

# Transformation of the Social and Medical Spheres under the Conditions of COVID-19

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## ABSTRACT

Health care remains a sector of paramount importance that needs urgent innovation and further transformation in the face of current challenges. Information technologies and capabilities of artificial intelligence should be widely used to form integrated innovative models of the health care system. Governments, providing state support for transformational changes, play a leading role in unlocking the potential of these technologies. There is no doubt that the COVID-19 pandemic will make adjustments to the management model and financing of the health care sphere. The academic paper has analyzed the current state of readiness of health care systems of the studied countries to withstand the challenges and crises in the medical sphere on the basis of the Global Health Index (GHSIndex). Despite the fact that countries that are classified as high-income countries have higher GHSIndex values than poor countries, no causative-consecutive interconnection was found between public spending on health care and its effectiveness. The influence of the application of modern managerial approaches and possibilities of information technologies and artificial intelligence on the transformation of health care systems, reorienting them to the integrated human-centered and value model has been investigated. A conceptual model and principles of transformation of the medical sphere have been compiled in accordance with current challenges, based on the implementation of new approaches in health care management, namely: value, human-centric and holistic, for further research into the mechanisms of transformation of the medical sphere through new interdisciplinary links, methodological developments, and theoretical foundations.

**Keywords:** Medical Sphere; Health Care System; Human-Centered Approach; Integrated System; eHealth, Value Creation.

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## INTRODUCTION

There are always three interrelated issues on the agenda of the health care system of any country. This primarily concerns ensuring its effectiveness within conditions of constant pressure on costs and at the same time improving the health of the population in an environment that is undergoing huge changes and the impact of critical situations.

The global coronavirus pandemic has been a severe test for health care systems around the world. In the process of overcoming the severe consequences of the COVID-19 crisis, weaknesses and gaps in the medical sphere have been revealed, namely: lack of important stocks of medical devices and equipment, insufficient investment in public health care infrastructure and lack of coordination and mobility in policy-making by government and health care officials, leading to overburdening of health care systems, rapid spread of infection and high mortality.

However, there were countries whose health care systems responded more effectively. In Asia, South Korea, Singapore, Hong Kong and Taiwan much more effective response was observed at the initial phase of the pandemic, managing to contain the epidemic and reduce mortality among the population. The pandemic containment strategy in Australia, Germany, Iceland and New Zealand can also be considered as successful, where some progress has also been made in curbing the spread of infection.

Examples of countries showing excellent results set new standards for best clinical practice, along with innovation

and improvement of the health care system as a whole. New social trends include increasing patients' attention to their own health through greater access to information about it, and the introduction of new technologies, such as monitoring devices, advanced analytics and artificial intelligence, designed to ensure the rapid development of the e-Health system.

An effective solution of the existing problems in the medical sphere cannot be ensured through the implementation of separate initiatives, as it requires a comprehensive transformation of the health care system. Most national health care systems represent a system of different organizations and institutions, which often do not provide any system of interaction and are outdated. Nowadays, leaders of health care sphere and national governments need to holistically rethink models of national health care systems for their further fundamental transformation.

The COVID-19 pandemic acts as a catalyst for transformation, accelerating the implementation of changes in the medical sphere. Consequently, it is necessary to develop a new model of medical services with a greater emphasis on prevention, remote service activities and significant technological dependence. This is primarily needed to address current technical challenges, such as overcrowding of laboratory centers, ensuring the rapid introduction of new technologies, mental and ethical issues related to lack of necessary resources and protection of private and personal information during crises.

In addition to the fight against COVID-19, the transformation of the medical sector must ensure proper governance in the field of public health care. Crisis periods often act as catalysts for innovation in the health care sphere. Just as previous epidemic campaigns have stimulated improvements in the health care system infrastructure and hygiene standards, that is, innovations in traumatology have become a product of military surgery medicine, fight against COVID-19 can also accelerate the emergence of a new model of organization and management of the health care system worldwide.

## LITERATURE REVIEW

Health care is an extremely expensive, complex and important area that has a significant impact on the economy around the world, not to mention the quality of people's daily lives [1]. Changes in health care sphere affect everyone, because they are the basis of human well-being and the society [3]. The vision of health care is refocused on a more human-centric and integrated system that guarantees the provision of continuous health care throughout life [2]. However, the implementation of this vision requires an understanding of the challenges and profound changes in the health care system.

The COVID-19 pandemic has been a real test for numerous aspects of the medical sector, especially in terms of their overall preparedness. The system of public administration and the existing medical infrastructure were not ready for the sudden burden [4-6] caused by the pandemic. Although countries were provided with developed emergency plan documents, health care systems were unable to cope with the sudden onset of the disease [7-8]. The policy component of the health care system that has caused potential delays in making important decisions, such as the introduction of "lockdown" and other restrictive measures that may significantly affect the outcomes of health care [9-10], needs to be reviewed.

It is important to carry out rethinking and refocusing the process of transformation of the medical sphere on the path of widespread introduction of information technologies. New technologies provide the medical sector with a new horizon of opportunities, however, their potential has remained unimplemented [11] prior the pandemic in the world. Despite the growing number of studies conducted in the field of eHealth, there is still uncertainty in the interpretation of this term and consistency in the taxonomy of e-health technologies [8]. In various studies, the term eHealth has been used to describe a wide range of digital technologies used by different interested parties in different contexts [13-17]. The use of elements of remote medicine or telehealth has already taken place in emergencies, crises and planned medicine [18-19]. During the COVID-19 pandemic, they began to be used much more widely. Telehealth capabilities are used for large-scale screening of patients prior to their hospital visit and assessment, for day-to-day care of patients treated at home, for remote counseling services, or for quality control of services provided [20-22].

Such evolution of the medical system is likely to continue through the further introduction of new technologies, such as: the use of unmanned aerial vehicles as vehicles for critical emergencies, development of robotics, large-scale 3D printing of health care items and smartphones to monitor patients' compliance with treatment methods [23-24], or m-health [25].

Along with this, approaches to management in the medical sector are also changing. There are studies that suggest

using Service Design as an approach that can contribute to the transformation of health care sphere by providing a human-centric, systematic and interactive approach to the creation of new health services [26]. The concept of service design involves the use of creative and transformational approaches to the formation of a new vision of future change, considering the medical sector as a holistic management system; consequently, this makes it possible to apply an integrated approach to the modernization and transformation of complex systems such as the health care system in order to achieve social change [27].

In 2016, within the framework of the World Economic Forum, the "Value in Healthcare" project was introduced to explore innovative ways in order to solve the problem of creating value in the medical sector [28] by applying a management approach based on creating values for the consumer.

The above mentioned concepts (service design and value creation) need to be considered in more detail as the most promising methods to ensure the transformation of health care services under the conditions of the global pandemic COVID-19 by forming a new vision of the health care system and using new approaches to managing new challenges. The purpose of this study is to form a conceptual vision of the vectors of transformation of the medical sphere under the conditions of a pandemic crisis COVID-19.

## METHODOLOGY

The present conceptual study begins with an analysis of the current state and identified major health challenges in terms of demographic trends and economic constraints, along with problems of lack of focus on people, fragmentation of services, slow implementation of information technologies and challenges caused by crises. Further, the theoretical aspects of the latest concepts of management in the sphere of health care are investigated in the context of this study. The integrated conceptual model of transformation of medical branch for the further research of reliability of the hypothesis has been formed on the basis of methods of comparison, generalization and other general scientific methods.

## PRESENTATION OF THE BASIC MATERIAL

The social, political, economic and medical consequences of the 2019 coronavirus pandemic (COVID-19) are impressive, as its scale is measured by the number of lives, psychosocial impact and the slowdown in economic development worldwide. The indicated consequences are transformed into a valid basis for using this negative experience not only to prevent similar crises in the future, but also to rethink approaches to the full range of problems of the national health care system.

Only over the last two decades the world has suffered from mass infectious diseases (pandemics). Today we have the third outbreak of coronavirus (CoV), which is of international concern, after the severe acute respiratory syndrome of 2002-2004 (SARS-CoV) (in total 8461 cases of infection were detected, of which 916 ended in death, that is, mortality was 10,83%) and Middle Eastern Respiratory Syndrome (MERS-CoV) in 2015 (as of June 1, 2015, 1154 confirmed cases were registered, of which about 431 were fatal [26]). Other outbreaks of viral epidemics also should be mentioned, such as the Zika virus in 2015-2016 (covering more than 1,5 million people, mostly in South and Central America) and the Ebola virus, which has spread to West Africa, the United States and

Europe in 2014-2015 (the number of cases of infection was more than 9 thousand people, 4450 people died; the mortality rate was 50%).

The beginning of 2020 was sadly marked by the rapid and most widespread coverage of almost the entire world community by the COVID-19 coronavirus pandemic (SARS-CoV-2). As of the beginning of November 2020, about 48,7 million infected patients were registered in the world, about 1,2 million people died. The world average mortality rate is around 3,5% [30].

It is becoming clear that infectious diseases should be considered among the most important health threats that humanity will face in the future. Consequently, the transformation of various aspects of health care sphere both at the level of the person and at the level of the society and the state as a whole is inevitable.

The discrepancy of capacity and recklessness towards biological threats among some leaders of the countries has made national health systems unprepared to respond to today's challenges. One of the most universal indicators of

the readiness of the country's medical system is the Global Health Index (Global Health Security Index/GHS Index). The indicators and issues that make up the structure of the GHS Index provide an opportunity to analyze the capabilities of the health care sector in the context of the national health system and identify possible national risk factors to increase both political will and funding to eliminate them on national and international level [31].

In order to analyze the current state of the health care system according to the GHS Index of Ukraine, the countries of European continent have been selected, which fall in terms of population in the range from 10 to 50 million people for comparability (Table 1).

As it can be seen from Table 1, Ukraine occupies the last place in terms of the level of preparedness of the health care system with a GHS Index value of 38 as of 2019, while the average index among European countries is 43; in addition, it should be noted that Ukraine has the lowest income among the studied countries.

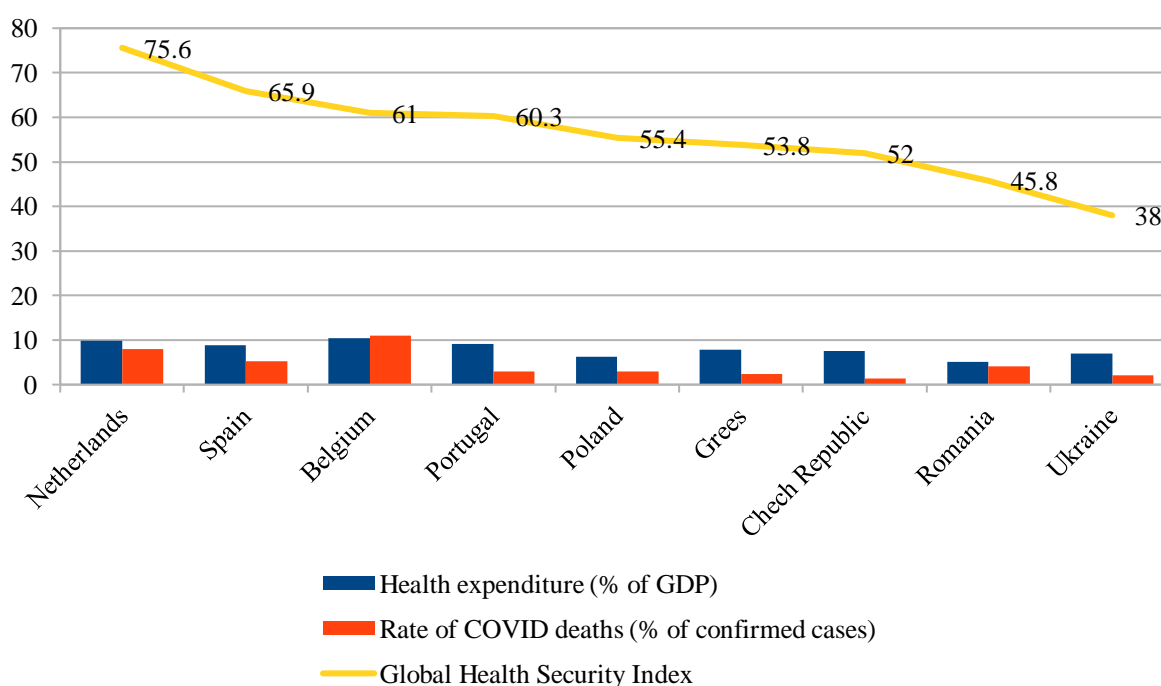
**Table 1:** Assessment of the state of the health care system according to the components of the GHS-index of the studied countries, 2019

| Rank                    | Country            | Index Score | Prevent | Detect | Respond | Health | Norms | Risk |
|-------------------------|--------------------|-------------|---------|--------|---------|--------|-------|------|
| Average (195 countries) |                    | 42          | 34,8    | 41,9   | 38,4    | 26,4   | 48,5  | 55,0 |
| 3                       | The Netherlands    | 75,6        | 73,7    | 86,0   | 79,1    | 70,2   | 61,1  | 81,7 |
| 15                      | Spain              | 65,9        | 52,9    | 83,0   | 61,9    | 59,6   | 61,1  | 77,1 |
| 19                      | Belgium            | 61,0        | 63,5    | 62,5   | 47,3    | 60,5   | 59,7  | 78,2 |
| 20                      | Portugal           | 60,3        | 52,8    | 50,5   | 67,7    | 55,0   | 63,0  | 77,3 |
| 32                      | Poland             | 55,4        | 50,9    | 61,7   | 47,5    | 48,9   | 58,9  | 67,9 |
| 37                      | Greece             | 53,8        | 54,2    | 78,4   | 44,0    | 37,6   | 49,1  | 58,2 |
| 42                      | The Czech Republic | 52,0        | 51,1    | 50,7   | 46,6    | 37,4   | 58,9  | 74,0 |
| 60                      | Romania            | 45,8        | 48,9    | 42,8   | 35,3    | 36,7   | 52,4  | 65,7 |
| 94                      | Ukraine            | 38,0        | 38,1    | 36,6   | 34,8    | 23,0   | 55,1  | 43,3 |

*Compiled by the author on the basis of [31]*

The average overall score of the GHS index among all 195 countries, being assessed, is 42 out of a possible 100 scores. Among the 60 high-income countries, the average GHS score is 51,9. In addition, 116 high-income and middle-income countries have not reached score above 50 [31].

Having conducted the analyzes of the dependence of the health care system's efficiency of the studied countries on the level of health care costs and the overall GHS index under the conditions of the COVID-19 pandemic, we have found significant differences in the performance of health care systems, without a clear causal link between invested money and mortality rate (Figure 1).



**Figure 1:** Comparative analysis of mortality rates, public health expenditures and the GHS index in 2019.

Compiled by the author on the basis of [29, 31, 32]

National health care systems that spend the greatest amounts of money may not necessarily deliver better results in the fight against the pandemic. Studies note that a significant proportion of health care expenditures are spent on treating avoidable complications, inadequate treatment, or managerial negligence and ineffectiveness [10].

In addition, it should be noted that mortality (Table 2) from coronavirus infection is influenced by a number of subjective factors, such as age, population density, public perception of real danger and the level of communication with the population.

**Table 2:** Infection and mortality rates from COVID-19 of the studied countries as of September 11, 2020

| Country            | Population | Density | Number of infected per 1000 people | Number of deaths per 1000 people | Mortality (in% from the number of infected) | Number of tests per 1000 people |
|--------------------|------------|---------|------------------------------------|----------------------------------|---|---------------------------------|
| The Netherlands    | 17,1       | 508,54  | 4,58                               | 0,36                             | 7,96  | 106,94                          |
| Spain              | 46,8       | 93,11   | 12,11                              | 0,64                             | 5,25  | 157,12                          |
| Belgium            | 11,6       | 375,56  | 7,81                               | 0,86                             | 10,96                                       | 218,42                          |
| Portugal           | 10,2       | 112,37  | 6,09                               | 0,18                             | 2,98  | 216,78                          |
| Poland             | 37,8       | 124,03  | 1,91                               | 0,06                             | 2,98  | 74,26                           |
| Greece             | 10,4       | 83,48   | 1,19                               | 0,03                             | 2,39  | 104,99                          |
| The Czech Republic | 10,7       | 137,18  | 3,03                               | 0,04                             | 1,38  | 94,72                           |
| Romania            | 19,2       | 85,13   | 5,18                               | 0,21                             | 4,08  | 106,14                          |
| Ukraine            | 43,7       | 77,39   | 3,4                                | 0,07                             | 2,07  | 41,31                           |

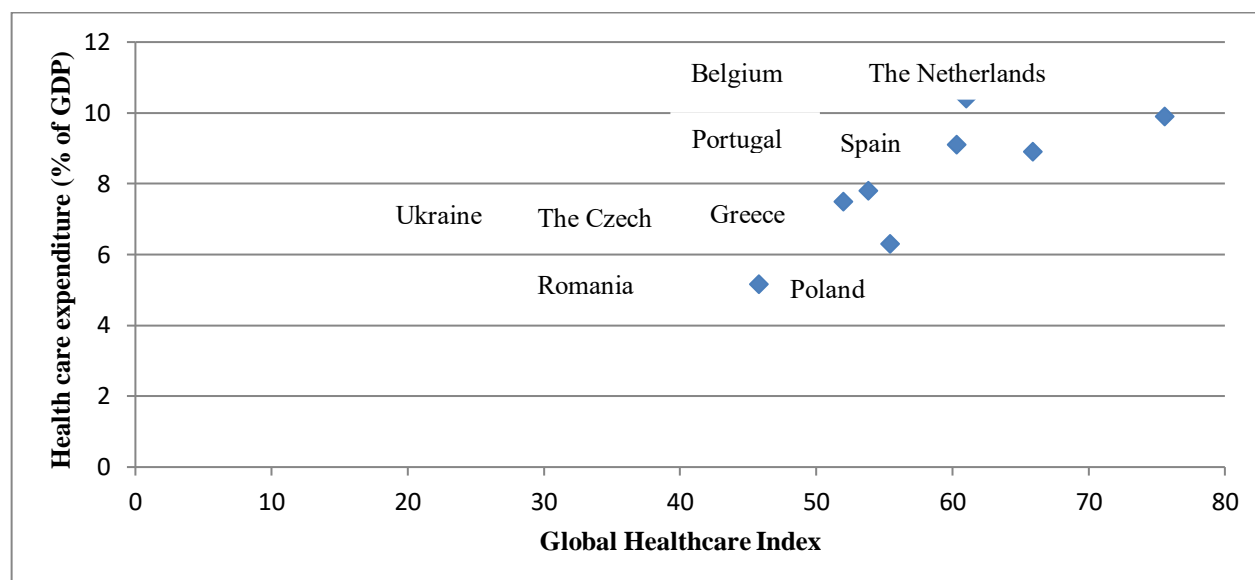
Source: [29]

There is a consensus among the interested parties of the global health care sector concerning the issue that the sphere is facing the problem of overspending. Despite ten years of trying to control expenditures, they continue to grow at about twice the rate of GDP growth in most of the developed countries According to the data of the World

Bank, the overall annual growth rate of health care expenditures in OECD countries from 2009 to 2015 was 2,9%. The equivalent of GDP growth rate per capita was 1,2% [34]. That is, there is a question of effective management and distribution of funds in the health care system.

To a large extent, the effects of the second wave of the pandemic will depend on the effective operation of the national health care systems that have been mobilized

during the first wave. Figure 2 reflects the readiness of the health care systems of the studied countries as of 2019.



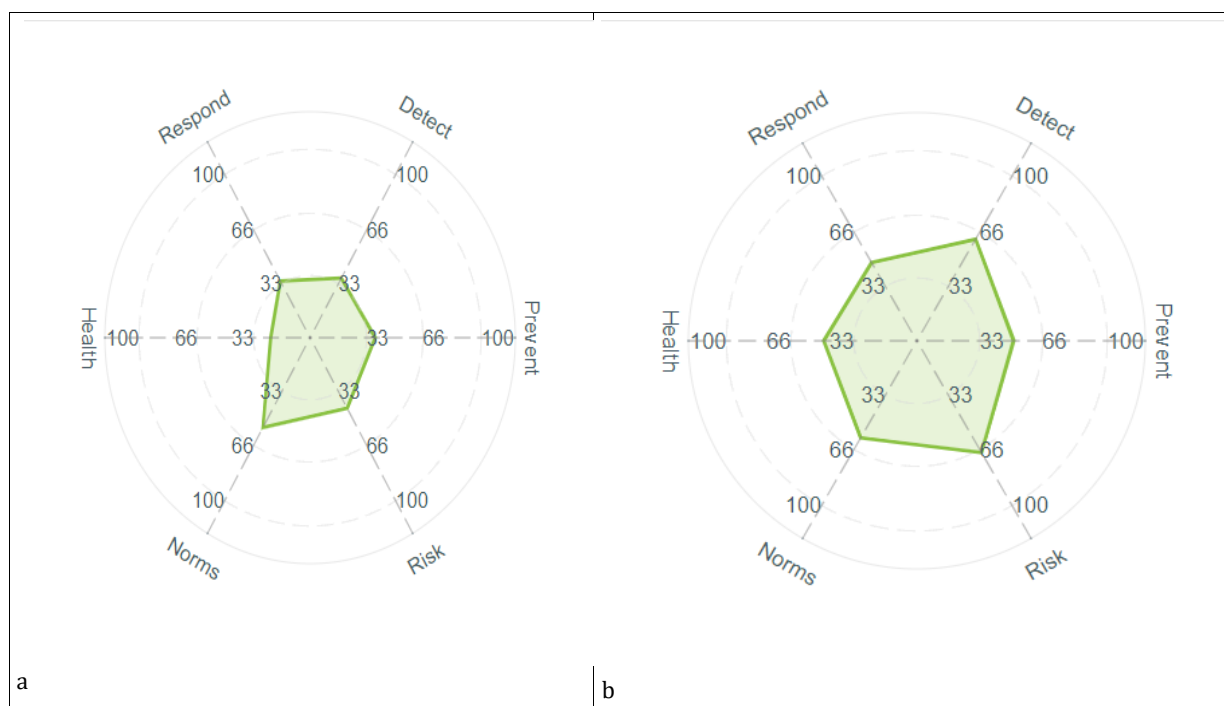
**Figure 2:** Readiness of the health care systems of the studied countries for the crisis as of 2019

Compiled by the author on the basis of [31, 32].

For comparison, we can single out several countries close to Ukraine in terms of population, namely Spain and Poland (Figures 3 and 4).

According to [17], less than 7% of countries have higher levels, which are responsible for the ability to prevent the

emergence and release (Prevent) of pathogenic microorganisms. According to this indicator, each of the three compared countries has higher indicator than average ones.



**Figure 3:** Comparative analysis of the components of the GHS Index of Ukraine (a) and Poland (b)

It has been compiled by the author on the basis of [31].

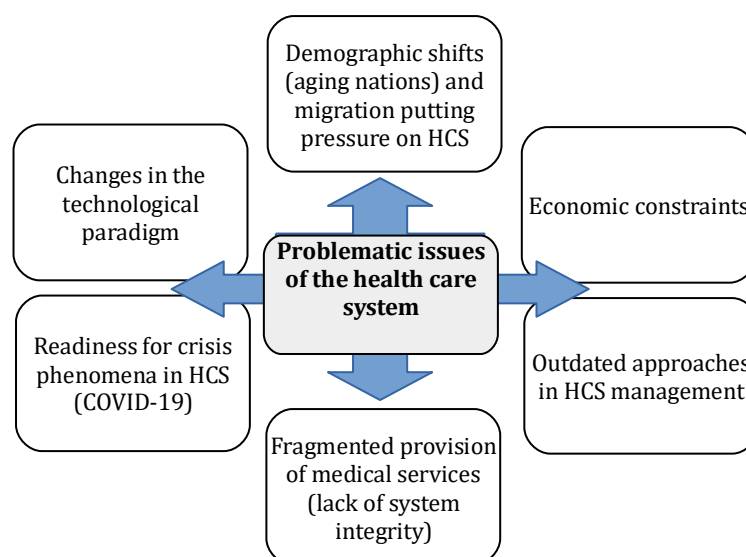


**Figure 4:** Comparative analysis of the components of the GHS Index of Ukraine (a) and Spain (b)

*It has been compiled by the author on the basis of [26].*

Only 19% of countries receive the highest scores for detection and reporting (Detect). According to this indicator, Ukraine lags behind the average value as it has an unsatisfactory value due to the integration of data between the sectors of human health / animal protection / environmental protection. Less than 5% of countries received the highest score for their ability to respond quickly and contain the epidemic (Respond). In this sector, problems were identified in all three representatives of the sample due to zero indicators towards ensuring emergency response planning. In Ukraine, in addition to the problem outlined, the following indicators are also of zero importance, namely: emergency preparedness and response planning; implementation of response plans; cooperation of health care and safety authorities. The average score according to the Health care system indicators in the world is 26,4 out of 100, making it the lowest category. From our sample, Spain and Poland have

above-average scores, while Ukraine has close to average scores. The basic identified problems of Ukraine in this area are as follows: the ineffectiveness of medical countermeasures and staff mobilization; poor communication level with health care workers during a health emergency, lack of practical skills in combating infectious diseases and lack of equipment. Over the past three years, less than half of countries have implemented confidence-building measures under the Biological Weapons Convention, demonstrating their ability to comply with important international norms and obligations related to biological threats (Norms). Only 23% of countries are rated at the highest level in terms of their political system and government efficiency (Risk). On the basis of the conducted research of the components of the GHS Index it is possible to single out the general problematic issues of the medical sphere that need to be improved in the process of transformation (Figure 5).



**Figure 5:** Directions for improving the functioning of the national health care system.

*Compiled by the author. Note: HCS - health care system.*



Demographic changes around the world are putting pressure on health care systems. One of the most significant problems is the increase of the elderly population, which leads to changing health needs, an increase in the prevalence of chronic diseases, mental health problems and obesity [35] and, as the pandemic has shown, such people are more likely to need expensive treatment due to significant complications from the virus. The inadequacy of rising costs in the health care sphere, which are not always related to the quality of services provided and their effectiveness, has led to the fact that health care systems include a "value approach" in the agenda focused on maximizing the economic efficiency of medical services [36]. According to this approach, value is defined as the effectiveness of medical services achieved for certain groups of the population (for instance, in the fight against coronavirus infection) at certain expenditures. The main purpose of a value-based health care system is to continuously improve the efficiency-cost ratio by providing targeted medical services in a specific segment [28]. However, such a reorientation of the health care system requires a profound transformation in the consciousness of numerous health care providers in order to facilitate political and organizational change. Based on the analysis of the health readiness index in most countries, the problem of communication or coordination of activities between different departments of the medical sphere has been identified not only within the system, but also with other safety centers related to human life and health. This problem is particularly acute during the global pandemic crisis; it requires the transformation of the entire system in the direction of an integrated model of the health care system.

WHO widely promotes a reorientation of approaches in the management of the medical sphere towards integrated person-centered health care systems [3]; such approach involves giving people the opportunity to independently

control their health, and not be passive recipients of care. Within the conditions of the COVID-19 pandemic crisis, humans' responsibility for their own health and the health of others has become a determining factor in curbing the spread of the pandemic in the world. People need to be well informed in order to understand the consequences and manage their own health. Integrated health care systems must ensure the continuity of health promotion, diagnostic, treatment, rehabilitation and palliative care services at various levels and in all care sites throughout life [3]. This requires a rethinking of modern problem-solving practices after their onset and treatment of the disease, rather than the patient.

Information technologies and capabilities of eHealth, electronic data processing and telehealth create the main platform for the transformation of the health care system in the direction of an integrated model. ITs offer great opportunities for the formation of an integrated human-centric model of health care system, which requires the use of intelligent information systems with user-friendly interfaces.

Health care mobile applications, portable devices, social services, online support communities, offer affordable and effective services that enhance or even replace existing interactions with formal and informal health care providers. At the same time, the introduction of innovative technologies promotes better communication and cooperation between ecosystem's interested parties, such as: patients, health care professionals, insurance companies, hospitals, pharmacies, pharmaceutical companies, authorities, etc. The exchange of data in real time both within the health care system and with other third-party organizations, responsible for human life and safety and the implementation of semi-automated decision-making systems, will simplify access to services and reduce their cost (Table 3).

**Table 3:** Advantages of introduction of information technologies and artificial intelligence in the process of transformation of the medical system

| Naming  | Advantages  | State's support  |
|---|---|--|
| Telehealth  | <ul style="list-style-type: none"> <li>• Availability of medical services for the patient</li> <li>• Technical support for the implementation of the patient's monitoring</li> <li>• Release of medical staff</li> <li>• Reducing the load on the infrastructure</li> </ul>   | Development of official laws and regulations in the sphere of telehealth   |
| Point-of-care (POC) diagnostic<br>Mobile diagnostic | <ul style="list-style-type: none"> <li>• Increasing geographical access to diagnostics</li> <li>• Expenditures reduction</li> <li>• Reduction of deadlines</li> </ul>   | Simplification of the process of certification of mobile diagnostic tools  |
| Electronic Health Records (EHR) and Data Analytics  | <ul style="list-style-type: none"> <li>• Unification and homogenization of data</li> <li>• Implementation of a blockchain system and ensuring patients' access to their own data</li> <li>• Early detection of diseases</li> <li>• Improving the management system in the medical sphere through data analysis</li> </ul> | Introduction of state control and accountability of private medical institutions and use of databases in the public sector |
| Electronic platforms for training and               | <ul style="list-style-type: none"> <li>• Raising awareness</li> <li>• Democratization of health care system</li> <li>• Unloading of medical workers</li> <li>• Formation of sources of reliable information</li> </ul>  | Providing reliable information to the population   |

|                                      |  |  |
|--------------------------------------|--|--|
| informing patients                   | <ul style="list-style-type: none"> <li>Cooperation with pharmaceutical companies</li> </ul>                                |  |
| mHealth<br>Mobile monitoring devices | <ul style="list-style-type: none"> <li>Real-time monitoring of the patient's condition</li> <li>Self-monitoring</li> </ul> | Support for the implementation of innovations at the state level |

*Compiled by the author*

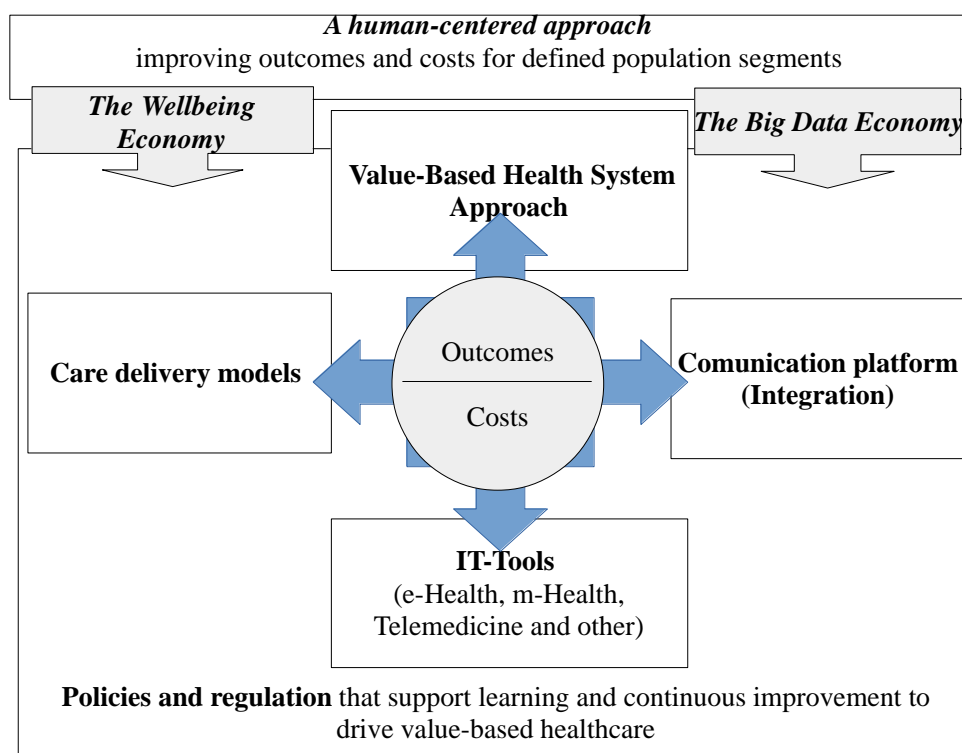
The pandemic crisis has negatively affected almost all sectors of the world economy, but some of them have received a significant impetus for development over the past 5-6 months, based on the features of human and business demand at this time. The United Nations in its Future Possibilities Report 2020 [37] identifies six megatrends transforming the world after the end of the COVID-19 pandemic. They are as follows: The Big Data Economy; Hyper-connected Society; The Wellbeing Economy; Low-Carbon Economy; The Circular Economy; The BioGrowth Economy; The Experience Economy. The first two megatrends are the most interesting for the health care sector, although according to the research [37] they will all have a positive impact on the development of the health care system.

In order to further rethink and improve approaches to the transformation of the national health care system, it is necessary to develop a conceptual model of an integrated health care system that will meet the challenges of nowadays.

The challenges, faced by national health care systems, force them to seek new solutions and approaches, drawing on the experiences of those countries that have shown the best results in preparedness to pandemic. Although we are still at a relatively early stage of the crisis, it is still possible to formulate the basic principles of effective medical transformation on the example of the most well-developed health care systems that can be applied by any national

- Comprehensiveness - large-scale testing, tracking of contacts and sources of infection, adaptive quarantine.
- Innovation - increasing the traceability and transparency of health care systems through the introduction of information technologies and artificial intelligence.
- Segmentation - targeted prevention and differentiated treatment based on key disease groups and risk categories.
- Multidisciplinary - a comprehensive approach to the treatment of the patient, not a single disease, at each stage of its progression.
- Integration - implementation of integrated health care systems that combine medical and social care.
- Systemicity - the integrity and comprehensiveness of health policy.
- Economic feasibility - improving the ratio of efficiency of medical services and costs incurred.

Based on the conducted study of analytical data, identified gaps in national health care systems and key megatrends in the world economy, we have formed an integrated conceptual model of transformation of the medical field (Figure 6).



health care system as part of its pandemic strategy:

**Figure 6:** Integrated conceptual model of transformation of the medical sphere  
*It has been compiled by the author*



## DISCUSSIONS AND CONCLUSIONS

The COVID-19 outbreak serves as a reminder that this is not the last virus attack on the humanity; consequently, planning of health emergencies, as well as strengthening global health care system preparedness by transforming national systems in accordance with the challenges of our time, is an indisputable fact. In order to effectively transform the health care system, existing gaps in health care systems and their ability to respond to epidemics of infectious diseases in the 21st century must be taken into account.

An analysis of the preparedness of the health care systems of the studied countries on the basis of the GHS index demonstrates the fact that no country is ready for epidemics and pandemics. Overall, international preparedness is weak. Many countries are unable to ensure adequate safety and the ability of their health care systems to function effectively in order to prevent, detect and respond appropriately to large outbreaks of infectious diseases.

Based on the conducted analysis of the GHS index components, it is possible to trace the existing interconnection between indicators and the level of state income; forasmuch as high-income countries have higher indicators in all respects, while lower-income countries (such as Ukraine and Romania) show lower levels. However, this does not give grounds to conclude that the increase in government's expenditures on health care sector leads to a more effective response. No causative-consecutive interconnections were found in this study.

In general, the GHS Index identifies serious challenges in countries' ability to prevent, detect, and respond to medical crises. In addition to problems within the health care system, such factors as sensitivity to political, social-economic and environmental risks, which may reduce the preparedness for and response to a pandemic outbreak, have a significant impact.

Although the signs of the crisis, which are consequences of the COVID-19 pandemic, have hit all spheres of life of a person and the state, countries, as a whole; they have also become a prerequisite for the implementation of opportunities in the short term towards creating modernized, integrated, patient-centered health care systems that aim to make better use of resources in order to meet the needs of patients.

As soon as the pandemic is under control, it will be critical for any health care system not to lose the institutional "muscle memory", which is being created now in the fight against COVID-19. The temptation to return to traditional models of governance will be strong, but one should remember that there is no return to those traditional models of health care provision that are no longer economically viable. Without fundamental changes in approaches to governance in the health care system, governments will face even greater pressure towards limit medical expenditures. The facts show that the most sustainable and effective changes occur during periods of recession. The issue on the formation of practical measures and organizational mechanisms for the transformation of the medical sphere needs further investigation in order to conduct the transformation of the medical sphere, taking into account the latest concepts and challenges of nowadays.

## REFERENCES

1. Akter S, D'Ambra J, Ray P. An evaluation of PLS based complex models: the roles of power analysis,

- predictive relevance and GOF index. Proceedings AMCIS: 2011.
2. Berry LL, Bendapudi N. Health Care: A Fertile Field for Service Research. *Journal of Service Research*. 2007; 10: 111-22.
3. Black AD, Car J, Pagliari C, Anandan C, Cresswell K, Bokun T, et al. The impact of eHealth on the quality and safety of health care: a systematic overview. *PLoS Med*. 2011 Jan;8(1):e1000387. doi: [10.1371/journal.pmed.1000387](https://doi.org/10.1371/journal.pmed.1000387). [cited October 15, 2020]. Available from: <http://dx.plos.org/10.1371/journal.pmed.1000387>.
4. Blomkvist J, Holmlid S, Segelström, F. "Service Design Research: Yesterday, Today and Tomorrow," in *This is Service Design Thinking*, Stickdorn, M. and Schneider, J., eds. Amsterdam: BIS Publishers; 2010.
5. Carter DP, May PJ. Making sense of the U.S. COVID-19 pandemic response: A policy regime perspective. *Administ Theory Praxis*. 2020. 45:265– 77. doi: [10.1080/10841806.2020.1758991](https://doi.org/10.1080/10841806.2020.1758991)
6. Cunningham S, Wake D, Waller A, Morris A. Definitions of eHealth. In: Gaddi A, Capello F, Manca M, editors. *eHealth, Care and Quality of Life*. Milan, Italy: Springer; 2014.
7. Danaher TS, Gallan AS. Service Research in Health Care: Positively Impacting Lives. *Journal of Service Research*. 2016; 19(4): 433-7.
8. Deloitte. 2019 Global Health Care Outlook. 2019.
9. Eysenbach G. What is e-health? *J Med Internet Res*. 2001 Jun;3(2): e20. doi: [10.2196/jmir.3.2.e20](https://doi.org/10.2196/jmir.3.2.e20).
10. Gaddi A, Capello F. The debate over eHealth. In: Gaddi A, Capello F, Manca M, editors. *eHealth, Care and Quality of Life*. Milan, Italy: Springer; 2014.
11. Global Health Security Index. 2019. [cited November 11, 2020]. Available from: <https://www.ghsindex.org/wp-content/uploads/2020/04/2019-Global-Health-Security-Index.pdf>
12. Gorini A, Gaggioli A, Vigna C, Riva G. A second life for eHealth: prospects for the use of 3-D virtual worlds in clinical psychology. *J Med Internet Res*. 2008;10(3): e21. doi: [10.2196/jmir.1029](https://doi.org/10.2196/jmir.1029). [cited October 20, 2020]. Available from: <http://www.jmir.org/2008/3/e21/>
13. Greenhalgh T, Wherton J, Shaw S, Morrison C. Video consultations for covid-19. *BMJ*. (2020) 368:m998. doi: [10.1136/bmj.m998](https://doi.org/10.1136/bmj.m998).
14. Hafiz H, Oei S-Y, Ring DM, Shnitser N. Regulating in Pandemic: Evaluating Economic and Financial Policy Responses to the Coronavirus Crisis. Boston College Law School Legal Studies Research Paper. 2020 [cited October 9, 2020]. Available from: <https://ssrn.com/abstract=3555980>.
15. Health expenditure as a percentage of gross domestic product in selected countries in 2018 [cited November 11, 2020]. Available from: <https://www.statista.com/>
16. Hick JL, Hanfling D, Wynia MK, Pavia AT. Duty to Plan: Health Care, Crisis Standards of Care, and Novel Coronavirus SARS-CoV-2. NAM Perspectives. Discussion paper. Washington, DC: National Academy of Medicine. 2020.
17. Hollander JE, Carr BG. Virtually perfect? Telemedicine for Covid-19. *N Engl J Med*. 2020. 382:1679–81. doi: [10.1056/NEJMp2003539](https://doi.org/10.1056/NEJMp2003539) <http://wdc.org.ua/uk/covid19-transformation-after-pandemic->

18. Kandel N, Chungong S, Omaar A, Xing J. Health security capacities in the context of COVID-19 outbreak: an analysis of international health regulations annual report data from 182 countries. *Lancet*. 2020. 395:1047– 53. doi: 10.1016/S0140-6736(20)30553-5
19. Kellermann AL, Jones SS. What It Will Take to Achieve the As-YetUnfulfilled Promises of Health Information Technology. *Health Affairs*. 2013; 32(1): 63-8.
20. Kolie D, Delamou A, van de Pas R, Dioubaté N, Bouedouno P, Beavogui AH, et al. Never let a crisis go to waste: postEbola agenda-setting for health system strengthening in Guinea. *BMJ Global Health*. 2019. 4: e001925. doi: 10.1136/bmjgh-2019-001925
21. Langabeer JR, Gonzalez M, Alqusairi D, Champagne-Langabeer T, Jackson A, Mikhail J, et al. Telehealth-enabled emergency medical services program reduces ambulance transport to urban emergency departments. *West J Emerg Med*. 2016. 17:713–20. doi: 10.5811/westjem.2016.8.30660
22. Lurie N, Carr BG. The role of telehealth in the medical response to disasters. *JAMA Intern Med*. 2018. 178:745–6. doi: 10.1001/jamainternmed.2018.1314
23. Nkengasong J. China's response to a novel coronavirus stands in stark contrast to the 2002 SARS outbreak response. *Nat Med*. 2020. 26:310– 1. doi: 10.1038/s41591-020-0771-1.
24. OECD. Health at a Glance 2015: OECD Publishing, 2015.
25. Pagliari C, Sloan D, Gregor P, Sullivan F, Detmer D, Kahan JP, et al. What is eHealth (4): a scoping exercise to map the field. *J Med Internet Res*. 2005;7(1):e9. doi: 10.2196/jmir.7.1.e9.
26. Paterlini M. On the front lines of coronavirus: the Italian response to Covid19. *BMJ*. 2020. 368:m1065. doi: 10.1136/bmj.m1065.
27. Porter ME, Lee TH. The Strategy That Will Fix Health Care. *Harvard Business Review*. 2013; 91(10): 50-70.
28. Sangiorgi D, Patrício L, Fisk RP. Designing for Interdependence, Participation and Emergence in Complex Service Systems. *Designing for Service: Key Issues and New Directions*, Sangiorgi, D. and Predville, A., eds. London: Bloomsbury Academic; 2017.
29. Smith M. Best Care at Lower Cost: The Path to Continuously Learning Health Care in America. National Academies Press. 2013. [cited November 11, 2020]. Available from: <http://www.hep.fsu.edu/~wahl/artic/NAP/HealthCare13444.pdf>.
30. Story A, Aldridge WA, Smith CM, Garber E, Hall J, Ferenando G, et al. Smartphone-enabled video-observed versus directly observed treatment for tuberculosis: a multicentre, analystblinded, randomised, controlled superiority trial. *Lancet*. 2019. 393:1216–24. doi: 10.1016/S0140-6736(18)32993-3
31. Ullah H, Nair NG, Moore A, Nugent C, Muschamp P, Cuevas M. 5G communication: an overview of vehicle-to-everything, drones, and healthcare use-cases. *IEEE Access*. 2019. 7:37251– 68. doi: 10.1109/ACCESS.2019.2905347
32. United Nations Organization. Future Possibilities Report. 2020.
33. Value in Healthcare: Laying the Foundation for Health System Transformation. World Economic Forum, April 2017. [cited October 20, 2020]. Available from: [http://www3.weforum.org/docs/WEF\\_Insight\\_Report\\_Value\\_Healthcare\\_Laying\\_Foundation.pdf](http://www3.weforum.org/docs/WEF_Insight_Report_Value_Healthcare_Laying_Foundation.pdf)
34. World Data Center for Geoinformatics and Sustainable Development. Foresight Covid-19: Transformation of the Covid-19 Post-Pandemic World, European Context. [updated 2020 September 13; cited October 10, 2020]. Available from:
35. World Health Organization. Coronavirus Disease (COVID-19) Dashboard. [updated 2020 November 11; cited November 11, 2020]. Available from: <https://covid19.who.int/>
36. World Health Organization. Framework on integrated, people-centred health services. 2016.
37. Zhai Y, Wang Y, Zhang M, Gittell JH, Jiang S, Chen B, et al. From isolation to coordination: how can telemedicine help combat the COVID-19 outbreak? *medRxiv* [Preprint]. 2020. doi: 10.1101/2020.02.20.20025957