



An Overview of the Current State and Prospects of Development of e-Health in Uzbekistan

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ABSTRACT

Introduction: A significant role is played by the automation of diagnostic and treatment process, and the implementation of information and communication technologies, medical information systems, telemedicine, electronic health records, and electronic prescriptions in the field of health care institutions. The main purpose of this review was to familiarize the readers with the achievements and problems in the area of the health care information in Uzbekistan.

Method: During preparation of this review, a comprehensive search of publications concerning informatization of health care in Uzbekistan was carried out. The electronic search was carried out by the keywords: e-health, telemedicine, health information system, medical information system, and child health in Uzbekistan.

Results: Retrospective analyses showed that in Uzbekistan the health system has actively implemented specialized medical information systems through various projects on telemedicine. One of the most important areas is improving the health information system in the field of reproductive health, women's health, and children and adolescents health issues. The main expected results of implementation of e-Health and the use of telemedicine technologies and systems that enhance the efficiency of health care are: promotion of the health of the population; decrease in the illness rate, disability, death rate; increase of availability and quality of medical care; strengthening the primary link of health care; creation of conditions for rendering effective medical care on a pre-hospital basis; development of a preventive orientation of health care; satisfaction of the needs of the population at high-technological types of medical care.

Conclusion: Today, thanks to the implementation of extensive government programs in health care in Uzbekistan that has almost been completely reconsidered by the health care system. The country has taken measures to create the Integrated National Health Information System. Also, the informatization process is still confronted with many difficulties and it proceeds unevenly. The success of health care informatization in Uzbekistan at this stage depends on the decision of the organizational and technical issues.

Keywords: Uzbekistan, E-Health, Health Information System, Telemedicine, Child Health

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Introduction

Health care is one of the systems which require complex measures to be taken for implementation of information and communication technologies (ICT). It is important for ensuring the efficiency of the reforms which are carried out in this field, improvement of the organization, and quality of medical service.

Historically, the health care system of Uzbekistan was a strictly centralized state system until 1991. It was formed on the basis of the Semashko model, since the Republic was part of the former USSR. In this regard, the health care system of Uzbekistan has undergone the same changes as the Soviet health care system as a whole (1-3).

The first reports about the possibility of the use of computers in health care of the former Soviet republics appeared in the late 50s- early 60s of the 20th century.

This interest has been associated with the implementation of scientific and technological advances in clinical medicine and, before all, in the heart surgery (4). In 1965-1974, the basic conceptual positions were formulated and the first projects for all levels of health management were carried out. During this period, the foundations of informatization infrastructure of research institutes and the Ministries of Healthcare of the Soviet Republics were laid. The first steps were taken in practice towards the use of computer systems and the design of clinical systems was prepared. However, these systems could not be used widely since the computers represented large complexes, which required huge rooms, a large number of service personnel and installations in major research institutions and leading clinics (5, 6). In the 1980s, personal computers became cheaper and more compact, and their computing capacities have increased. It has allowed attempts to move

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toward creation and implementation of health IT systems for various purposes, but it led to refusal of earlier created software products not compatible to new PCs.

After Uzbekistan gained its independence in 1991, it seemed necessary to reorganize the health care processes, as well as all other processes managed at the state level. In 1998, the State health care system reform program was adopted. The priority directions of the program were:

- Improving health financing systems;
- Reforming primary health care;
- Creation of effective state-guaranteed system of emergency medical assistance;
- Improving health care for mothers and children;
- Ensuring stable sanitary and epidemiological welfare of the country.

To improve the efficiency of health care in Uzbekistan, a profound restructuring of the entire system was implemented. The current health care system is a synthesis of the rational principles of the former organizational model and new requirements of time to high-quality medical care (1, 7-9).

A large number of publications are devoted to reforming of the health care system of Uzbekistan. However, a systematic overview on the field of informatization of health care, as the most important direction of increase in management efficiency and quality of medical care, has not been carried out yet. In this article, we made an attempt to answer the following questions:

What are the principal approaches in Uzbekistan?

What are the prospects of implementation of e-Health in Uzbekistan?

At what level is the implementation of telemedicine and medical information systems?

The main purpose of this review was to familiarize the readers with the achievements and problems in the area of the health care informatization in Uzbekistan.

Methods

Data Source

During preparation of this review, a comprehensive search of publications concerning informatization of health care in Uzbekistan was carried out. We searched the articles to find the links on this subject. An overview of studies published in English and Russian by searching electronic databases including PubMed, Scopus, RSCI (Russian Science Citation Index), and Cyberleninka was conducted from 2000 onward.

Search Strategy

This study used a quantitative, bottom-up approach to review the informatization of health care in Uzbekistan. The electronic search was carried out by keywords: E-Health, Telemedicine, Health Information System, Medical Information System, and Child Health in Uzbekistan.

Inclusion and Exclusion Criteria

The overview included studies related to the implementation and development of the projects in the area of the health care informatization in Uzbekistan over the last 15 years, which allowed us to estimate the current state of introduction of information technologies at health

care in Uzbekistan. The studies whose title and keywords did not include any Internet-related words were excluded.

Data Extraction

The initial search was carried out. Then, short messages, letters to editors, repeated articles and those which did not meet the criteria for inclusion in this review were excluded. In the dataset, each article was listed with its title, author, published year, author-supplied keywords, abstract, publication title, references cited and other parameters. All articles, meeting the inclusion criteria, were read and analyzed by the author. In that overview, through analyzing article titles, abstracts, and keywords, four primary domains in the Internet research were extracted: e-Health, Health Information System, Telemedicine, Child Health in Uzbekistan.

Results

The Concept of "National Integrated Health Information System of Uzbekistan"

Similar to many countries, Uzbekistan has begun to work on creation of e-Health system. The Ministry of Health has developed a strategy for the development of the National Integrated Health Information System (NIHIS), on the basis of which in 2009 the Concept of "National Integrated Health Information System (NIHIS) of Uzbekistan" was approved (10).

In accordance with the Concept, NIHIS can be divided into two main parts, supporting each other (10). The first part consists of the Integrated Health Care Platform (IHCP) which represents the general communication infrastructure and is the basis of the system. It should be built on the components mutually connecting all subsystems into a single common infrastructure. This approach also allows you to add or disable unnecessary applications, if necessary. The following components are integral parts of the platform:

- The Electronic Medical Records System – the system of management and storage of clinical data. It should be a high-performance subsystem of patient data management and storage, which use modern ICT based on public health standards, offering seamless integration with other components. It is meant that this subsystem is central to NIHIS.
- The Electronic Demographic Register (EDR) is the central demographic register which can be used both for clinical and administrative tasks. Creating a connection between the database of the Electronic Medical Records (EMR) and that of the Electronic Demographic Register (EDR) is possible to receive the single system of storage open for a data interchange with any authorized system using the common infrastructure and standard interfaces.
- The Electronic Register of Resources (ERR) provides opportunities for modern management of a wide range of the resources available in the field of health care. This register contains information on the technical equipment of health care system, about medical personnel and physical resources.
- The Terms Service is a repository of various standards of medical records with their coding and description (International Classification of Diseases ICD10,

International Classification of Primary Health Care (ICPC2) used in health care.

- The NIHIS portal provides a central Internet portal, used by both medical staff and patients to access different medical information systems.
- The Integration Service provides the integrity and consistency of data, communications between different participants of health processes, and access to information and security mechanisms.

All databases and repositories of NIHIS are independent products with certain principles of operation. The integration of all these components into a single integrated system will provide a powerful tool to ensure the free exchange of data, information management and optimal health care. The openness of the system and its compliance with the standards also allow for connection of any other database or storage system required for the health system processes.

The second part of NIHIS represents external medical applications, and also systems which provide an interface for all authorized participants in health care processes. Various agencies involved in the field of health care, using external applications and systems can be: health care institutions; medical and obstetric centers; rural medical stations; clinics; central district hospitals; regional hospitals; centre for emergency care; city clinical hospital; biochemical laboratories, etc. Any number of external applications and systems for medical care can be connected to NIHIS if they are designed in accordance with relevant standards. Various medical institutions can use all kinds of applications and systems that are certified by authorized state certification bodies.

One of the most important conditions is that the state should have full control over various systems from third-party vendors, which will be connected to the National Integrated Health Information System. At the state level, organizations should create quality assurance, licensing and certification of such systems. This will help keep health care process consistent and transparent, in a completely controlled environment (10).

International projects

Currently in the health care of the Republic of Uzbekistan, a number of international projects are carried out, some of components of which are directly or indirectly related to the creation and development of information systems and information resources. Since 2000, the Emergency Care Service (ECS) started functioning in Uzbekistan. It is a separate and largest organizational structure in the health care system of the country (11). The head of ECS organization is the Republican Research Center of Emergency Care (RRCEC) with the Republican medical aviation and the service "103" of the city of Tashkent. 12 regional branches providing specialized emergency medical care to the population of Uzbekistan are also under its supervision. The Service is equipped with the modern high-technology medical equipment and combines material-technical, scientific and human resources into a single structure. The Service remains on government funding and is intended for timely rendering of free highly

specialized emergency medical care to the population in various medical emergencies (12-14).

Another component of reforms in the health system in Uzbekistan is the transformation of primary health care (PHC) and the formation of the institution of general practitioner (9). So, in the project of "Health", the creation and implementation of "Health Management Information System (HMIS)" is considered (15).

Designing a system for automation processes for epidemiological monitoring of infectious morbidity on the territory of Uzbekistan started in 2008. In 2011, the system was put into operation. The purpose of the system was to automate the epidemiological monitoring of infectious disease processes of the population in the framework of the current system of collecting primary information in a single organizational, legal, methodological and information space divisions of the Ministry of Health.

Organizational and functional structure of the participants of the System is a hierarchical structure consisting of four levels of the hierarchy:

- I. Republic
- II. Region
- III. District
- IV. Primary link

Data on morbidity can be processed by the system at any time of demand and are formed in the reports in any time period (daily, monthly, quarterly, the specific time period) and at any level of the hierarchy (the level of health institutions to the Republic level in whole) in the relevant regional sections. Five departments are involved in the system: epidemiological, sanitary and epidemiological tracking, parasitological, especially dangerous infections, and organizational and methodical.

The Information system "The Database on the Donors and the Persons Who are Taken Away from Donorship" was developed and implemented within the UNDP project. The system is intended for use in the organizations of the blood service of Uzbekistan, which are engaged in selection and inspection of donors, procurement, research on the donors' blood and its components, storage, application and utilization (16).

The Geographic Information System (GIS) is actively developed by the Ministry of Health of Uzbekistan. The System is intended for collection, storage, processing, access, analysis, interpretation, and graphical visualization of spatial data. In today's information society, GISs are increasingly used, because they are the most convenient tool for solving many practical, scientific and educational problems associated with the use of geographic information. The greatest effect is achieved by the use of GIS for acceptance of competent administrative and economic management decisions at all levels. All organizations of the Ministry of Health of Uzbekistan, which are engaged in treatment, research and storage of databases, are of automation objects. The System's features are as follows:

- Ensuring information storage in a single information space;
- Forming a unified database of disease;
- Collecting and processing the clinical data;

- Viewing, monitoring, and analyzing geographical and demographic situation of morbidity, etc.;
- Viewing of the results of the outbreak of diseases, vaccination and statistical analyses;
- Providing the input of the results of primary clinical trials on all direction of diseases;
- Providing the input of the results of infectious researches;
- Generating analytical reports.

Further integration of the System is carried out with the National Health Information System of Uzbekistan, with the Emergency Care Service, and also with the corporate portal of Ministry of Health of Uzbekistan.

Development of telemedicine

The clinical component of introduction of ICT in Uzbekistan's health care system is implementation of new and progressive medical technology – “Telemedicine”. The main objective of the development of a telemedicine service is decentralization of the health system without reducing the service quality of the population residing in rural areas (15).

To improve the quality of diagnostic services in the regions, since 2002 implementing the network “Telemedicine System of Macro- and Microscopy” (TSM) has begun. The introduction of ICT in the pathoanatomical service allows the authorities to solve the following problems:

- To hold consultations on difficult biopsies and autopsies, sent from various regions of Uzbekistan
- To carry out discussion of the results of autopsies of especially dangerous infections;
- To provide consultations of difficult biopsies and cytological smears of malignant tumors of the breast, cervical, endometrial tumors and other sites, as well as childhood tumors;
- To hold clinical-anatomical conferences with analysis of the reasons of child and maternal mortality and also difficult and rare diseases, especially among the newborns and women of reproductive age;
- To improve the skills of pathologists and cytologists by means of distance learning;
- To provide distance learning for students.

The telemedicine system was brought into operation in 2002 on the basis of first Tashkent state medical institute (TSMI-1) with the help of Swinfen Charitable Trust (UK) which was one of the first telemedicine projects. Requests from the TSMI-1 were on the following specialties: neurology, dental surgery, radiology, orthopedics, plastic surgery, and oncology. Consultants to these requests were doctors-volunteers from Australia, Austria, Great Britain, and Northern Ireland. The responses to the requests of Uzbek doctors have helped to significantly improve the diagnosis and treatment of patients of Clinical Hospital TSMI-1. Following the results of the reports, requests were single, and had no regular character. Today the project is complete.

In October 2003, the pilot project on a telemedicine in the field of military medicine and natural disasters medicine was carried out. Within the project, a corporate medical network should be built among the Central clinical military hospital (Tashkent), the Fergana military

hospital, Republican research center of emergency care (Tashkent), the First Tashkent state medical institute. The project was sponsored by the program of NATO “Partnership for Peace”; 15 doctors from the specified medical organizations were trained on a telemedicine. The project also had one-time nature was of a non-recurrent nature. Regular teleconsultations were not carried out due to the lack of telecommunication infrastructure. Today, the project is complete, and the telemedicine system does not function.

Since 2006, telemedicine technologies have found application in the V.V. Vakhidov Scientific Center of Surgery. Telemedicine technologies are mainly used for teleconsultation of seriously ill children with colleagues from A.N. Bakoulev Scientific Center for Cardiovascular Surgery of the Russian Academy of Medical Science (RAMS), Scientific Center of Surgery of RAMS, and others. Consultations are given on a regular basis on the technology of deferred consultations (off-line). Consultations on videoconferencing (on-line), due to the lack of specialized equipment, are carried out periodically (on request). The regular off-line consultations with periodic on-line consultations have shown efficiency in cardiac practice.

Telemedicine in emergency care service has begun to develop since 2002, when within the project “Europa Aid” the telemedicine network was built linking the Centre of Emergency Care in Tashkent with two affiliates located in Karshi and Nukus cities. In 2004, affiliates in Nukus and Karshi, and the Republican Research Center of Emergency Care were equipped with the necessary minimum amount of equipment (computer, scanner, digital camera, X-ray viewer, Internet connection) for teleconsultation in the mode “Store and Forward”. In addition, the Republican Research Center of Emergency Care was connected to the system of international consultations through the charity fund of UK. Apart from the listed projects a telemedicine projects can be identified in ophthalmology and education. The main problems in implementation of telemedicine projects can be distinguished in two main sections. This is organizational and technical problems.

Organizational problems:

- An insufficient regulatory framework in issues of representation of telemedicine services;
- Lack of coordinating the implementation of telemedicine projects;
- Insufficient readiness of the personnel;
- Insufficient awareness of the population;
- Stability issues.

Technical problems:

- Absence of common standards;
- Absence of a unified telecommunications infrastructure;
- Unstable communication channels (telecommunications part);
- Power outages (regions).

IT in the field of child health

Children and adolescents under the age of 14 years constitute more than a quarter of the population of Uzbekistan. In this regard, special attention is paid to

the issue of maternal and child health in the country. Improving health information systems, coordination and monitoring of implementation of activities in the field of reproductive health, women's health, children and adolescents is one of the most important objectives of the state policy in Uzbekistan.

In the field of children's health care today with the assistance of international organizations – the World Health Organization (WHO) and the UN Children's Fund (UNICEF), such important programs as Integrated Management of Childhood Illness (IMCI) and the WHO Anthro software are introduced

Implementation of the IMCI strategy has an impressive effect on reducing child mortality and improving the quality of life of infants worldwide. IMCI is an integrated approach to children's health, centred on the health of the child as a whole. IMCI objectives are to reduce the number of deaths, illnesses and disability and to promote improved growth and development of children under the age of five years.

The cornerstone of the IMCI strategy is a series of guidelines based on scientific evidence. These guidelines were developed to provide primary health care workers, using a simple and effective tool in the fight against the main causes of child mortality and morbidity. In 2011, the WHO Regional Office assisted in conducting the first training for the introduction of computerized adaptive tool and Training (ICATT) IMCI in order to facilitate further implementation of IMCI in Uzbekistan (17-19). With the support of WHO and a group of national experts, ICATT IMCI has been adapted to the system of Uzbekistan. As part of a joint project of the Ministry of Health of the Republic of Uzbekistan, UNICEF, the European Union project «Improving services maternal and child health. Phase II» provided seminars on strategy “Integrated Management of Childhood Illness”, using ICATT.

Currently, outpatient care setting is implementing the WHO Anthro software for personal computers or laptops that use the operating system Microsoft Windows. It is designed to facilitate the application of the WHO Child Growth Standards (2006, 2007) in monitoring the growth (weight-for-age, length/height-for-age, weight-for-length/height, BMI-for-age) and development of motor skills in individual children and generally in children up to 5 years of age. In Russian and Uzbek languages, there were adapted and printed guides to using WHO Anthro software (20).

The program consists of three modules:

1. Anthropometric Calculator (AC)
2. The individualized assessment (IA)
3. Examination of the nutritional status (NS)

Thus, the implementation of the above modern ICT in child health will help to unify, and provide reliable information in the assessment of growth and development, nutritional status and health of children, which will improve the quality of services to patients and healthy children.

In 2015, experts of the Center for Strategic Innovation and Informatization, the Republican Specialized Scientific-Practical Medical Center of Pediatric and the Tashkent Pediatric Medical Institute have begun to develop an

information system called “Electronic child health passport”.

“Electronic child health passport” will provide complete medical information from birth to 18 years, increasing the performance monitoring of the health and improving the quality of medical support; reducing the probability of medical, settlement and information errors; preventing the development of diseases; taking preventive measures on time, and if necessary to choosing the right tactics in treatment. Available centrally stored data on the child's full medical history can allow the medical staff to make the right decision in the service and treatment that will undoubtedly improve the quality of medical care.

Discussion

Reforming of healthcare promotes the health of the nation and brings quite real economic benefits. The main expected results of implementation of e-Health and the use of telemedicine technologies and systems that enhance the efficiency of health care are:

- Improving the health of the population, and decreasing the illness rate, disability, and death rate;
- Increasing availability and quality of medical care;
- Strengthening of primary link of health care, and providing opportunities for rendering effective medical care on a pre-hospital basis;
- Developing a preventive orientation of health care;
- Satisfying the needs of the population at high-technological types of medical care.
- Better management of medical institutions and processes;
- Rationalization the system by managing costs and financial flows (less burden on hospitals by increasing the authority of primary health care facilities);
- Control of cost-effectiveness, especially in primary health care facilities in rural areas;
- Strengthening the financing and management of the entire health system;
- Improvement of sanitary and epidemiological services;
- Decentralization of the health care system without reducing the quality of care in rural areas (telemedicine);
- Medical care based on best experience and accumulated knowledge.
- Continuous professional medical education, including on the basis of distance learning methods on the job.

Conclusion

Today, thanks to the implementation of extensive government programs in health care in Uzbekistan which has almost completely reconsidered health care system and created a single system to provide free emergency medical care to the population. Much work is done in the area of maternal and child health. The country has begun work on the creation of the Integrated National Health Information System.

It should be noted that the informatization process is still confronted with many difficulties and proceeds unevenly. Information technology in health institutions is used to varying degrees, depending on the form of ownership, location, and the institution size. The success of health care informatization in Uzbekistan at this stage depends

on the decision of the organizational and technical issues, such as: insufficient regulatory framework, insufficient readiness of the personnel, lack of single standards, insufficient awareness of the population, lack of technical equipment of the medical institutions, and lack of single telecommunication infrastructure.

Conflict of interest

None declared.

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