# SCRUTINY THE EFFECTIVENESS OF USING NEW TELEHEALTH METHODS FOR PRIMARY DIAGNOSTICS

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***Abstract.*** *Modern medicine is becoming more advanced thanks to the development of information technology, and revolutionary changes in the field of information technology and communication play an important role in this.*

*Modern telemedicine is a medical field that uses information and communication technologies to remotely provide medical care to patients. This may include real-time consultations with doctors, transmission of medical data and test results, remote monitoring of patients' conditions, tele-diagnosis, electronic medical records, and much more. One of the advantages of modern telemedicine is the possibility of remote provision of medical care to patients in remote or inaccessible areas, as well as providing more convenient access to medical care for patients who are unable to visit a doctor in person.*

*Modern technologies such as mobile applications, cloud computing, artificial intelligence, and machine learning are used to improve the quality of medical care and reduce the time spent on diagnosis and treatment. However, like any new technology, telemedicine has its limitations and raises questions related to data security and patient confidentiality.*

*The article discusses telemedicine methods and its key features of remote consultation, monitoring, and diagnosis. Innovative solutions are proposed based on the studied methods of remote methods.*

***Keywords:*** *Telemedicine, remote diagnostics, monitoring, observation, teleradiology, mobile applications, virtual consultation, medical records.*

## I. INTRODUCTION

Telemedicine is the use of information and communication technology to diagnose, treat, and monitor the health of patients remotely, without the need for physical presence of the doctor and patient in the same place. Telemedicine may include remote consultations, remote patient monitoring, as well as remote procedures and diagnostic tests [1,2].

Telemedicine allows patients to receive quality medical care without leaving their homes or workplaces, which is especially convenient for those who live in remote areas or have limited mobility. Telemedicine also reduces waiting times for doctor appointments and improves overall access to medical care.

However, it is important to understand that telemedicine cannot fully replace traditional medicine, especially in cases where a physical examination of the patient or complex medical procedures are required. Telemedicine may also encounter some technical and organizational problems, such as insufficient internet connection speed, difficulties in transmitting and storing medical data, and problems with information confidentiality [3].

Nonetheless, telemedicine is an important direction for the development of medicine that can improve accessibility and quality of medical care for a larger number of patients. Telemedicine

continues to actively develop, and we can expect further improvement and expansion of its capabilities in the future.

Some of the directions for the development of telemedicine include:

1. Development of technologies and equipment for remote diagnosis and treatment: Currently, telemedicine technologies are already used to transmit patient data and conduct real-time consultations, but the future of telemedicine includes more advanced technologies that will allow for more accurate and detailed diagnosis, such as the use of virtual and augmented reality or neural networks [4].

2. Widening the availability of telemedicine services: Currently, telemedicine services are not available to all patients, but in the future, they may become more widely accessible. This may include the use of telemedicine in state medical institutions, as well as the expansion of telemedicine services for patients with chronic diseases and disabilities.

3. Improving the integration of existing technologies and systems: One of the problems with modern telemedicine is the insufficient interaction of various systems and technologies, which can lead to problems with data transmission and patient management. In the future, we can expect more attention to be paid to integrating different systems and technologies to improve the quality of medical care.

4. Development of new standards and regulatory acts: The development of telemedicine also requires efforts in the field of standardization and regulation. In the future, we can expect the development of new regulatory acts and standards to improve the security and confidentiality of data, as well as to increase the quality of medical care [5].

The subject of telemedicine is the remote transmission of medical data (information) from one point to another, such as ultrasound, CT scans, ECG, echo-cardiography, laboratory data, X-rays, etc. The technological support of such methods of medicine cannot be equated with other fields. Telemedicine is not a separate field, but a part of or serves as a new direction in the field of healthcare [7]. Now more than ever, telecommunication technologies have the potential for great success in all areas of human activity, and their implementation in healthcare offers a chance to discover new solutions for disease diagnosis. Thus, we can create a system where all medical services are integrated into one system, for timely treatment and primary diagnosis. Telemedicine can be effective in remote areas of the country where there is a shortage of medical personnel, which contributes to the immediate consideration of such important tasks in the field of telemedicine. The use of telemedicine allows, for example, the provision of medical consultation services in areas where patients have no possibility to obtain the help of narrow specialists directly in the institution. But even in huge megacities and developed countries, telemedicine is of no less importance. Thanks to it, treatment costs are significantly reduced, the quality of diagnosis is improved, and the possibility of remote health monitoring is realized. This is especially important for patients with chronic diseases and elderly people.

## II.ANALYSIS OF TELEHEALTH METHODS SUCH AS REMOTE CONSULTATION, MONITORING, AND DIAGNOSIS.

The global telemedicine market can be segmented based on several criteria, including:

- The nature of remote interaction (clinic-to-clinic, clinic-to-patient's home)
- Technological parameters of interaction (monitoring systems, communication channels, measuring devices and sensors, video conferencing systems, databases, mobile and wearable technologies, etc.)

- Purpose of application (medical education, diagnosis, monitoring, consultations, treatment)

Different approaches to designing and developing software solutions and corresponding tools are used depending on these criteria. However, since these segments are closely interconnected, developers must possess skills and expertise in a wide range of development areas, including experience with embedded solutions, mobile and cloud technologies and protocols specific to the medical industry [8,9].

Telemedicine is a medical practice that uses information and communication technologies to provide medical assistance to patients at a distance. There are many telemedicine methods that are used to provide patient care:

1. Teleconsultations: doctors and patients can connect with each other through video communication to conduct a consultation or remote patient examination.
2. Remote monitoring: this method allows doctors to observe the health of the patient from a distance. This can be particularly useful for patients with chronic conditions such as diabetes, cardiovascular diseases, or asthma.
3. Electronic medical records: this method allows medical personnel to have access to electronic medical records of patients, which facilitates the exchange of information between doctors.
4. Medical applications: there are many medical applications that help patients monitor their health, such as applications for tracking physical activity, sleep, and nutrition.
5. Remote diagnostics: this method allows for diagnostics to be conducted remotely. For example, doctors can use special equipment for conducting remote ultrasound scans or remote X-rays.
6. Telemedicine telemonitoring: this method allows doctors to monitor patient health indicators, such as oxygen levels in the blood, pulse, blood pressure, etc.
7. Virtual reality and augmented reality: this method allows patients and doctors to use virtual reality or augmented reality for education, diagnosis, and patient treatment.
8. Telemedicine training programs: this method allows doctors and patients to receive training and consultations from a distance.

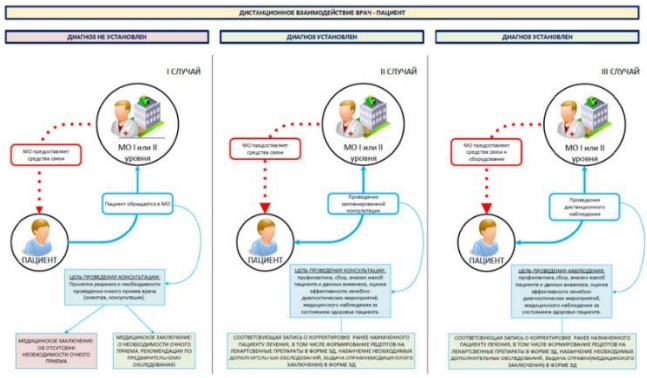



**Figure 1.** Remote interaction between "doctor-patient"

Next, we will take a detailed look at the above-mentioned telemedicine methods used to provide assistance to patients.

**Teleconsultation** (Distance consultation) - is a telemedicine method that allows doctors and patients to conduct consultations and communicate at a distance using video communication or other communication technologies (Fig. 2).

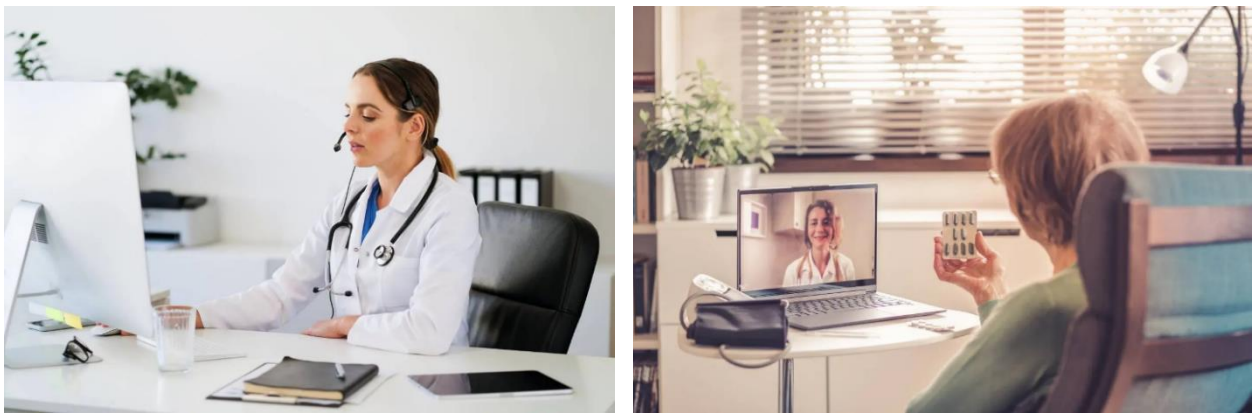


**Fig 2. Teleconsultation process between patient and medical staff**

This method allows patients to receive medical assistance and consultations without the need to visit a doctor in the office. It is also convenient for patients who live in remote areas where access to medical services may be limited. The process of teleconsultation usually begins with making an appointment. The patient can schedule a consultation through an internet portal or by phone. After the doctor confirms the time and date of the consultation, the patient is provided with instructions on how to connect to video communication or another communication platform. During the teleconsultation, the doctor can discuss the patient's health condition, ask questions, conduct an examination, and provide treatment recommendations. The doctor may also order additional tests if necessary.

Overall, teleconsultation is a convenient and effective method of telemedicine that helps patients receive medical assistance without the need to visit a doctor in person. It can also improve the accessibility of medical services, especially for those who live in remote areas or have limited mobility [6].

**Advantages of teleconsultation.**

Telemedicine is convenient not only for patients from remote regions. Doctors in online consultations can prescribe tests so that the patient can come for an examination with a complete package. The main advantages of teleconsultation are:

1. **Quick assistance;**
2. **Time and money savings;**
3. **A diverse range of doctors;**
4. **Reduction of the spread of diseases;**
5. **Possibility of tax deduction for treatment;**
6. **Continuous monitoring for chronic diseases.**

**Disadvantages of Telemedicine.** Telemedicine has many advantages in creating comfortable conditions for patients, but it also has some drawbacks that should be taken into account. Such disadvantages include:

1. Limitations in conducting a physical examination. Telemedicine can be useful for assessing symptoms and providing treatment consultations, but it cannot replace a full physical examination. A doctor will not be able to check blood pressure, examine the skin, and check for other physical problems that may require immediate treatment.

2. The need for a stable internet connection. To conduct a teleconsultation, access to a stable internet connection is required. An unstable connection can lead to problems with video or audio quality, which can make communication between the patient and the doctor difficult.

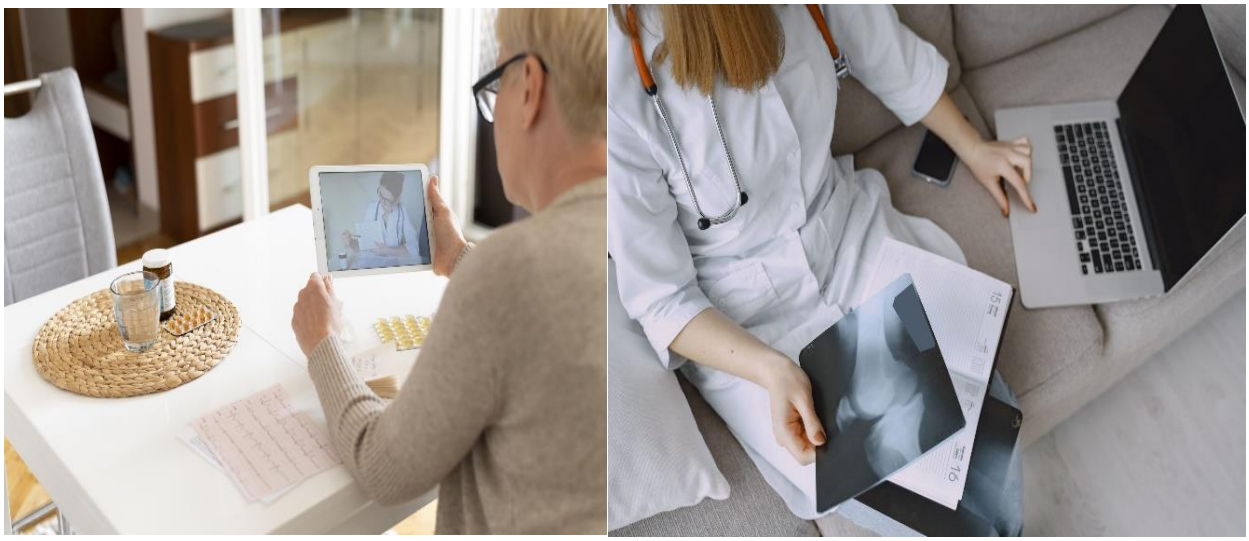
3. Inappropriate equipment. Suitable equipment is required for teleconsultation. If a patient does not have a camera or microphone, it can lead to difficulties in communicating with the doctor.

4. Unfamiliarity for some patients. Some patients may feel uncomfortable or unfamiliar communicating with a doctor through video communication. This can affect the quality of communication and consultation.

In general, teleconsultation is a useful telemedicine tool that can help patients receive medical care at a time and place that is convenient for them. However, before using this method, it is necessary to take into account its limitations and disadvantages.

**Remote monitoring** is a telemedicine method that allows medical personnel to monitor the health of a patient remotely. This method uses various technologies such as mobile devices, wearable sensors, smartphone apps, and cloud computing.

Remote monitoring can be especially useful for patients who have chronic illnesses or need long-term follow-up. It can also help healthcare professionals identify and respond more quickly to changes in a patient's health, which can reduce the risk of complications and improve patient outcomes (Figure 3).



**A)** **B)**

**Fig 3.** A) The process of remote patient monitoring (X-rays) B) Real-time online monitoring

According to the form of conducting, it can be divided into methods of remote monitoring of patients as:

- Synchronous (real time)
- Asynchronous (deferred in time, or at a specific time of day)
- Remote (online monitoring by means of devices that record and, in some cases, transmit biosignals)

Here are some examples of how remote monitoring can be used in medical practice:

1. **Blood glucose monitoring.** Patients with diabetes can use wearable blood glucose monitors that upload data to the cloud. Doctors can view this data and see how the patient's blood glucose changes throughout the day.

2. **Monitoring of cardiac activity.** Wearable sensors can be used for cardiac monitoring, such as heart rate and rhythm monitoring. This data can help doctors identify heart problems and prevent serious complications.

3. **Sleep monitoring.** Some wearable devices can be used to monitor sleep and determine how well a patient is sleeping. This can help doctors assess how well patients are resting and recommend lifestyle changes or treatments if needed.

***Table 1.***

***Pros and cons of the remote diagnostic method***

| No. | pros | Minuses |
|---|---|---|
| 1 | Reducing the number of hospitalizations | 1. Costs for technical equipment and organization - Internet connection, gadgets, software |
| 2 | Reducing the length of stay of patients in the hospital, as well as the time of admission | 2. Need for training in the use of personal health assistants |
| 3 | Reducing the number of emergency calls | 3. Dependence of the possibility of introducing remote monitoring on the health status of patients, since this solution is not suitable for everyone |
| 4 | Improving the health indicators of the population in rural areas and remote regions | 4. Presence of personal biases and low digital literacy - both among patients and among doctors |
| 5 | More successful prevention of chronic conditions and relapses | |
| 6 | Reducing the risk of contracting COVID-19 and other SARS in hospitals | |

**Electronic Medical Record (EMR)**

Electronic medical record (An Electronic Medical Record (EMR) is an electronic document that contains medical information about a patient, including medical history, laboratory and instrumental test results, drug lists, and other information related to the patient's health [11].

The EMR is a digital version of a traditional medical record that was previously kept on paper. The use of EMR allows doctors and medical staff to effectively and quickly access medical information about a patient, reduce the time to search and analyze information, reduce the risk of errors in diagnosis and treatment, and improve the quality of medical care.

EMRs are often integrated with other systems in a healthcare facility, such as laboratory ordering systems and prescription management systems, to improve communication between them and reduce the time to complete medical procedures [10].

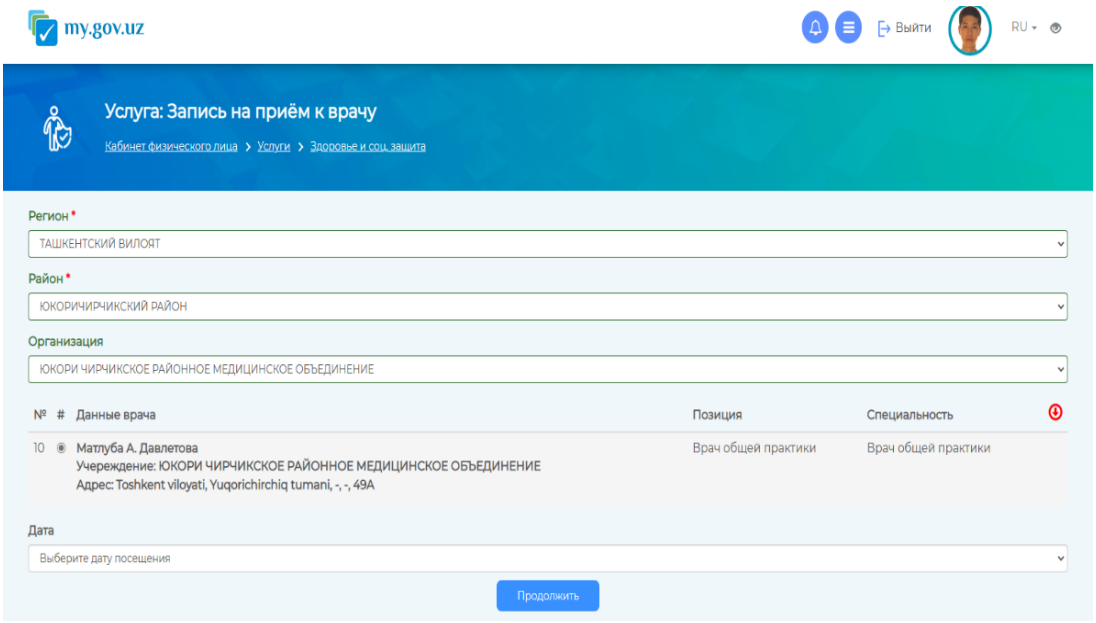



**Fig 4.**A sample of the electronic medical record service on the my.gov.uz portal

***Table 2.***

***Pros and cons of electronic digital recording***

| No. | pros | Minuses |
|---|---|---|
| | 1. Quick access to real-time medical information about the patient, which allows doctors to make a faster and more accurate diagnosis and start treatment. | 1. The need to implement and maintain modern technologies and systems, which can be a costly and complex process. |
| | 2. The best quality of medical care and greater accuracy of diagnoses due to modern algorithms and technologies for processing medical data. | 2. The risk of violating patient confidentiality and the possibility of cyberattacks by intruders. |
| | 3. Improved prescription management, reducing the risk of dosage and prescribing errors. | 3. Some healthcare facilities may face challenges in training staff and adapting to new processes and technologies. |
| | 4. Economic benefits associated with reduced use of paper records, improved efficiency of care and reduced costs for long-term storage of documents. | 4. Some patients may have concerns about how their data is being processed and stored, which can lead to a breach of trust in the medical institution. |

**Medical Applications**

**Medical Applications**is a software for mobile devices that helps users track and manage their health, access medical information, communicate with doctors and receive consultations [12,13].

There are many medical applications that can be useful for users, depending on their needs and goals. Some of the more common types of medical applications include:

1. **Health and Fitness Management Applications:**such apps help track physical activity, diet, and weight, and provide tips to improve overall health [20].

2. **Applications for drug dosage management:**these apps help keep track of medications taken and remind users to take them.

3. **Applications for medical diagnostics:**these apps can help the user to perform a simple medical test and get a preliminary diagnosis based on the results [18,19].

4. **Applications for medical consultation:**such applications provide the possibility of consultation with doctors and medical specialists.

5. **Health Monitoring Applications:**these applications can track various medical indicators such as blood pressure, blood glucose and others.

6. **Applications for medical education:**such applications can provide educational material on medical subjects for patients and medical professionals [14,15].

However, please note that medical apps are not a substitute for consulting a doctor and cannot diagnose or treat diseases. Users should use health apps as a complement to health care, not as a substitute for it.

***Table 3.***

***Pros and cons of medical mobile applications***

| No. | pros | Minuses |
|---|---|---|
| | 1. Availability: Medical mobile applications are available anytime, anywhere, allowing users to receive medical consultations and advice at their convenience. | 1. Not always accurate: medical mobile applications can provide inaccurate information about the health of users, which can lead to incorrect diagnosis and treatment. |
| | 2. Convenience: Medical mobile applications allow users to easily make an appointment with a doctor, get test results, communicate with a doctor, etc., without having to visit the hospital or wait in line. | 2. Not all apps are safe: Not all medical mobile apps are designed and tested by experts, which can pose a health risk to users. |
| | 3. Saving information: Medical mobile applications can save user health data such as medical history, medications taken, test results, which helps doctors provide the most accurate diagnosis and prescribe appropriate treatment. | 3. Not a substitute for a visit to the doctor: medical mobile applications cannot replace consultation with a doctor and conduct medical research, as specialized medical tools may be required for accurate diagnosis and treatment. |
| | 4. Awareness raising: Medical mobile applications can help users get information about their health, diseases and prevention methods, which helps to increase general awareness and health. | 4. Privacy issues: Medical mobile apps may not be secure enough from hackers and data breaches, which can compromise patient privacy. |

***Table 4.***

***Positive and negative features of the considered methods of telemedicine.***

| No. | Considered Methods | pros | Minuses |
|---|---|---|---|
| **1** | **Teleconsultation (Remote consultation)** | 1. quick help;<br>2. saving time and money;<br>3. a diverse circle of doctors; | 1. Limitations in conducting a physical examination.<br>2. The need to ensure a stable Internet connection. |

| | | | |
|---|---|---|---|
| | | 4. reducing the risk of disease spread;<br>5. the possibility of obtaining a tax deduction for treatment;<br>6. continuous monitoring of chronic diseases. | 3.Unsuitable equipment.<br>4.Unaccustomed to some patients. |
| **2** | **Remote monitoring** | 1. Reducing the number of hospitalizations<br>2. Reducing the time spent by patients in the hospital, as well as the time of admission<br>3. Reducing the number of emergency calls<br>4. Improving the health indicators of the population in rural areas and remote regions<br>5. More successful prevention of chronic conditions and relapses<br>6. Reducing the risk of contracting COVID-19 and other SARS in hospitals | 1. Costs for technical equipment and organization - Internet connection, gadgets, software<br>2. The need for training in the use of personal health assistants<br>3. Dependence of the possibility of introducing remote monitoring on the state of health of patients, since this solution is not suitable for everyone<br>4. The presence of personal biases and low digital literacy - both among patients and among doctors |
| **3** | **Electronic Medical Record (EMR)** | 1. Quick access to medical information about the patient in real time.<br>2. Better quality of medical care and greater accuracy of diagnoses.<br>3. Improved prescription management,<br>4. Economic benefits associated with the reduction of the use of paper documents. | 1. The need to introduce and support modern technologies and systems.<br>2. The risk of violating the confidentiality of patients and the possibility of cyber attacks by intruders.<br>3. Some healthcare facilities may face challenges in staff training and adaptation to new processes and technologies.<br>4. Some patients may have concerns about how their data is processed and stored. |
| **4** | **Medical Applications** | 1. Availability: Medical mobile applications are available anytime, anywhere, allowing users to receive medical consultations and advice at their convenience. | **1. Not always** Accuracy: Medical mobile applications may provide inaccurate information about the health of users, which can lead to |

| | | | |
|---|---|---|---|
| | | 2. Convenience: Medical mobile applications allow users to easily make an appointment with a doctor, get test results, chat with a doctor, etc., without having to visit the hospital or wait in line.<br>3. Saving information: medical mobile applications can save users' health data.<br>4. Awareness raising: Medical mobile applications can help users get information about their health, diseases and prevention methods. | incorrect diagnosis and treatment.<br>2. Not all apps are secure: Not all medical mobile apps are designed and tested by experts.<br>3. Do not replace a visit to the doctor: medical mobile applications cannot replace a consultation with a doctor and conducting medical research<br>4. Privacy Issues: Medical mobile apps may not be secure enough against hacker attacks and data breaches. |

## III.SOLVING THE PROBLEMS OF STUDYED TELEMEDICINE METHODS AS: REMOTE MONITORING, REMOTE CONSULTATION AND DIAGNOSIS

***Table 5.***

***Positive and negative features of the considered methods of telemedicine and problem solving.***

| No. | Considered Methods | pros | Minuses | Solutions |
|---|---|---|---|---|
| **1** | **Teleconsultation (Remote consultation)** | 1. quick help;<br>2. saving time and money;<br>3. a diverse circle of doctors;<br>4. reducing the risk of disease spread;<br>5. the possibility of obtaining a tax deduction for treatment;<br>6. continuous monitoring of chronic diseases. | 1. Limitations in conducting a physical examination.<br>2. The need to ensure a stable Internet connection.<br>3. Unsuitable equipment.<br>4. Unaccustomed to some patients. | 1. The use of remote consultation should be applied on a par with a physical examination.<br>This type can be used mainly in remote regions of the country, where there is an excess of personnel. |
| **2** | **Remote monitoring** | 1. Reducing the number of hospitalizations<br>2. Reducing the time spent by patients in the hospital, as well as the time of admission<br>3. Reducing the number of emergency calls | 1. Costs for technical equipment and organization - Internet connection, gadgets, software<br>2. The need for training in the use of | 1. It is necessary to provide all local clinics and family clinics with all technological equipment for |

| | | | | |
|---|---|---|---|---|
| | | 4. Improving the health indicators of the population in rural areas and remote regions<br>5. More successful prevention of chronic conditions and relapses<br>6. Reducing the risk of contracting COVID-19 and other SARS in hospitals | personal health assistants<br>3. Dependence of the possibility of introducing remote monitoring on the state of health of patients, since this solution is not suitable for everyone<br>4. The presence of personal biases and low digital literacy - both among patients and among doctors | patronage services.<br>2. Training of personnel in relevant areas to improve the quality of medical services.<br>3. It is necessary to provide a stable Internet connection in first-aid posts. |
| **3** | **Electronic Medical Record (EMR)** | 1. Quick access to medical information about the patient in real time.<br>2. Better quality of medical care and greater accuracy of diagnoses.<br>3. Improved prescription management,<br>4. Economic benefits associated with the reduction of the use of paper documents. | 1. The need to introduce and support modern technologies and systems.<br>2. The risk of violating the confidentiality of patients and the possibility of cyber attacks by intruders.<br>3. Some healthcare facilities may face challenges in staff training and adaptation to new processes and technologies.<br>4. Some patients may have concerns about how their data is processed and stored. | 1. It is important to pay attention to the confidentiality of individual patient data. For example, patients with a disease (HIV, AIDS, etc.)<br>2. Gradually move to electronic queues or premature recording for specific consideration and diagnosis. |
| **4** | **Medical Applications** | 1. Availability: Medical mobile applications are available anytime, anywhere, allowing users to receive medical | 1. Not always accurate: medical mobile applications can provide inaccurate information about | 1.Use medical applications for daily routines, and under other circumstances, be aware of the |

| | | | | |
|---|---|---|---|---|
| | | consultations and advice at their convenience.<br>2. Convenience: Medical mobile applications allow users to easily make an appointment with a doctor, get test results, chat with a doctor, etc., without having to visit the hospital or wait in line.<br>3. Saving information: medical mobile applications can save users' health data.<br>4. Awareness raising: Medical mobile applications can help users get information about their health, diseases and prevention methods. | the health of users, which can lead to incorrect diagnosis and treatment.<br>2. Not all apps are secure: Not all medical mobile apps are designed and tested by experts.<br>3. Do not replace a visit to the doctor: medical mobile applications cannot replace a consultation with a doctor and conducting medical research<br>4. Privacy Issues: Medical mobile apps may not be secure enough against hacker attacks and data breaches. | doctor (recommended).<br>2. Refuse application in case the situation needs physical examination.<br>The dosage of medicines should be strictly fixed in the application, in another case, you should consult a doctor.<br>Do not give your information to strangers other than your doctor. |

The above methods of telemedicine are fundamental, as they are not yet popular, although many different positive aspects can be seen. In table-5 we can see which methods cover a more important and serious nature by property, and which, on the contrary, a secondary role. Telemedicine As it was stated at the beginning that telemedicine is an important direction in the development of medicine, which can improve the availability and quality of medical care for a larger number of patients [16,17].

The table indicated the disadvantages and proposals for the gradual improvement of the quality of telemedicine services for the population. The basic directions of telemedicine can contribute to the expansion of the same area, but at the same time, it will be necessary to expand the range of development of information technology and communication. Covering the population with such favorable conditions includes the most urgent tasks and responsibilities for improving the health sector.

## IV.CONCLUSION

Telemedicine allows patients to receive quality medical care without leaving their homes or places of work, which is especially convenient for patients who live in remote areas or have limited mobility. Telemedicine also reduces the waiting time for an appointment with a doctor and improves the availability of medical care in general.

As a result, the methods discussed in our article are important for the formation of a new direction in the field of healthcare as "telemedicine".

Telemedicine is the use of information technology to provide medical services at a distance. In recent years, telemedicine has become increasingly popular and in demand due to the rapid development of technology.

The prospects for telemedicine are very broad:

1. Availability of medical care. Telemedicine can help solve the problem of access to medical care for people living in remote areas or those who cannot visit a doctor in person.

2. Cost reduction. Telemedicine can significantly reduce healthcare costs as many healthcare services can be provided remotely, saving patients time and money.

3. Improving the quality of medical care. Telemedicine technologies allow doctors to quickly access medical information and consult with their colleagues in real time, which improves the quality of medical care.

4. Development of telediagnostics. Telediagnostics allows remote diagnostics of diseases, which is especially useful for people living in remote areas.

5. Improving the effectiveness of treatment. Telemedicine allows monitoring diseases and the effectiveness of treatment at a distance, which allows you to quickly respond to changes in the condition of patients and increase the effectiveness of treatment.

Thus, the prospects for telemedicine are very encouraging and allow us to hope for an even wider application of this technology in medicine.

As a result, we can note that such a direction as telemedicine can become a huge leap or a revolutionary achievement of modern innovative medicine.

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