2020

Coronavirus Epidemic: National Healthcare Systems Response

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With the spread of COVID-19, national healthcare systems around the world are experiencing an immense pressure. Most countries are facing the same challenges: lack of medical staff, overloaded hospitals, and insufficient equipment and facilities for diagnosis and treatment, as well as forced suspension of the provision of scheduled services, etc.

International organizations, such as the United Nations (UN), the World Health Organization (WHO), the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD), and the European Centre for Disease Prevention and Control (ECDC) pay great attention to the analysis of problems related to the impact of COVID-19 on healthcare systems, develop practical recommendations for their solution, and provide support measures.

The Digest has been prepared using reports and materials from the abovementioned international organizations and specialised analytical publications, data from foreign and Russian news agencies, as well as articles published in The New England Journal of Medicine, one of the most authoritative periodicals .

1. Global challenges

1.1 Shortage of medical resources

The sharp increase in the number of COVID-19 patients has revealed that the healthcare systems of many countries were unprepared for an emergency and provision of timely treatment.

According to the World Health Organization, approximately 40 percent of patients have mild coronavirus cases and do not require hospitalisation, 40 percent of patients have moderate symptoms that may require hospitalisation, 15 percent of patients have severe cases that require oxygen therapy and other medical measures in the hospital, 5percent of patients develop extremely severe pathologies requiring artificial lung ventilation

(ALV).

The high proportion of severe and extremely severe forms of the disease in some countries (for example, in the UK, Italy, the USA and South Korea) led to rapid depletion of human resources as well as of stocks of beds, biomedical materials and equipment, including personal protective equipment, test systems and ventilators.

> *Right after the COVID-19 outbreak, the United States recognised the lack of medical personnel and personal protective equipment. This forced the management of medical institutions to reuse single use masks.*
>
> *Italian doctors proposed to provide life-saving resources, such as intensive care beds and ventilators, only to those patients whose treatment prognosis was the most favorable.*
>
> *South Korea faced a shortage of hospital beds with some patients dying at home while waiting for hospitalisation.*
>
> *In the UK the requirements for medical workers were reduced due to the lack of personal protective equipment for them. This caused disapproval among healthcare providers.*

Another important aspect is the high risk of contamination of health workers in primary healthcare centers and hospitals. Up to 10 percent of the reported cases in China and up to 9 percent of all cases in Italy are attributed to medical professionals. In some EU countries, this number reaches 26 percent.

In their turn, outbreaks in hospitals are an important factor in local transmission, affecting the elderly people and other at-risk population groups.

1.2 Search for effective treatment and vaccine

At least 35 laboratories and research institutes from all around the world are attempting to develop a vaccine against the coronavirus. But most world experts and the WHO agree that it will take up to a year and a half to develop an effective vaccine.

> *The first company to start clinical trials in the USA was Moderna. In Europe, the main players are German pharmaceutical companies BioNTech and CureVac. In China, a vaccine prototype called Ad5-nCoV was developed by the Academy of Military Medical Sciences in partnership with CanSino Biologics, a Hong Kong-based company. In the UK, a group of scientists from the University of Oxford developed a vaccine prototype called ChAdOx1. On March 18, 2020 the WHO announced the start of clinical trials.*
>
> *In Russia, the Center for virological research Vector in Novosibirsk began preclinical tests of an experimental vaccine. Three more vaccine prototypes were created by the Federal Medical-Biological Agency (FMBA). FMBA plans to receive the first test results in June 2020, and the second phase is planned to be completed by the beginning of the third quarter of 2020.*

An effective treatment for the coronavirus has not yet been found. There are clinical trials of various drugs used to treat other diseases, in particular, such as lopinavir-ritonavir (commonly used to treat HIV), dexamethasone (a steroid used to reduce inflammation), chloroquine and its derivative, hydroxychloroquine (used to treat malaria), tocilizumab (an immunosuppressive drug).

2. Government responses at a national level

2.1 Government measures in healthcare

Measures taken by governments in healthcare in the context of an increased load on the healthcare system include: control of virus spread (social distancing, lockdown), mobilization of medical staff, ensuring the availability of diagnostic and treatment means, provision of sufficient space for medical care. Provision of psychological assistance to the population is also of particular importance.

Up to now, there are not enough data to assess the effectiveness of the lockdown measures (both at home and in medical institutions) and exposure tracking. Available data is based on the results of modeling, which is carried out to determine whether these measures will help reduce and delay the peak load on the healthcare system. Simulation of the COVID-19 spread shows that 70 percent of exposures must be identified for successful containment.

The effectiveness of lockdown depends on two main factors: 1) how much the infected people and their family members actually reduced their social contacts; 2) when a COVID-19 patient starts to be a source of infection for others.

Isolation and lockdown measures become the most effective when the virus spread begins at the same time with the symptoms onset. For example, in case of severe acute respiratory syndrome (*SARS*), a disease caused by another coronavirus. In case of influenza, patients already become a source of infection as soon as their incubation period starts.

> *Thanks to mass screening of the new coronavirus incidence, Singapore showed great opportunities to track contacts of the infected patients. In particular, from the very beginning of COVID-19 outbreak, the country introduced a contact tracking system for a period of 14 days before the infection was detected. The patients were hospitalized for a two week*

quarantine.

Governments are searching for ways to strengthen their healthcare systems by increasing the number of medical personnel and making the most effective use of their potential.

Countries with extensive healthcare funding (such as Switzerland or Germany) have the largest number of doctors and nurses per capita. The ability to involve some medical staff to fight COVID-19 from neighboring areas gives these countries a great potential to fight the current situation. Other countries, where funding remains low, generally have fewer doctors and nurses per capita (for example, Mexico, Turkey, Poland). Therefore, their ability to involve additional staff in the context of a crisis is extremely limited.

Some countries such as Brazil, the United Kingdom, Italy, the United States, and France have chosen to involve retired medical professionals. This approach is risky as the involved elderly medical professionals are the most subject to the risk of coronavirus infection.

The Republic of Belarus, Italy, China, and the United States attract military medical professionals to help provide treatment and transport patients. For example, Spain, Russia, the United States, and Ukraine sometimes mobilize final-year medical students to provide medical services or consult by phone hotline.

> *On March 9, 2020, the Italian government announced the possibility of mobilizing retired doctors and nurses for up to 6 months as well as final-year medical students. The main aim was to engage 20 thousand additional medical workers.*

> *In France, Italy, Spain, and some Canadian provinces, healthcare professionals receive priority access to childcare centres. This allows them to continue their work even in cases when schools are closed and they have no one to leave their*

children with.

Fig. 1 Number of doctors per
 1,000 people (2016)

Source: World Bank   CC BY
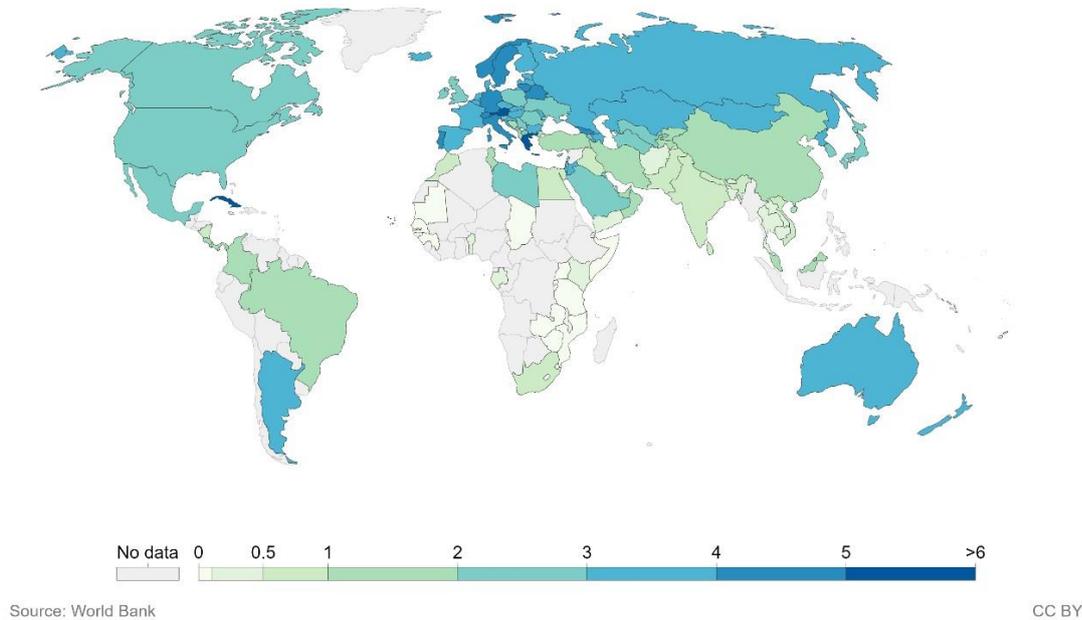
Timely vaccination will reduce the risk of overloading medical workers and hospitals.

> *The Ebola Experience in the Democratic Republic of the Congo (DRC) indicates the need to support the existing vaccination programmes against such diseases as measles, polio, or any other for which there is an inexpensive and affordable vaccine. This allows not to split insufficient medical resources in two areas in the event of an outbreak of other infectious diseases. Having successfully overcome Ebola, since the outbreak began, the DRC has lost almost twice as many people from such a well-known disease like measles.*

3. When a coronavirus infection spreads, it is necessary to have diagnostic and treatment tools available (both in terms of price and quantity) and use them in a safe environment.

New tools for rapid diagnostics are currently being developed by the research laboratories, state-owned enterprises, and private companies. After approval by the government regulatory authorities, the countries should be prepared for a sharp increase in the number of tests performed.

It is necessary to provide sufficient material and human resources in advance to perform tests, control deliveries, and build international procurement coordination so that diagnostic systems are available where they are most needed.

> *The total number of tests performed varies depending on the country. As of March 20, 2020, South Korea has performed more than 6.1 thousand tests per 1 million people, which is 45 times more than in the United States at that time. This is due to a combination of strategic, logistical, potential, regulatory, and even cultural peculiarities. At the very beginning of the outbreak, South Korea decided to thoroughly monitor the possible contamination cases. Initially, the US experienced difficulties with low-quality test systems, as well as with permissions from the regulatory authorities, which led to postponement of mass testing.*

It is necessary to track production, distribution and sale of personal protective equipment (PPE), including masks, face shields, hand sanitizers. Countries take various measures to fight illegal export of PPE so that medical personnel have access to the necessary means of protection.

**Primary care medical workers need
the following and other items to protect
themselves and others from #COVID19 every month**

- 2.3 million N95 respirators
- 89 million masks
- 30 million medical overalls
- 1.59 million pairs of glasses
- 76 million pairs of latex gloves
- 2.9 million litres of
  hand sanitizers

#COVID19
#coronavirus

World Health
Organization

*The European Commission has decided to temporarily release the import
of medical equipment from third countries from customs duties and taxes
in order to reduce the price of antiviral protection means.*

Governments must ensure the control of affordability of life-saving medicines. Restrictions on movement and trade may affect medicine availability in the medium term.

Especially since the production of active pharmaceutical components is mostly concentrated in several regions, such as China or India. The crisis provides an opportunity for states to reassess their dependence on particular countries from the point of view of medicines supply.

In addition, the pandemic requires more cooperation between medical institutions. If one hospital has a large number of unused ventilators, and another one has a critical shortage of them, prompt delivery of this equipment to the 'hot spot' should be arranged during the outbreak.

Limited treatment resources reveal the ethical issues in the work of medical institutions. This has long been discussed in the medical field and, to some extent, is of a philosophical nature. However, now it is as immediate as never before.

In 2015, the state of Maryland (USA) developed a scoring system based on several ethical principles, which was used to determine the priority of patients who needed ventilators under the conditions of medical equipment shortage. When making a decision, doctors should be guided by the potential effectiveness of care (survival chances), based on the life expectancy forecast and the stage of the patient's life cycle. It is emphasized that the use of such systems is hypothetical, they can be used and scaled up across the country only in the event of a catastrophic shortage of life-support medical resources.

4. The examples of China and Italy demonstrate the urgent need to ensure a sufficient number of hospital beds, especially in intensive care, to address the sharp increase in the number of patients with severe symptoms. The number of acute care beds (ACU) is an indication of the general capacity of hospitals to provide emergency care.

Japan and Korea have the largest number of acute care beds — more than 7 per 1 thousand people and Germany—6 per 1 thousand people. For most OECD countries, this value varies from 2.5 to 5. Moreover, in such countries as Mexico, Canada, Chile, Sweden, Israel, Spain and the United States, this figure is less.

Under the current circumstances, countries are making efforts to: 1) optimize the use of current facilities, 2) reduce the use of intensive care units and hospitals without extreme necessity, so that more COVID-19 patients could be admitted.

If necessary, the countries will have to re-equip hotels, schools, barracks or other facilities into intensive care units. Within the given context, a forecast of short-term demand for medical services for one to two weeks ahead is also of primary importance. Forecasts will allow medical institutions to better prepare for the flow of COVID-19 patients, provide the necessary space, purchase equipment and supplies, thus avoiding the [bottleneck effect.](#)

Fig. 2 Total number of beds
per 1,000 people (2018)

No data 0   1   3   5   7   9   11   >15
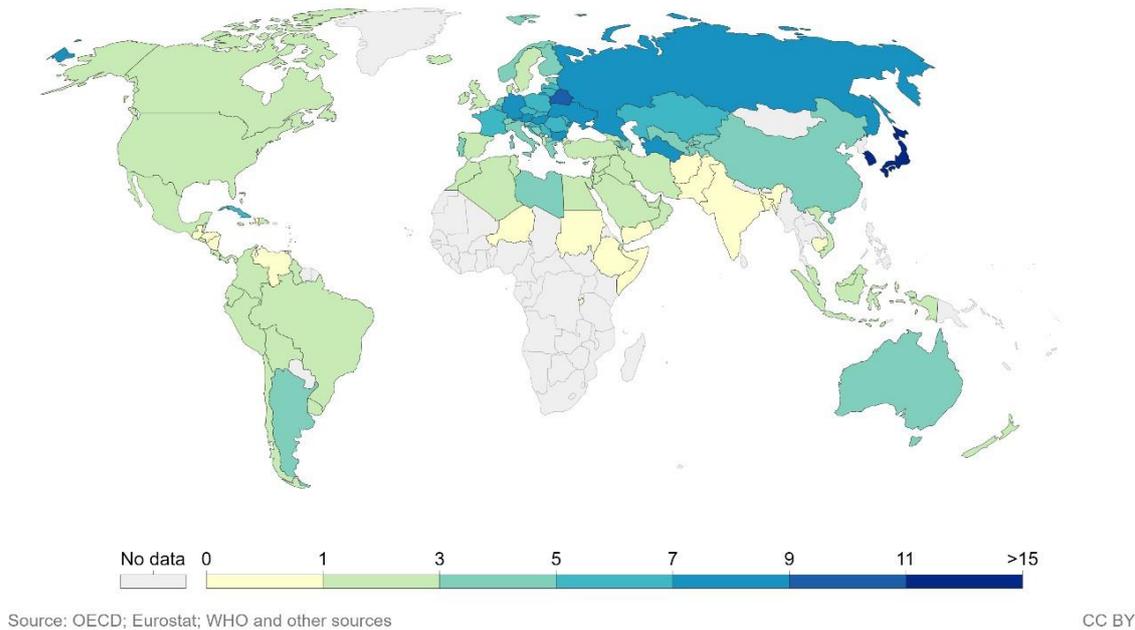
In the Eastern part of France, where intensive care facilities are sufficiently overloaded, they decided to deploy a military camp for provision of additional beds for patients. The authorities also use the armed forces to transport patients to other regions in order to distribute the load on the healthcare system.

5. The spread of COVID-19 has a strong impact on the psychological state of the population.

OECD countries currently have about 15 percent of the population with mild or moderate mental disorders, and additional 5 percent with serious mental illnesses.

For people experiencing stress, depression or loneliness, there are special online resources containing some practical recommendations: to limit the flow of news and information, to maintain social relations by phone or in the Internet, to do some physical activity at home, and to avoid tobacco and alcohol use.

Society can support employees of key industries involved in the fight against COVID-19, as well as those who are most at risk and stressed. For example, you can applaud medical professionals at a certain evening time, write words of support in social networks, and help the elderly with their daily needs: e.g. buying food and medicines. Measures are being taken to allow pharmacists to renew the expiring prescriptions (such as in Ireland), including for people with mental diseases. Countries are also trying to facilitate for patients the access to telemedicine consultations.

2.2 Role of the Supreme Audit Institutions in the fight against COVID-19

Supreme Audit Institutions (SAI) contribute to improving the effectiveness of public support measures for the healthcare sectorduring the COVID-19 pandemic. For example:

•   The British SAI conducted an audit of the healthcare system which showed how unprepared it was for the peak of the epidemic expected to hit the country in June 2020. This audit also identified severe shortages of medical personnel.

•   the US SAI conducted the analysis of COVID-19 spread; published the assessment of Medicare and Medicaid programmes in terms of access to healthcare; established a working group to ensure response, information exchange and control over the communication systems and strategic planning of COVID-19 issues;

•   The Austrian SAI conducted an audit of the health sector and revealed certain shortcomings: little attention to such problems as insufficient number of hospital beds and medicines;

•   In Venezuela, SAI instructed the regional control and accounting authorities to review prices for the essential goods and medical products and assess if they are overstated.

- Peru SAI has launched a large-scale inspection as part of the overall strategy for control of the government measures in case of emergency. The aim of the inspection is to strengthen the capacity of medical services, reduce the negative socio-economic consequences of the emergency, and facilitate the implementation of measures aimed at control over the virus spread;

- a special audit team was created in the SAI of Kuwait to review the government spending on the implementation of the coronavirus control measures;

- Brazil SAIs will conduct a review of the agencies involved in the fight against the COVID-19 pandemic within the framework of a special plan;

- The SAIs of Honduras and Colombia will assess the procurements in healthcare.

In general, in terms of the government responses and their support for the healthcare sector in the context of the COVID-19 pandemic, it is forcasted that the health crisis will become a kind of test of government [effectiveness as a whole](#). Quality of public services, availability of medicines and equipment, capacities of transport infrastructure, training of qualified personnel, and food security and support for business and citizens—all these issues should be subject to effective state regulation in order to ensure a successful fight against epidemics and their economic consequences.

2.3 Examples of government and business cooperation

As the pandemic spreads and the number of cases increases, businesses and individuals are becoming actively involved in solving the problems the health systems of different countries face. The efforts of businesses and the private sector are focused on solving the following main problems:

1) shortage of personal protective equipment and medical equipment;

> *Apple has designed a protective face shield, which is planned to be provided to doctors working with COVID-19 patients. The company plans to produce 1 million units of such personal protective equipment weekly. In addition, Apple will donate 1 million masks to medical workers in the US and Europe.*

> *Stanfield's Ltd has signed two contracts worth more than CAD $28 million (US $20 million) with the Canadian government and the authorities of the province of Nova Scotia for production of more than 3 million protective medical overalls.*

> *The Alexander Onassis Foundation donated 13.5 million masks to Greece amounting to a total of 7.75 million euros.*

> *Chinese company Huawei donated 1 million face masks to Canada.*

> *Bayern football players Joshua Kimmich and Leon Gorecka set up the 'We Kick Corona' Foundation. About 3 million euro have been collected. The Fund amounts will be allocated to purchase of medical equipment, helping patients and homeless people, organization of donation points, etc.*

2) Shortage of ventilators: many industrial companies (General Motors, General Electric, UK Steel, Renault, Peugeot, Drägerwerk, Tesla, Philips) are now converting their production;

For instance, in the UK a number of companies, including those that have not traditionally been engaged in the production of medical equipment (Airbus, Jaguar, Land Rover and Rolls-Royce), announced their intent to produce ventilators to satisfy the increased demand.

Dyson, a manufacturer of household electrical appliances, develops 'a brand new' ventilator called CoVent.

University College London (UCL) and Mercedes Formula One engineers have developed an adapted device with constant positive airway pressure that delivers oxygen to lungs without invasive ventilators.

In the United States, under the Defense Production Act, the Department of Health and Human Services has concluded a contract with Philips to supply 43,000 ventilators for a total of $646.7 million.

General Motors will produce 30 thousand ventilators for the needs of the US Department of Health and Human Services.

Taiwan Foxconn (Hon Hai Precision Industry) is one of the largest manufacturers and contractors engaged in the assembly of electronics for Apple, Sony, Microsoft, and Dell will launch the production of ventilators.

3) financing of test systems, search of a vaccine and treatment methods.

The Greek Stavros Niarchos Foundation will donate $100 million to fund medical research around the world Amazon, the largest online retailer, has started building a laboratory for production of tests for coronavirus in order to protect its employees from infection. Employees are supposed to be tested regularly, including those not showing any symptoms of the disease.

The Indian pharmaceutical company Alvogen sent 50 thousand packages of chloroquine to Iceland as humanitarian aid.

2.4 Use of digital technologies

Modern digital technologies open up new opportunities for countries to detect, prevent, respond and recover after the pandemic.

1. Detection. Countries with an established system of national electronic health records have accurate medical data that can be used for real-time monitoring. Only 8 out of 36 OECD[1] countries as well as Singapore are ready, from the technical and operational point of view, to extract information from these systems within a short period of time.

Some countries use national statistics to monitor the spread of COVID-19. Insurance company data is usually used alongside with the information from customs and immigration services. When visiting a hospital, a doctor can put a patient to the risk group based on data of the history of his travelling abroad and clinical symptoms.

Data not related to the healthcare system can be used: from social networks to search engines. The Canadian company BlueDot that uses machine learning to research the world's media, was one of the first to identify COVID-19 cases. Such conclusions can be especially useful when compared with 'traditional' data provided by the healthcare system.

Smartphone data can be used for tracking and control (maintaining lockdown, tracking of contacts of infected patients). For example, in Israel, smartphones data is used to detect people that have had contacts with COVID-19 patients. They are sent instructions to maintain lockdown for a period of 14 days.

However, the use of data from smartphones raises the issue of the right to privacy and liberty. Tracking movements is an interference with

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[1] Finland, Estonia, Israel, Denmark, Austria, Canada, Slovakia and the United Kingdom.

privacy, so it is essential to ensure that such interference is only carried out when necessary and within certain time limits.

2. Prevention. Providing telemedicine services can have many potential benefits in the context of COVID-19 spread. Patients with mild symptoms can consult at home, avoiding potential contamination of other people and medical workers. Alongside with this, medical facilities will not be subjected to extra stress. Telemedicine has been used before at Ebola and Zika outbreaks. It is possible to use chat-bot to answer questions about symptoms and to provide up-to-date information.

3. Response. Telemedicine is used to monitor the health status of COVID-19 patients who stay at home. At least in 14 OECD countries, telemonitoring is already used to monitor patients with chronic illnesses. In South Korea and Israel, the use of wearables and communication technologies allows to remotely monitor the COVID-19 stay-at-home patients.

In China, Israel and the United States robots are used to reduce contacts with infected people. The use of robots can also help with food delivery and even sterilization of premises. In a number of African countries, drone aircrafts are often used to deliver vaccines, protective equipment and vital supplies to the remote areas.

4. Recovery. After the the pandemic finishes, countries will need to learn from the crisis caused by the spread of COVID-19. Healthcare systems must be able to provide data for national and world statistics in an almost real-time mode. In the future, this will allow rapid monitoring and response measures in case of emergencies.

In general, the COVID-19 pandemic has changed the way the information technology and data exchange should be organized in a modern healthcare system. It becomes clear that such data cannot be limited only to medical records, but should include much more extensive indicators of human activity in real life and on the Internet. Additionally, given the scale of people's travelling around the world,

more and more experts are coming to the conclusion that the analysis of the healthcare system data cannot be limited to one city or region, but should be carried out at the national or even international level.

However, the experience of countries that have successfully managed to constrain the spread of coronavirus shows the importance of sharing and analysis of not only medical data to successfully address public health challenges.

> *Taiwan authorities have managed to integrate data on foreign trips of their citizens into their medical records and made this information available for medical institutions which allowed medical workers to focus on those patients who were more likely to be infected. This also helped to understand the approximate number of potential infections and take early preparatory measures.*

In addition, the use of information technology helps remove the excessive load from the healthcare institutions, which is one of the main negative consequences of the pandemic when a large number of people need medical help at the same time.

Organization of real-time exchange and analysis of medical data at the national level provides no less extensive opportunities in order to determine the existing and potential outbreak hot zones as soon as possible. In this case it would be possible to introduce a lockdown on a limited area to avoid further spread, as well as the effective distribution of limited medical resources available in areas that may become epidemic outbreak hot zones.

3. Government responses within the framework of international organizations and comprehensive cooperation

The UN and its specialized organizations such as the WHO and UNESCO play a key role in coordinating international cooperation in terms of the fight against COVID-19.

The United Nations has established the COVID-19 Response and Recovery Fund. The Fund goal is to help thy developing countries with weak healthcare systems to overcome the crisis and long-term pandemic consequences.

The UN has also developed a global humanitarian response plan totaling $2 billion in order to fund the poorest countries to control the COVID-19 (delivery of tests and medicines, installation of hand-washing points, information campaigns). The programme will be implemented in Africa, Asia and Latin America..

3.1 WHO

In the first half of March, WHO and the Swiss Philanthropy Foundation established the Solidarity Response Fund. It has already raised more than $95 million from 200 individuals and organizations. The funds raised will be used as assistance to employees of medical institutions.

On April 2, 2020, based on the World Health Organization Regional Office for Europe, a new online platform called COVID-19 Healthcare System Response Monitor was launched. This tool was designed to provide decision makers in the health system with the necessary information to fight the pandemic.

The WHO issued a number of different technical guidelines for the response to COVID-19, including coordination, planning and monitoring at the national level; national laboratories; treatment of patients (in terms of hospital treatment and at home care); provision of operational support and logistics; reduction of the risk of animal-to-human transmission of the virus. The documents contain information about the measures taken in healthcare and clinical practice.

The organization developed tools to help hospitals cope with the flow of COVID-19 patients who require emergency and intensive care in hospitals: a tool for estimating the required number of medical personnel (helps calculate potential workloads, the number of personal protective equipment and other resources) and an emergency deployment planning tool (helps calculate the number of beds, the forecasted date of their shortage, and precise human resources requirements).

On February 24, 2020, the WHO released a control questionnaire to assess hospital preparedness for the COVID-19 outbreak. The document contains eleven sections that correspond to the main measures to be implemented by hospitals in an emergency situation, including the measures in crisis management, information provision, continuity of medical services and treatment of patients, reserve capabilities, human resources, logistics and inventory management, infection prevention and control.

Each section contains a list of questions that can be used to evaluate the implementation of the recommended actions.

The WHO has issued a Strategic Preparedness and Response Plan. The goal of the plan is to slow down and stop the spread of infection, prevent outbreaks and reduce the rate of spread of the disease, and ensure favorable care for all patients, as well as to minimize the

negative impact of the epidemic on healthcare systems, social services, and economic activities.

The document reflects the accumulated information about the virus and transforms this knowledge into strategic measures to guide the efforts of all countries and international partners in the process of developing national and regional operational plans taking into account certain conditions.

The WHO provides humanitarian aid to COVID-19 victims. Since the beginning of the outbreak, the WHO has sent more than 900 thousand surgical masks, 62 thousand N95 masks, 1 million gloves, 115 thousand medical overalls, 17 thousand glasses and 34 thousand face shields to 133 countries. Test systems have also been delivered to 126 countries around the world.

3.2 UNESCO

On March 30, 2020, UNESCO organized an online meeting of representatives of ministries of science from 122 countries. The purpose of the meeting was to discuss the role of international cooperation and increased investment in science within the context of COVID-19.

It was noted that the international community mobilized efforts in response to the emergency situation, in particular, through exchange and widespread distribution of research results and changes in working methods.

For example, major scientific journals published more than 1,000 research articles about the virus in the public domain. Within a few days, international research consortia were established. This allowed a rapid progress, including determining the RNA sequence of the virus in several weeks.

3.3 World Bank and IMF

The World Bank plans to implement a number of projects in healthcare related to overcoming the consequences of COVID-19 in 60 countries. Their total cost may reach $2.8 million. Funds will be allocated promptly. The total amount of funding for which this is applied amounts to $14 million.

The International Monetary Fund provides emergency financial assistance to the countries that have suffered from the coronavirus and, together with the World Bank, provides medical equipment, masks and respirators.

The total amount of emergency aid is up to $100 million. Total drawing potential is $1 million.

About 85 countries have requested the IMF to assist in support of their national [healthcare systems.](#)

International aid is vitally important for the world's poorest countries. Experience with various epidemics shows that there are often the necessary vaccines but they still remain inaccessible to many countries. Poor countries in Africa or other parts of the world may not be able to cope with both medical needs and economic consequences of COVID-19 epidemic. International assistance will have to ensure, among other things, global access to the vaccine as soon as it is ready.

At the same time, a long-term and global solution to the problem of infectious diseases requires maintaining sustainable financing of the healthcare sector in all countries of the world. Experience with certain diseases demonstrates that it usually goes through several stages - 'from panic to negligence'.

For example, since the 1930s to the end of the 20th century, malaria outbreaks occurred 75 times on the territory of 61 countries, which in most cases was the result of termination of funding of disease control programmes after the end of the acute phase of the crisis.

According to a group of German and American researchers, to create a global emergency response system in the healthcare sector, it is necessary to increase the funding of international medical programs by $9.5 billion annually. These costs are not comparable to the damage from the coronavirus which, according to the United Nations Conference on Trade, will amount to more than $1Tn in 2020, and, according to the forecasts of Asian Development Bank, the world economy will lose more than $4Tn .

4. Conclusions and recommendations

1. The crisis caused by the COVID-19 have demonstrated that the lack of possibility to attract additional resources (both material and human) can make healthcare systems vulnerable in the event of a sharp increase in demand for their services.

2. The key measures that healthcare systems are taking to address the crisis include control of the spread of COVID-19 by introducing lockdown, repurposing and mobilizing medical personnel, enlarging the premises of hospitals and other facilities of medical care, and using digital tools.

3. Countries affected by COVID-19 are getting financial, humanitarian and technical assistance from other states, businesses and international organizations. The role of Supreme Audit Institutions in provision of government support is very important.

4. The main recommendations for the response of national healthcare systems to COVID-19 outbreak, based on foreign experience, are as follows:

- improve the adaptability of healthcare systems;

- make epidemiological control mechanisms more effective by increasing the use of electronic medical records systems, as well as other statistical tools which will allow monitoring and taking prompt measures;

- strengthen coordination between the countries. The efforts of the international community should be coordinated both in terms of taking measures to control the virus spread and in search for an effective [treatment method and a vaccine](#);

- significantly increase the resources allocated for testing and treatment of COVID-19.