributions, ensuring that no data is lost or altered. This technology has the potential to offer a transparent, immutable ledger that tracks each transaction in real-time.

- *Practical Example:* Countries like Estonia have successfully integrated blockchain technology into their public healthcare systems, ensuring that citizens have access to transparent and tamper-proof records. Kazakhstan could benefit from this technology by creating a public ledger where each contribution and subsequent expenditure is transparently recorded. [8]

Structure of Blockchain-Based Fund Tracking

Blockchain integrates the following components:

1. **Blocks:** Each block contains:
 - o Contribution ID
 - o Amount contributed
 - o Timestamp
 - o Allocation details
 - o Digital signature for verification.
2. **Decentralized Ledger:** All participants (e.g., contributors, SHIF, healthcare providers) access a tamper-proof ledger.

Practical Simulation

If 1,000 contributors contribute C=10,000 KZT monthly:

Total contributions recorded:
 $C_{total} = 10,000 \times 1,000 = 10,000,000$ KZT.

Real-time transparency ensures all allocations are visible:

$$T_f = C_{total} - \sum A_j$$

3. Mobile Applications for Real-Time Monitoring

As mobile applications continue to

gain popularity, they could be leveraged to enhance transparency. A dedicated mobile app could provide users with instant access to their contribution records and track how funds are being utilized for medical services.

- *Example Solution:* A mobile version of the *eGov* platform could be developed, where users can receive push notifications about their payments, view detailed reports on fund allocation, and even track the services that have been covered by their contributions. This would empower individuals to stay informed about the usage of their funds. [11]

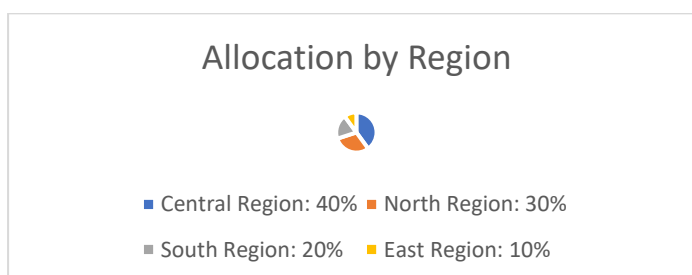
4. Public Dashboards and Reports

In addition to individual tracking, the development of public-facing dashboards could help increase overall transparency. These dashboards could display aggregated data on how MHI funds are distributed across various regions and healthcare providers. They could include visualizations such as pie charts, bar graphs, and maps to provide a comprehensive view of fund allocation.

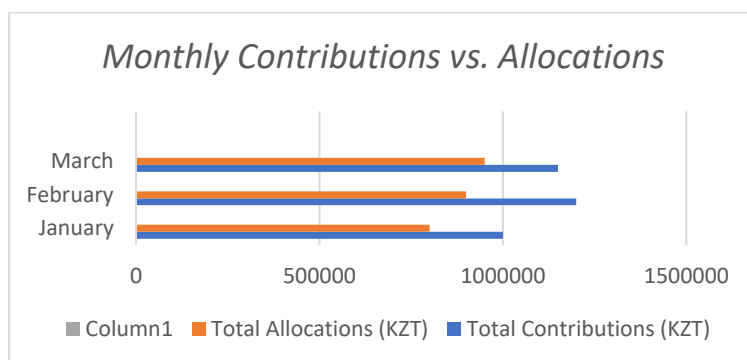
- *Practical Example:* The U.S. government’s *Open Payments* system provides similar financial transparency by publishing data on payments made by drug and device manufacturers to healthcare providers. Kazakhstan could implement a similar public reporting system for MHI, where citizens can see the distribution of funds across the healthcare system.

Visualization for Public Reporting

Using aggregated data, public dashboards can provide transparency in MHI fund allocation. Below is an example of visualizations (picture 1):



Picture 1 – allocation by region



Picture 2 - Monthly Contributions vs. Allocations

Conclusion

The digitalization of the MHI system in Kazakhstan represents a crucial opportunity to address several existing challenges. Financial transparency, redundancy of functions, and limited access to healthcare can all be mitigated through the implementation of digital solutions. By introducing electronic platforms for fund tracking, blockchain for data management, and telemedicine for remote consultations, Kazakhstan can significantly improve the effectiveness and

accessibility of its MHI system. These technological innovations are not merely technical upgrades, but strategic tools capable of transforming the healthcare system into a more efficient, transparent, and equitable model that better serves both citizens and healthcare providers.

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