

Solving problems of geriatric care in the Republic of Kazakhstan based on new ICT trends

R Muhamedyev¹, E Muhamedyeva¹, A Mansharipova², V Chaykovska³

¹ IITU, Kazakhstan

² KRMU, Kazakhstan

³ KNMU, Kazakhstan, Institute of Gerontology of NAMS of the Ukraine, Ukraine

*Corresponding author's e-mail: muhamedijeva@gmail.com

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Abstract

In recent years, the measures to improve geriatric care of the population are taken in the Republic of Kazakhstan. Relevance of this issue is determined by a population aging on the one hand, and by RK humanization policy on the other hand. Consideration of these issues is impossible without corresponding data support, which is necessary for organizational tasks and for the entire cycle of medical data processing, starting from data collection, through a comprehensive analysis and issue of recommendation. Using modern software, communication and intelligent technologies promises not only improving of geriatric care quality but reducing the cost and obtain social-economic benefits. The article introduces the problem of geriatric care in Kazakhstan and offers an approach to the solution based on the new trends in the field of ICT.

Keywords: Geriatric care ICT Ambient Assi Living machine learning broadband network Machine-to-Machine big data

1 Introduction

Importance of gerontological research in the world is associated with accelerated aging of the population in developed countries [1 - 4] and with corresponding increase in health care costs [4] (Figure 1).

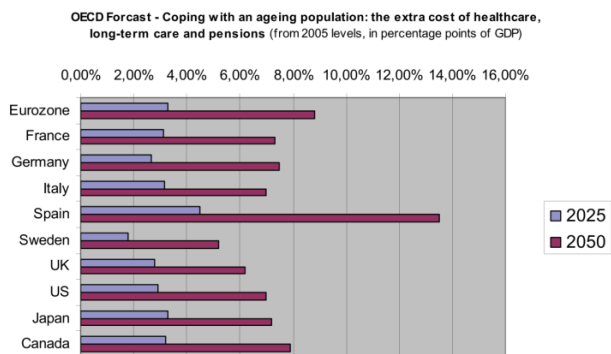


FIGURE 1 Forecast of costs' growth for health care, pensions and social services in percents of gross domestic product (GDP) (<http://www.capsil.org/files/Ageing%20Well%20Background.pdf>)

Major portion of the elderly people is in need of intensive medical care, single elderly people require special attention from medical and social services. In this regard, the developed countries have taken measures to prevent social isolation of elderly people; conditions for active lifestyle maintenance and participation of elderly people in the labor market are created. These are both appropriate measures of health maintenance, and initiatives in the field of business, employment, and reduction of health care and elderly patients care spending [8 - 10].

Modern ICT's provide a set of tools and techniques that reduce the costs and improve geriatric care quality, and also implement proactive medical and social measures to reduce the costs and improve geriatric care quality. Implementation of the system geriatric care includes use of modern ICTs in a heterogeneous distributed system that provides not only heterogeneous data collection, but also its intellectual analysis. The complexity of processes require special researches with the aim to find the appropriate models, methods and solutions that provide of intelligent support not only older persons but also geriatric system as whole.

2 General

World Health Organization (WHO) predicts that the share of people aged 60 and older in Kazakhstan from 11% in 2014 will reach 25% in 2050. With increase of duration of life health care expenses inevitably rise (Figure 2) [13]. Therefore, improvement of medical assistance for elderly people, complex solution of biomedical, social and psychological problems defined by one of the priorities of the State program "Salamatty Kazakhstan" 2011-2015, approved by the Presidential Decree №1113 from 29.11.2010. In recent years, the formation of the gerontology service is taken place in the Republic of Kazakhstan [11], laws and policies aimed to improvement of geriatric care to the population were adopted [12]. In the President's message it is stated: "According to international estimates, about 5 percent of the population with basic types of diseases use about 70 percent of all health care services. Well-organized prevention activities could prevent diseases at early stages".

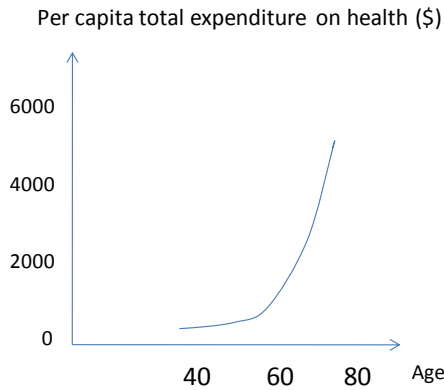


FIGURE 2 The average cost of "healthy" life maintenance at different ages [13]

Timely diagnostics and disease prevention will significantly reduce the costs of out-patient treatment and in-patient treatment, and also will help to preserve mental and physical performance of elderly people. Initiatives in this area are associated with use of information and communication technologies (ICT) [4-7]. It is time to bring into scientific discourse the term "data-based (electronic) gerontology and to consider aspects of ICT use in science and practical applications associated with aging within its scope. In this domain a large number of international programs, projects, communities and academic institutions [33-42] are working, particularly the consolidated program on creation of living support environment of - AAL (Ambient Assisted Living Joint program) (<http://www.aal-europe.eu/>), bringing together 123 projects with the total fund of 700 million euro.

However, up to now there are no electronic data systems that can address comprehensively the problem of medical and social services for elderly population. It is necessary to search for new ways and technologies that could reduce the costs during with rise of the services quality standard.

In the Republic of Kazakhstan in the earlier study related to this topic, there was developed the web-portal "Active Longevity" (<http://100let.kz/>), which provides information, data collection and preliminary analysis of screening information about the elderly population of Kazakhstan [14, 15].

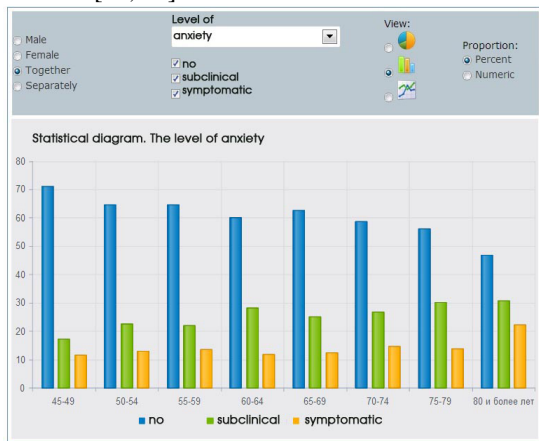


FIGURE 3 Anxiety level by age group

The portal allowed to collect, process and visualize significant amount of information about 4000 elderly residents of the Republic of Kazakhstan (Figure 3, 4), assess the risks of major diseases, screening research boundaries and self-diagnostics [14, 15]. There were obtained important data for design of gerontological electronic system. It was displayed that efficiency of solving medical problems such as prevention, diagnostics, rehabilitation and forecasting will depend on integration of not only clinical, but also personal and social characteristics of patients in the information system and the lack of information can lead to errors in management of the health care service.



FIGURE 4 Visualization of screening data on the web-portal "Active Longevity"

ICT development trends offer the possibility for solving the problem of efficiency of RK gerontology services. The key aspect is the use of new generation of ICT for screening of the medical and social situation, needs assessment and provision of timely assistance especially with a view of the large territory and low population density of RK.

ICT are moving to a new level, improving the resources of data-processing systems, or Clouds, a communication medium or network (Pipe) and Devices (Figure 5).

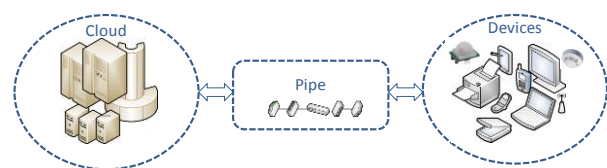


FIGURE 5 Major ICT domains

Combining wireless sensor network, inter-machine communication systems (Machine-to-Machine (M2M)) [16, 17], the broadband network access based on the new communication protocols [18] and other technologies [19-23] are the development basis of the effective medical information systems. These technologies provide a high level of reliability and small delays in remote monitoring and data transfer of different volumes [24, 15].

The functioning of the new communication and screening systems on the basis of new communication protocols involves generation of large amount of data [25], or Big Data, with special processing requirements [26, 27].

In the health monitoring systems the focus is shifted to the development of intelligent algorithms for identification

of consistency patterns with the use of machine learning methods [28]. At the same time there are resolved such problems as identification of abnormal conditions, diagnostics, forecasting, recommendations and visualization of big data for human decision-making [23, 30].

The general scheme of machine learning methods application is shown in the Figure 6 [29].

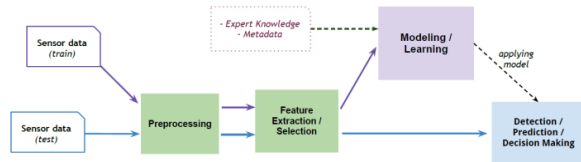


FIGURE 6 Generic architecture of the main data mining approach for sensor data

The functional of the electronic system predicts existence of Training and Qualification section that will improve the quality of service operations and of the related to its units [31, 32].

The mentioned above information gives ground to state that ICT development trends have clearly expressed technological and scientific background to support the gerontological service and to organize its work on a new level.

3 Offered solution

Based on a new ICT development trends a multi-level distributed personified electronic system is offered. The system will provide support, monitoring, detection and prediction, and support for comprehensive geriatric services for the population. Multi-layer architecture of the system is illustrated in the Figure 7.

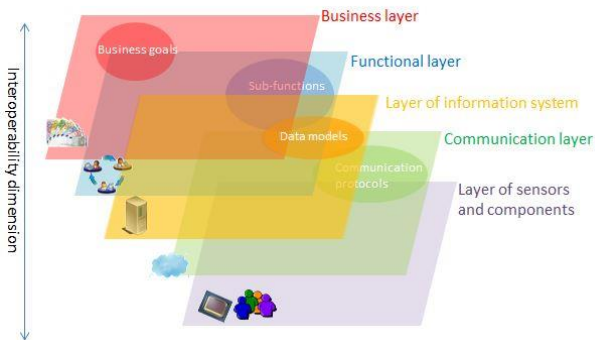


FIGURE 7 Main system layers

To reach the goal it is necessary to solve a number of technological and systemic issues related to selection of necessary technologies, algorithms and software in the core domains of the system.

The main efforts should be focused on research in the field of communications (Network Domain), information systems (IS Domain), user interaction with the system (User Domain). The sensory level (M2M domain) need to be partially affected. This choice is due to the fact that, firstly, in other areas could be used the achieved significant results, partly brought to the technology level, and secondly, exactly in the development field of the appropriate IS applications of machine learning methods, and the processing of large

amounts of data today are the most relevant [28].

4 Economic benefits

Solution of this task will bring a social effect expressed in improvement of the quality of medical services and slowdown in growth of their costs, and totally, in improvement of the quality of life for older persons.

Economic benefits will consist of three aspects.

Firstly, the project will contribute to emerging of a new market of services, with the estimated volume of 3-5 mlrd. Euro (similarly to European markets of services for elderly people (300 milliards) and with consideration of a lower level of life and less (approximately by 30 times) population of the Republic of Kazakhstan)

Secondly, the system will aid to extend the healthy period of life that will bring both economic and social benefits. For instance, in conditions of Kazakhstan increase of the number of working people for 85 thousand people can lead to growth of gross domestic product for 1% or for 102 milliards of USD.

Thirdly, the system will contribute to increase of the state healthcare spending for older persons (till 70% of all healthcare spendings).

5 Conclusion

New communications and computational technologies offer good opportunities into the solving one of the greatest World problem - the problem of accelerated aging of the population. This problem concerns not only developed countries but developing countries. In RK the special portal was developed as the first step on the way. The next step is design and develop complex of geriatric services based on modern concepts and technologies. The complexity and diversity of the processes require appropriate research, development and approval of the system model that requires to : 1) Analyze data acquisition systems, human-machine interfaces and machine-to-machine interaction, intelligent methods applied in the health care system; 2) Develop a system model for elderly patients' services with help of modern ICT's and in view of the health care system development; 3) Develop models, methods and algorithms of data consistency patterns retrieval system for intelligent system of gerontology services' maintenance.

Realization such project will bring a social effect for every senior person as well as economic benefits in the scale of country.

The developed system model should be focused on working with the components of a new e-government generation, including medical e-cards, social services and insurance system. The task realization will contribute to the emergence in the Republic of Kazakhstan of a new services market, its estimated amount is 3-5 billion euro, and to the increase the labor force participation of elderly people, which will lead to the increase in the number of working people and growth of gross domestic product.

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Authors






Ravil Muhamedyev, Kazakhstan, Almaty

Current position, grades: Head of Department CSSE&T, professor, International IT University, Almaty, Kazakhstan

University studies: International IT University, Almaty, Kazakhstan

Scientific interest: stochastic simulation, machine learning, simulation of anisochronous systems

Publications: 160 papers, 5 books

	<p>Elena Muhamedyeva, Latvia, Riga</p> <p>Current position, grades: Senior lector of Department CSSE&T, master of computer science, International IT University, Almaty, Kazakhstan. University studies: International IT University, Almaty, Kazakhstan Scientific interest: machine learning, data mining Publications: 30 papers.</p>
	<p>Almagul Mansharipova, Kazakhstan, Almaty</p> <p>Current position, grades: Head of Department science KRMU, professor, member of Association aksam, Almaty, Kazakhstan University studies: Kazakh Russian medical university Scientific interest: Research in the field of medicine, cell biology, bioinformatics. Publications: 150 papers, 3 patents.</p>
	<p>Vera Chaykovska, Ukraine, Kiev</p> <p>Current position, grades: Kazakhstan a professor of Gerontology and Geriatrics Department, Almaty, Kazakhstan University studies: Kazakh National Medical University Scientific interest: Organization of gerontological research and geriatric population assistance Publications: 200 papers, 4 monographs (as a co-author), 2 teaching guides</p>