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Telemedicine – a new direction in modern medicine

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Abstract: *Modern medicine is becoming more advanced due to the development of information technology, and revolutionary changes in the field of information technology and communication play an important role here. Telemedicine is a new direction in modern medicine that uses information technology to provide medical services at a distance. It allows for consultations, diagnosis and treatment of patients remotely, using various means of communication, such as video communication, mobile applications and the Internet. Telemedicine makes it possible to deliver medical care in remote and hard-to-reach areas, as well as reduces the burden on medical institutions and improves the quality of medical care. It also increases the availability of medical care for patients with disabilities, such as the elderly and people with limited mobility. Telemedicine has many applications, such as teleconsultations, telediagnostics, telemonitoring and telerehabilitation. It can be used in various fields of medicine, such as cardiology, oncology, neurology and psychiatry. However, telemedicine also has its limitations and raises questions about data privacy, communication quality and the possibility of conducting a physical examination.*

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

Introduction

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

Telemedicine allows patients to receive quality medical care without leaving their home or workplace, which is especially convenient for patients who live in remote areas or have limited mobility. Telemedicine can also reduce waiting times for doctor's appointments and improve the availability of medical care in general.

However, it is important to understand that telemedicine cannot completely replace traditional medicine, especially in cases where a physical examination of the patient or complex medical procedures are required. Telemedicine may also face some technical and organizational problems, such as insufficient Internet connection speed, difficulties in transmitting and storing medical data, and issues with information privacy [3,4,5].

However, telemedicine is an important area of medical development that can improve the availability and quality of medical care for a larger number of patients.

Analysis of telemedicine methods such as: remote consultation, monitoring and diagnostics

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

- Nature of remote interaction (clinic - clinic, clinic - 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, diagnostics, monitoring, consultations, treatment)

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

provide assistance to patients [6,7].

1. Teleconsultation: Doctors and patients can contact each other via video to conduct a consultation or examination of the patient from a distance.

2. Remote monitoring: This is a method that allows doctors to monitor the health of a patient from a distance. This can be especially useful for patients with chronic diseases such as diabetes, cardiovascular disease or asthma.

3. Electronic medical record: This is a method that allows health care professionals to have access to patients' electronic medical records, making it easier for doctors to share information.

4. Medical Apps: There are many medical apps that help patients monitor their health, such as apps for tracking physical activity, sleep, and nutrition.

5. Remote Diagnosis: This is a method that allows diagnosis to be made at a distance. For example, doctors can use special equipment to perform remote ultrasound scans or perform remote X-rays.

6. Telemedicine Telemonitoring: This is a method that allows doctors to monitor a patient's health indicators, such as blood oxygen levels, heart rate, blood pressure, etc.

7. Virtual Reality and Augmented Reality: This is a method that allows patients and doctors to use virtual reality or augmented reality to educate, diagnose, and treat patients.

8. Telemedicine Training Programs: This is a method that allows doctors and patients to receive education and consultations at a distance.

Next, we will discuss in detail the above telemedicine methods that are used to provide assistance to patients [7,8].

Teleconsultation (Remote consultation) is a telemedicine method that allows doctors and patients to consult and communicate at a distance using video communication or other communication technologies (Fig. 2).



Fig 2. Teleconsultation process between patient and health care provider

This method allows patients to receive medical care and consultations without having to visit a doctor in the office. It is also convenient for patients who live in remote areas where access to health care services may be limited. The teleconsultation process usually begins with scheduling an appointment. The patient can schedule a consultation through an online 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 the video link or other 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 can also order additional tests if necessary [9,10,11].

Overall, teleconsultation is a convenient and effective telemedicine method that helps patients receive medical care without having to visit a doctor in person. It can also improve the accessibility of health care services, especially for those who live in remote areas or have limited mobility [12,13].

Advantages of teleconsultation

Telemedicine is convenient not only for patients from remote regions. Doctors during online consultations can prescribe tests so that the patient comes to the examination with a full package.

The main advantages of teleconsultation:

1. fast help;
2. saving time and money;
3. a diverse circle of doctors;
4. reducing the risk of spreading diseases;
5. the possibility of obtaining a tax deduction for treatment;
6. constant monitoring of chronic diseases.

Disadvantages of teleconsultation

Teleconsultation has many advantages for creating comfortable conditions for patients, but it also has some disadvantages that should be taken into account.

It is worth noting the following disadvantages:

1. Limitations in conducting a physical examination. Teleconsultation can be useful for assessing symptoms and consulting on treatment, but it is not a substitute for a full physical

examination. The doctor will not be able to check blood pressure, examine the skin, and check for other physical problems that may require immediate treatment [14,15].

2. The need to ensure a stable Internet connection. In order to conduct a teleconsultation, it is necessary to have access to a stable Internet connection. An unstable connection may lead to problems with the quality of video or sound, which may complicate the consultation between the patient and the doctor.

3. Inappropriate equipment. It is necessary to have appropriate equipment to conduct a teleconsultation. If the patient does not have a camera or microphone, it may lead to difficulties in communicating with the doctor [16,17].

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

Overall, teleconsultation is a useful telemedicine tool that can help patients receive medical care at a time and place convenient for them. However, before using this method, its limitations and disadvantages must be considered.

Remote monitoring is a telemedicine method that allows medical staff to monitor the health status of a patient remotely. This method uses various technologies such as mobile devices, wearable sensors, smartphone applications, and cloud computing. Remote monitoring can be especially useful for patients who have chronic diseases or require long-term monitoring [18,19,20]. It can also help healthcare staff more quickly identify and respond to changes in a patient's health, which can reduce the risk of complications and improve treatment outcomes (Figure 3).



Fig. 3. A) The process of remote patient monitoring (X-ray images) B) Online monitoring in real time

By the form of implementation, remote patient monitoring methods can be divided into:

- Synchronous (in real time)
- Asynchronous (delayed in time, or at a certain time of day)
- Remote (online monitoring using 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 sensors to measure blood glucose levels, which transmit data to cloud storage. Doctors can view this data and track how the patient's blood glucose level changes throughout the day.

2. Cardiac activity monitoring. Wearable sensors can be used to monitor cardiac activity, such as heart rate and rhythm. This data can help doctors identify cardiac 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.

Pros and cons of the remote diagnostics method

Pros:

1. Reduction in the number of hospitalizations
2. Reduction in the time patients spend in the hospital, as well as the time of admission
3. Reduction in the number of calls to emergency medical services
4. Improvement in health indicators of the population of rural areas and remote regions
5. More successful prevention of chronic conditions and relapses
6. Reducing the risk of infection with COVID-19 and other acute respiratory viral infections in hospitals

Cons

1. Costs for technical equipment and organization - Internet connection, gadgets, software
2. Need for training in the use of personal medical assistants
3. Dependence of the possibility of implementing remote monitoring on the health status of patients, since this solution is not suitable for everyone
4. The presence of personal prejudices and low digital literacy - both among patients and doctors

Positive and negative features of the considered telemedicine methods.

Teleconsultation (Remote consultation)

Table 1.

Pros	Cons
1. fast help; 2. saving time and money; 3. a diverse range of doctors; 4. reducing the risk of spreading diseases; 5. the possibility of obtaining a tax deduction for treatment; 6. constant monitoring of chronic diseases.	1. Restrictions on physical examination. 2. The need to ensure a stable Internet connection. 3. Unsuitable equipment. 4. Unfamiliarity for some patients.

Remote monitoring

Table 2.

Pros	Cons
1. Reduction in the number of hospitalizations 2. Reduction in the time patients spend in the hospital, as well as the time of admission 3. Reduction in the number of emergency calls 4. Improved health indicators in rural areas and remote regions 5. More successful prevention of chronic conditions and relapses 6. Reducing the risk of contracting COVID-19 and other acute respiratory viral infections in hospitals	1. Costs for technical equipment and organization - Internet connection, gadgets, software 2. The need for training in the use of personal medical assistants 3. Dependence of the possibility of implementing remote monitoring on the health status of patients, since this solution is not suitable for everyone 4. The presence of personal prejudices and low digital literacy - both among patients and doctors

Solving the problems of the studied methods of telemedicine such as: remote monitoring, remote consultation and diagnostics

The above mentioned telemedicine methods are fundamental, as they are not yet popular, although you can see many different positive sides. In Table 5 we can see which methods cover a more important and serious nature by property, and which, on the contrary, play a secondary role. Telemedicine, as it was said 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 suggestions for the gradual improvement of the quality of telemedicine services for the population. The basic directions of telemedicine can contribute to the expansion of this same area, but at the same time it will be necessary to expand the range of development of information technology and communication. Coverage of the population with such favorable conditions includes the most urgent tasks and responsibilities for improving the health care sector.

Conclusion

Telemedicine allows patients to receive quality medical care without leaving home or without leaving their place of work, which is especially convenient for patients who live in remote areas or have limited mobility. Telemedicine also helps reduce waiting times for doctor's appointments and improve 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 called "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.

Table 3. Positive and negative features of the considered telemedicine methods and problem solving.

	Methods under consideration	Pros	Cons	Solutions
1	Teleconsultation (Remote consultation)	1. quick help; 2. saving time and money; 3. a diverse range of doctors; 4. reducing the threat of disease spread; 5. the possibility of obtaining a tax deduction for treatment; 6. constant monitoring of chronic diseases.	1. Restrictions on conducting a physical examination. 2. The need to ensure a stable Internet connection. 3. Inappropriate equipment. 4. Unusual for some patients.	1. The use of remote consultation should be applied on par with physical examination. This type can be used mainly in remote regions of the country where there is an excess of personnel.
2	Remote monitoring	1. Reduction in the number of hospitalizations 2. Reducing the time patients spend in hospital and the time of admission 3. Reduction in the number of emergency calls 4. Improving health indicators in rural areas and remote regions 5. More successful prevention of chronic conditions and relapses 6. Reducing the risk of infection with COVID-19 and other acute respiratory viral infections in hospitals	1. Costs for technical equipment and organization - Internet connection, gadgets, software 2. The need for training in the use of personal health assistants 3. Dependence of the possibility of implementing remote monitoring on the health condition of patients, since this solution is not suitable for everyone 4. The presence of personal biases and low digital literacy - both among patients and doctors	1. It is necessary to provide all local clinics and family clinics with all the technological equipment for home care services. 2. Training of personnel in relevant areas to improve the quality of medical services. 3. It is necessary to ensure a stable Internet connection in medical centers.

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