необходимые изменения в существующие требования по конфиденциальности информации [3].

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IMPLEMENTATION OF TELEMEDICINE TECHNOLOGIES: COMPARISON OF UKRAINIAN AND INDIAN EXPERIENCE

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Abstract. According to current agenda of Ukrainian government in November 2019, digitalization is named as one of the key priorities. Digitalization and support of informational technologies development are tried to be implemented in all sectors of economy. Healthcare sector is not an exception. Meanwhile, telemedicine is an inalienable part of information technologies in public healthcare, which has a long-standing history of implementation on an all-Ukrainian level. Taking into account mentioned facts, we think that it is relevant to analyze implementation of telemedicine technologies in such country as India, because of successful results despite several negative economic considerations in comparison to Ukraine. India reached objective positive changes in public health sector, increased life expectancy at birth, improved quality and delivery of telemedicine to rural area. That is why Indian experience can be a specific point of interest from Ukrainian side.

Key words: telemedicine, informational technologies, Ukraine, India

Comparison of Ukraine and India is relevant in the field of telemedicine because of economic and demographic considerations, which determine the level of healthcare in both countries. We can mention some of them: rural population (in % in comparison with number of total population) in 2018 for India is 65.7% and for Ukraine is 30.648% (Figure 1); amount of physicians per 1000 people in 2014 is 0.726 in India and 3.008 in Ukraine; expenditures on health per capita expressed in international dollars at purchasing power parity (PPP) in 2016 are 241.483$ in India and 534.191$ in Ukraine (Figure 2). Nevertheless, India shows stable growth in life expectancy at birth (Figure 3), in 1960 this parameter was equal to 41.422 years in India and 68.3 years in Ukraine. In 2017 this parameter reached 69.165 years in India and 71.781 years in Ukraine. Mentioned data demonstrate complexity of demographical and economic realities for India. Despite that, India keeps progressing in healthcare sector [15,16,17]. Taking into account facts above, it is a specific point of interest to analyze pathway of India in implementation of telemedicine technologies in comparison to scenario of development of this technology in Ukraine.

Figure 1

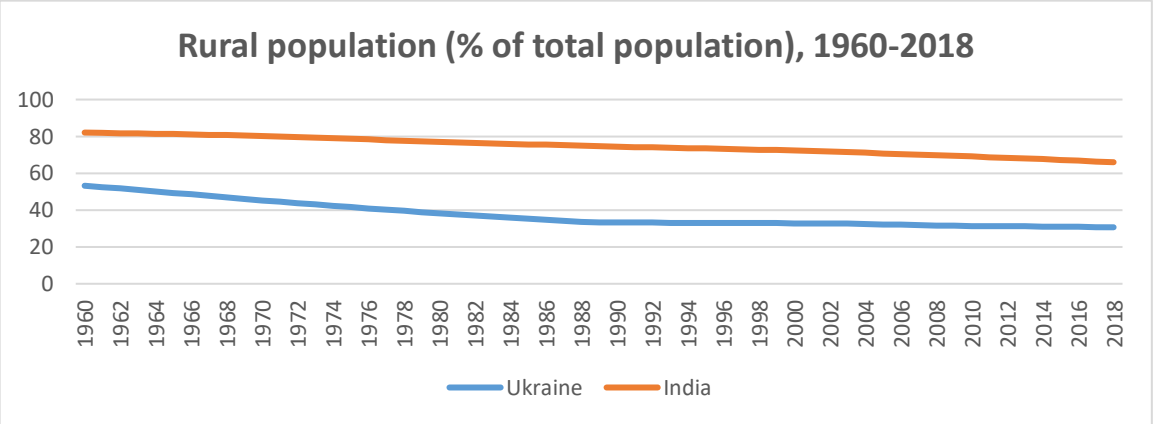


Figure 2

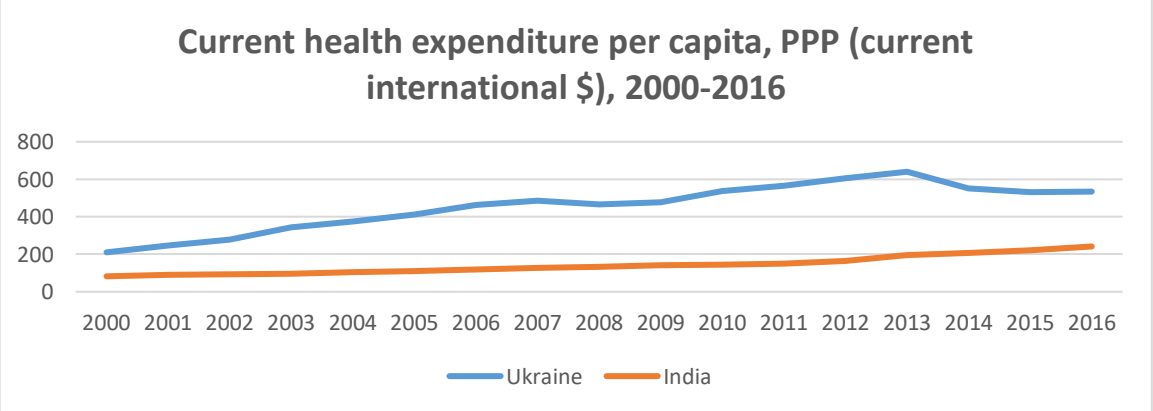
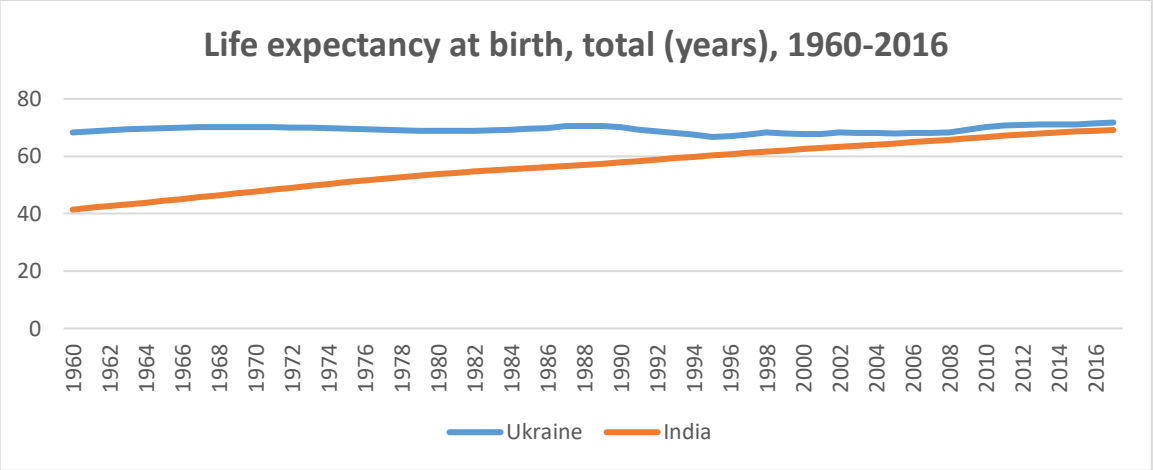


Figure 3



First registered case of telemedicine implementation in Ukraine is dated in the 1940s, when it was crucial to provide interpretation of medical examinations as a part of space research. That is why audio and video communication channels were used the most to deliver remote transition of ECGs recordings [2]. Further development of telemedicine technologies had a local pattern, implementation of technologies for remote transition of medical data was gradual and dependent from most relevant demands. One of the most significant areas was cardiovascular pathology, which hold leading positions among death reasons in population of Ukraine. In 2004-2005 the Ministry of Healthcare of Ukraine bought 570 transmitting devices and 57 receiving stations for transtelephonic electrocardiography “Telecard” (medical diagnostic complex “Tredex”) as part of program aimed to support medicine in rural areas. In total 52 remote diagnostical centers (RDC) were created. On a first stage in 2005 25 RDC were created on a base of regional centers. Transmitting devices were installed in 270 central regional hospitals of the respective areas [5]. One event determined further development of telemedicine in a centralized way. It was an agreement about project of telemedicine network in Kiev between government of Ukraine and government of Republic of Korea. According to mentioned agreement it was planned to issue a grant of no more than one million US dollars. As recipients of grant help Kiev City Clinical Hospital No. 6, Kiev City Ambulance Hospital, Kiev City Oncology Hospital and Kiev City Diagnostic Center were mentioned. This agreement was ratified on July 26, 2006 and according to the order of the Ministry of Health No. 269 of May 25, 2007 Telemedicine Center, Ministry of Health of Ukraine (TMC) was created on a base of Kiev City Clinical Hospital No. 6. By the Decree of the Cabinet of Ministers of Ukraine No. 878 dated October 1, 2008, it was included in the List of Healthcare Institutions that ensure the implementation of national functions. The most significant collaboration was research

and implementation of “Mobile medicine” project on October 1, 2009 after signing a memorandum of understanding between Ministry of Health of Ukraine, UN Office in Ukraine and MTS [7]. According to “Mobile medicine” project as of 2011, specific software “Doctor Eleks” was installed in new-created telemedicine centers at the Donetsk and Transcarpathian (Uzhgorod) regional hospitals, TMC in Kiev, the Republican Clinical Hospital named after O.N. Semashko (Simferopol), in the diagnostic center "St. Paraskeva" in Lviv [4]. At the same time, positive changes in implementation of telemedicine technologies were observed also in other healthcare establishments, that did not have direct collaboration with TMC in Kiev. First case of passive teleassistance can serve as an example of this process. It occurred in 2010 on a base of Research Institute of Traumatology and Orthopedics of Donetsk National Medical University named after M. Gorky during running of knee joint arthroscopy [3]. Another example is how telemedicine assisted in decreasing of time consumption during consultations among candidates for surgical interventions for surgical pathology and colon injuries. Mentioned experience was implemented at the Odessa Regional Clinical Hospital [6]. It is significant to mention that there was no increase of postoperative complications in a group of patients, treatment of which was assisted with telemedicine, in comparison to specialized hospitals. At the same time there is a lack of data, that covers further scaling of mentioned approaches, what keeps them active only for local needs. Partly it can be explained because of lack of specific law regulations of public relations in a telemedicine sphere in Ukraine, according to 2013 data [1].

Development of telemedicine technologies in India started in 2001 from organizing a pilot project by Indian Space Research Organization (ISRO). Main aim of this project was to connect Chennai's Apollo Hospital with the Apollo Rural Hospital at Aragonda village in the Chittoor district of Andhra Pradesh. Later, in March 2002, the Karnataka telemedicine project linked Narayana Hrudayalaya, a high-profile cardiology care hospital in Bangalore, with the Chamarajanagar District Hospital and the Vivekananda Memorial Trust Hospital in Saragur in southern Karnataka [9]. In further support and development of telemedicine services for Indian population served such organizations as ISRO, Ministry of External Affairs, Department of Information Technology (DIT), Ministry of Health and Family Welfare and the state governments. According to 2009 data, India succeeded in covering of almost all its territory with 269 telemedicine nodes (Figure 4) [10]. Highly effective were measures, aimed to tackle spread of diabetes among rural residents of Chunampet villages in Tamil Nadu in southern India. From 2006 to 2010 specific project Chunampet Rural Diabetes Prevention Project was developed and implemented in this region. The main objective of the project was to provide the opportunity for

screening, prophylaxis and treatment of diabetes in rural residents who, due to living in remoteness from medical care centers, were not able to contact medical establishment. As part of the project, a telemedicine car was created, which was equipped with a digital retinal camera, a slit lamp, an ECG machine, ultrasound dopplerography and biothesiometry installation (Figure 5). From a total amount of 27 014 of adult population, that was living at 42 villages, 23 380 people (86,5%) were tested on presence of diabetes. Results are the next: 1138 (4,9%) had diabetes and 3410 (14,6%) had prediabetes. Overall 1001 people were tested on presence of complications (recall level was 88,0% from total amount of respondents from this category). Diabetic retinopathy was revealed in 18.2%, neuropathy in 30.9%, microalbuminuria in 24.3%, peripheral vascular disease in 7.3% and ischemic heart disease in 10.8% of respondents with complications. As a result of such intervention mean level of hemoglobin A1c among studied patients with diabetes dropped from 9.3 ± 2.6% to 8.5 ± 2.4% within 1 year. Less than 5% of people required further treatment in Chennai at the specialized diabetes hospital [8].

Figure 4

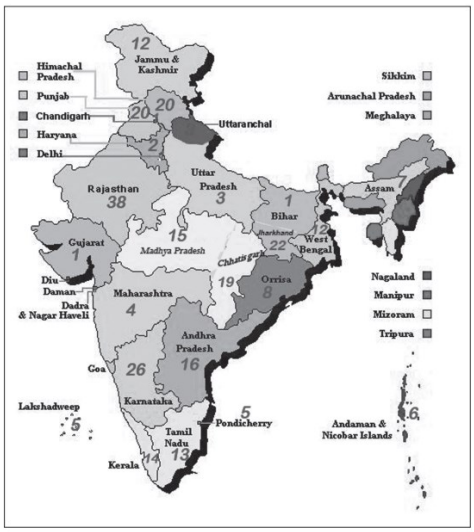


Figure 5

Nowadays telemedicine services in India are covered by jurisdiction of the Department of Information Technology and Ministry of Health and Family Welfare (MoHFW). Telemedicine department of MoHFW and Indian government have created a National portal of telemedicine for realization of a plan in a sphere of electronic health. Mentioned structures also started a National Medical College Network for uniting all medical colleges in country with common aims: to increase level of electronic education and to provide an easy access to telemedicine services as a part of National Rural Telemedicine Network [11]. The legal aspects of the functioning of telemedicine in Ukraine are agreed and regulated by the order of the Ministry of Health No. 681 and

the State Customs Service of Ukraine on the protection of information [2]. At the same time, it is necessary to mention, that the need to provide personal data for using telemedicine services limits the circle of potential users. According to a legal assessment [1], the possibility of maintaining confidentiality of information is violated. Nowadays on a telemedicine market of Ukraine there are several leading companies: MedBrama, to which 208 doctors, 4895 patients and 45 medical establishments are connected, 38 medical specializations and 23 types of services are provided [12]; Doctor Eleks, which is present on market for 12 years, has a client base of more than 250 medical establishments and 5 000 000 patients [13]. MedBrama is created with support from Ukrainian Association for the Development of Information Technology in Medicine for providing telemedicine services in Ukraine. This association is currently a member of IfFTeH and represents Ukraine from 2013. According to considerations from this association [14], MedBrama fully complies with applicable law. Dr. Eleks is an example of the implementation of e-health, aimed at facilitating the functioning of medical institutions from the side of workflow, which was achieved thanks to the standardization of the data protocols used.

According to the analysis, we can establish that the success of the development of telemedicine in India is achieved through competent and long-term cooperation between representatives of the private and public sectors, obtaining grant support from foreign investors and defining clear jurisdiction for all activities related to the field of telemedicine services. Further, a more detailed analysis of the Indian experience of implementing telemedicine is required in order to apply the identified features into the functioning of Ukrainian telemedicine.

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РЕКОНСТРУКЦІЯ КОЛЮЧЕ-РІЖУЧОГО ПРЕДМЕТА ШЛЯХОМ ТРИВИМІРНОГО ПРОСТОРОВОГО МОДЕЛЮВАННЯ

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Актуальність. Тілесні ушкодження, спричинені колюче-ріжучими предметами, посідають одне з вагомих місць у структурі насильницької смертності населення. Зважаючи на це, перед судово-медичним експертом постає питання стосовно ідентифікації гострого травмуючого предмета, яким було заподіяно тілесне ушкодження. Традиційні методики, які