



How did COVID – 19 help implement telemedicine in health care: what were the factors that made it possible and how can we use telemedicine to our advantage after the pandemic is over

Vpliv pandemije covid-19 na vključevanje telemedicine v zdravstveni sistem: dejavniki, ki so to omogočili in kako lahko telemedicina koristi zdravstvu tudi po koncu pandemije

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Abstract

This short review discusses telemedicine and its rapid implementation during the COVID–19 pandemic in the current health care systems. It presents several advantages and potential disadvantages of telemedicine and analyses what COVID–19 pandemic has changed in the existing health care organization to allow for a substantially broader use of telemedicine. It also describes examples of good clinical practice in several healthcare institutions during this pandemic and hypothesises which of these new ideas and organizational solutions that started during COVID–19, would remain useful for the future organization of health care systems.

Izveček

Prispevek nudi okviren pregled telemedicine in vpliv pandemije covid-19 na velik porast njene uporabe. Razprava se dotakne glavnih prednosti in slabosti telemedicine, predvsem ob izzivih zdravstvenega sistema med pandemijo covid-19. Opiše primere dobre praxe posameznih specialističnih področij, ki so se bolje prilagodila na trenutne razmere pandemije, in predlaga, kaj vse bi se lahko iz podatkov, ki jih med uporabo telemedicine shranjujemo, naučili in jih uporabili pri nadaljnjem organiziranju zdravstvenega sistema.

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1 Introduction

Telemedicine is a concept that covers all the ways and platforms that allow doctors and other health professionals to communicate with each other and with their patients. It enables remote clinical examination, as well as making diagnostic and therapeutic decisions and prescribing treatment based on the patient's data, documents, and other information transmitted via telecommunication systems (1,2).

Remote treatment started back in 1920 with the "Royal Flying Doctor" organization in Australia, when doctors gave advice via radio frequencies. Later, NASA accelerated the development of telemedicine to provide care for pilots and astronauts. Telemedicine, that is more like today's telemedicine, started in 1968 at Massachusetts General Hospital. Despite the fact that it was a significant technological advance at the time, telemedicine had almost died out by the early 1990s, when the decision to revive it was taken (3,4).

2 Telemedicine

2.1 Benefits of telemedicine

The advantages of telemedicine in healthcare are numerous. It enables a more consistent and uninterrupted way of treatment, provides access to medical assistance and information even outside the normal working day, reduces the burden of transportation for patients, helps to solve the problem of shortage of healthcare workers, and enables faster access to reliable medical information provided by a specialty doctor. It can also be of great help in the tracking and management of chronic diseases, as it enables virtual consultations on laboratory results, organizing and adjusting lifestyles, as well as consultations for patients who are managing their disease on their own, e.g. patients with diabetes. Through virtual portals, groups and seminars are also organized to educate people about certain diseases and about a healthy lifestyle. It also enables promoting a healthy lifestyle and motivating individuals to take more active care of their health.

Before the pandemic, about 50% of US hospitals provided health services via telemedicine. Pre-COVID-19 telemedicine was mostly used in radiology and stroke care (TeleStroke). However, many programs such as TeleTrauma, TeleBurns, TeleDermatology, TeleICU, and others were already being developed at that time. The use of after-hours telemedicine in nursing homes

has shown a 10% drop in hospitalizations. In addition, the nursing homes saved approximately \$150,000 (per home) per year (2,5).

There are various options arising for the development of devices that enable remote monitoring of patients. The US Food and Drug Administration (FDA) recently approved a sensor that remotely measures pulmonary artery pressure, which can prevent complications and reduce the number of hospitalizations. In Australia, where rural and indigenous populations are known to have a higher prevalence of risk factors for cardiovascular disease, the telemedicine program 'Tele-Cardiac Investigations' has been implemented in two remote regions. The program allowed cardiologists from large institutions (Royal Brisbane and Women's Hospital) to collaborate with local health professionals and remotely perform Holter ECG monitoring and stress testing. This telemedicine program increased the number of tests carried out in the indigenous population by 42% over the course of a year; test waiting times decreased by 44.6%, and the time it took patients to receive results decreased by 99.2%. Overall, the time from referral to results was reduced by 71.1%. Holter EKG testing via telemedicine enabled 91.3% of patients to be tested at their local healthcare facility (2,5,6).

Although telemedicine has many advantages, there have always been significant obstacles preventing the transition of telemedicine from occasional use to everyday practice. Before the COVID-19 pandemic, the use of telemedicine was limited to rural areas; in the US, only 8% of the population used telemedicine. In OECD (Organization for Economic Co-operation and Development) countries such as Australia, Canada, Portugal, and many others, before the pandemic, telemedicine consultations accounted for only 0.1-0.2% of all medical consultations. Although the use of telemedicine has increased in OECD countries over the years, its use in Canada, for example, only increased by 42% between 2012 and 2014 (7,8).

2.2 Telemedicine barriers

From the very beginning, in proportion to the development of telemedicine, ethical, legal, security, and many other questions have arisen, which need to be adequately answered before telemedicine can become part of our daily practice. In 2018 a systematic review of the

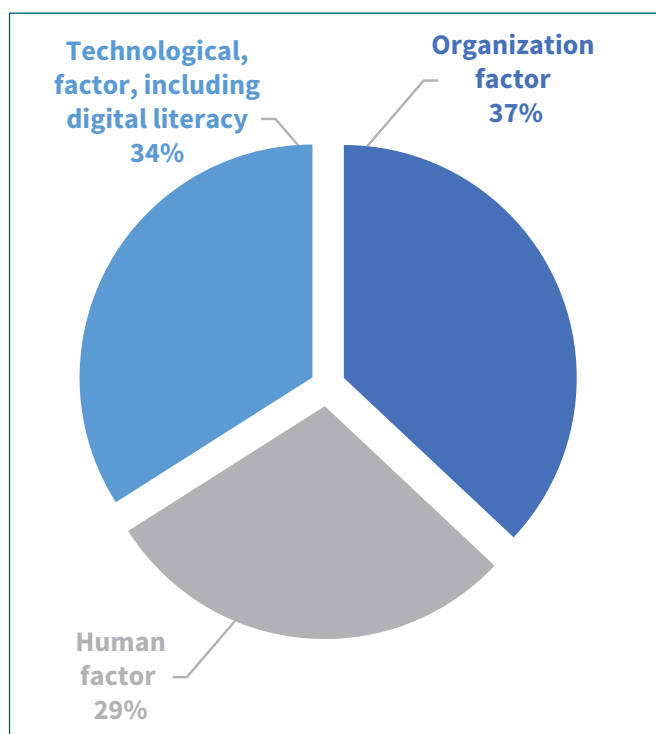


Figure 1: Factors hindering the development of telemedicine.

literature related to telemedicine was prepared, and the main areas that hinder its development were identified. Essentially, these areas can be divided into 3 groups (Figure 1): organizational factor, human factor (hesitations regarding the use of telemedicine by users, i.e. patients), and technological factor (concerns that health professionals and programmers have) (9,10).

The first group, i.e. organization, includes many obstacles. The first is insufficient financial investment in this area, representing 13% of the obstacle. The reason for the low investment value is insufficient financial return or numerous state restrictions. Until the emergence of the COVID-19 pandemic, the development and investment in telemedicine in the US was limited to geographical location. It was only in March 2020 that the law was changed, making it possible to invest in telemedicine within larger cities. Another organizational obstacle is the appropriate equipment of healthcare institutions, which represents 5% of the obstacle. Every healthcare facility would need an operational health web portal, rules, and protocols for telemedicine and technology that could be updated according to scientific and technological advances. The next organizational barrier covers the area of privacy and data protection, the area of doctor-patient confidentiality, and the area of legal responsibility, representing 11% of the obstacle. Most

countries do not have legally regulated relationships, rules, and procedures that would allow telemedicine to be safely and legally placed in the healthcare system (9,11-15).

The second group of barriers is investigated by means of questionnaires intended for users. It was found that the attitude towards telemedicine is highly dependent on the age of the population. It turns out that awareness of all that telemedicine has to offer is very low. Only 8% of respondents had used telemedicine in the past. However, it is an encouraging fact that as many as 66% of people answered that they would use telemedicine given the opportunity. Another obstacle to the use of telemedicine is computer illiteracy, which is more pronounced in the elderly population. The share of the elderly population is increasing and is predicted to reach 22% of the US population by 2050. The problems of the elderly population in the use of telemedicine can be a reduced willingness to learn, the cost of education, poor technical support, lack of trust in Internet services and other technologies, problems with the use of electronics, and so on. In addition to the other positive effects of telemedicine, it is also known to have some positive effects on the elderly population: reduced stress, increased autonomy, increased cognitive abilities, and an overall better quality of life (9,16,17).

The problem of computer literacy is also related to the obstacle from the third group, namely the resistance of health workers to the use of telemedicine, as it represents a change in their current way of working. Telemedicine is complex, requires education on the use of electronic programs and devices, and adaptation to a different way of examining patients. These adjustments are obligatory for a successful remote clinical examination. Healthcare workers are not sufficiently educated and aware of everything that telemedicine has to offer (9,18).

The use of telemedicine means electronics and computer systems will be involved in a very large part of the medical treatment process. Questions arise about the advantages and disadvantages of using telemedicine for the patient and about their right to choose their own treatment method. A study that reviewed articles from 2012 to 2017 related to telemedicine identified some ethical challenges that healthcare professionals should be aware of. It was found that when using telemedicine, the very important physical doctor-patient relationship, which has ordinarily has a positive effect on the treatment, is lost. Also, differences in accessibility arise based on the economic status of patients. Telemedicine means an additional burden of electronic literacy, which is indispensable for taking advantage of telemedicine. It is

also important to emphasize the fact that not all devices and applications are properly protected, which can lead to misuse of the patient's personal and medical data (19).

2.3 The impact of COVID-19 on the use of telemedicine

The COVID-19 pandemic has drastically changed the healthcare system worldwide, and a key element in this change is the increased use of telemedicine. Although much of the technology used in telemedicine has existed for decades, it has not been used due to strict regulations and poor financial support. During the COVID-19 pandemic, the use of telemedicine was significantly greater and it extended to the entire population; it was no longer intended only for people who have difficulties accessing a doctor. Therefore, the share of outpatient visits fell by 80%. In New York, after conducting a comparison, it was found that before the pandemic, about a hundred virtual examinations had been performed per day, and after the start of the pandemic, these examinations increased by 800% (measured between March and April 2020). The use of telemedicine for emergency cases increased from 82 visits to 1,336 urgent virtual examinations in the 15 days after March 4, 2020. Of these, 55.3% were related to COVID-19. Although the population demographic at these visits was diverse, most patients were between the ages of 20 and 44. In addition to the large increase in the use of telemedicine for emergency cases, a while later the use of telemedicine for outpatient treatment in all specialties also increased greatly. Before the pandemic, there were less than 50 virtual outpatient examinations per day during a normal working day. On March 19, 2020, when in the city of New York virtual examinations were approved also for non-urgent cases, 1,000 examinations were performed and the number of virtual outpatient visits reached 7,000 in 10 days, which represents more than 70% of all outpatient visits. Of these 7,000, 19.9% were related to COVID-19. Over the next six weeks, 144,940 virtual outpatient examinations were carried out, involving 115,789 patients and 2,656 healthcare professionals (7,20,21).

In the city of New York, a short observational study was conducted within one institution (New York-Presbyterian/Weill Cornell Medical Centre), where, based on the Press Ganey patient satisfaction survey, they checked how satisfied patients were with telemedicine compared to outpatient visits between April 1, 2019 and March 31, 2020. The research showed an 8,729% increase in virtual visits during the COVID-19 period, compared to the pre-COVID period. The results showed that patients

were statistically significantly more satisfied with the virtual visit compared to the outpatient examination (94.9% vs. 92.5%). Also, overall patient satisfaction was slightly higher during the COVID-19 period (COVID = 93.4%; pre-COVID = 92.5%). It also transpired that the lowest results of the survey were related to the female population and to the first, introductory examination of the patient (22).

The UC Christus Health Network in Chile conducted a survey regarding the satisfaction of health professionals with telemedicine. With the onset of COVID-19, the number of outpatient visits dropped by 87.9%. The biggest declines were recorded in paediatrics, ophthalmology, otolaryngology, and dermatology, and were between 61.1% and 70.0% compared to 2019. Therefore, the use of telemedicine has increased significantly. The survey was conducted between March and April 2020, when healthcare professionals answered open-ended types of questions in relation to the challenges brought by the virtual examination and how they would address them. All in all, 263 physicians (36.5%) from over 41 different specialties responded to the survey. 58.9% of these were women with an average age of 44 and an average of 16.8 years of practice. 61% of all these physicians had conducted 10 or fewer virtual clinical exams before the pandemic. 244 (92.8%) of all participating physicians were satisfied or very satisfied with telemedicine. 94.2% of respondents answered that they would recommend this method of communication to their family or friends. At the same time, the data showed that 61.8% of physicians felt that their clinical skills were being tested and that examinations seemed challenging. On average, this answer was more common among women (70.7%) than among men (50.9%). Surgeons, gynaecologists, and obstetricians felt the least challenged. Most of the challenges were related to organizing a virtual meeting in terms of accessing and using meeting platforms. Depending on the specialty, the medical specialists observed different challenges in the diagnostic process and the relationship established between the doctor and the patient. For primary care physicians and paediatricians, the biggest challenge was the diagnostic process, while psychiatrists saw the biggest challenge in establishing a doctor-patient relationship. 60% of psychiatrists noticed this problem, compared to surgeons who noticed this problem in only 16.4% of respondents (23).

It has been and will continue to be very important for physicians to quickly develop virtual treatment techniques: build a good virtual relationship with the patient, perform a 'physical' examination of the patient, and diagnose the disease. At the same time, it is very important

to develop curricula for future and young physicians who will learn all the newly developed techniques for a successful virtual examination of patients. This is already being carried out at NYU Langone Health. Students and interns follow virtual examinations where they learn new techniques. An important change has also come from the providers of various devices, which allow the free use and transfer of all data obtained in connection with remotely monitored patients (temperature, heart rate, pressure, glucose in the subcutaneous tissue, and so on) to a set of electronic health records (EHR). This option has existed for years, but until the pandemic, only a few providers implemented it, and even then, only for special cases. Patients have become accustomed to sharing their biometric data with the hospital through their patient portal and answering screening questionnaires before their virtual conversation with the doctor. Pregnant women with hyperglycaemia and/or hypertension routinely synchronize their home monitoring devices with a provider who uploads the data to an electronic health record (EHR), which has shortened postpartum hospitalizations (7).

2.4 What enabled the rapid implementation of telemedicine in the healthcare system and what is the state of telemedicine services in Slovenia?

COVID-19 drastically changed standard clinical practice and forced us to very quickly implement telemedicine in healthcare. The standard implementation and education practices that are usually required when introducing a new method in healthcare were skipped (23).

Due to the universal need for telemedicine, politics also became part of the development of telemedicine during COVID-19. The European Union started to encourage national health institutes to include telemedicine in everyday practice and it started advocating for the development of international standards and laws in the field of telemedicine. Similar to the USA, new laws were passed in a very short time in Europe as well, making telemedicine possible. For example, before the pandemic, Italy had not even allowed telemedicine as a way of treating patients in their healthcare system. On February 29, 2020, as many as 1,128 people infected with COVID-19 were recorded. Despite increased efforts to stop the spread, on March 12, 2020 the Italians already reported 15,113 infected people. It was only after the first wave that a law was passed on March 24, 2020 that enabled outpatient video clinics and remote monitoring.

In Slovenia, we currently have no legal framework that would define the field of telemedicine. However, the use of telemedicine is currently permitted in two areas: the first is conducting distant consultations and providing information regarding the patient's state of health, and the second is providing consultations regarding pharmaceutical activities. On a global level, telemedicine began to be promoted and advertised after COVID-19, the number of research aimed at improving it increased, and programs for evaluating and improving it began to be developed (11,24-26).

An important change also took place among insurance companies, which in the USA extended their insurance coverage during the pandemic to examinations performed via telemedicine. Even in Europe, since the COVID-19 pandemic, insurance companies have started to include coverage for telemedicine examinations; but not everywhere: it depends on each country. In countries such as Finland, Denmark, Croatia, Norway, Denmark, France, and Austria, insurance companies currently only cover certain areas and types of examinations in telemedicine. During the pandemic, most of these countries started to adopt new laws, based on which an insurance company will cover the greater part of the services offered by telemedicine. The Health Insurance Institute of Slovenia, which is defined by the Healthcare and Health Insurance Act, currently does not yet cover telemedicine services. In our country, this can only be covered by supplement health insurance companies (24,25).

In the US, regulations for the licenses required by technical providers of telemedicine software have been relaxed. The use of commercial products such as Zoom, Skype, Facetime, etc. has been allowed for the purpose of telemedicine. In a very short period of time, the applications became overused. It was found that this vastly increased use made them vulnerable to eavesdropping, recording conversations without permission, and other situations. The healthcare system has thus also become more exposed to cyber-attacks. Terrorists attack digital healthcare systems by stealing patient data and encrypting them, and a ransom is then demanded from the hospitals to recover the data. Such an attack resulted in the death of a patient in Germany. Protecting against such attacks and system intrusions will be difficult and complex and will require a multidisciplinary and multi-sectoral approach. Awareness of the problem is certainly the most important first step. The security of personal data is protected in Slovenia, as in Europe, by GDPR (General Data Protection Regulations). In addition, we also have Slovenian regulations: the Personal Data Protection Act, the Patients' Rights Act, and the Pharmacy

Practice Act. These laws present the basic protection and regulation of personal data in the healthcare system, but do not provide specific regulation and protection regarding telemedicine treatment. In addition to safety and licensing issues for technical providers, Americans have also changed the rules for physicians. Before the pandemic, every physician in the US had to be licensed in the state in which they practiced. With the onset of COVID-19, these rules were relaxed, allowing physicians to treat people from other states using telemedicine. The pandemic has thus opened up new questions about the current laws related to medical licenses, which will need to be changed if telemedicine is to complement the healthcare system under the best possible conditions (20,25-27).

The conditions of education in healthcare have also changed significantly. Information institutions such as Elsevier have started holding webinars on the current growth and changes in the field of telemedicine. The Primary Care Development Corporation has also held a series of webinars on how to start and sustain telehealth in healthcare settings, how to improve telecommunications and how to ensure that such treatment is ethical and compliant with all laws. AMIA (American Medical Information Association) also held a webinar on April 23, 2020, where they talked about the opportunities that the COVID-19 pandemic has created for telemedicine and how, over time, telemedicine can become an important part of our healthcare system.

Like everywhere in the world, Slovenian healthcare has also adapted to the COVID situation.

On March 9, 2020, a centralized novel coronavirus telephone helpline was established. From 8:00 a.m. to 8:00 p.m., medical students answered free calls from all over Slovenia and from abroad in connection with COVID-19. During the pandemic, a telemedicine centre was also established at the University Medical Centre Ljubljana, which provided telemedicine treatment for COVID-19 patients and patients with chronic diseases and conditions. Electronic communication with patients has been introduced in many outpatient clinics, which enables making appointments, ordering prescriptions, requesting sick leave and medical referrals, as well as making appointments for video treatment. These are just some of the things that have been added to our healthcare during the COVID-19 pandemic (28,29).

In Slovenia, we have a communication and information platform HealthDay.si, which is trying to establish a more information-friendly healthcare. Among other things, their goal is to have as many patients as possible in Slovenia be treated through telemedicine. They

do this by supporting innovative companies and leading an open conversation between everyone, including decision-makers, who are important for greater and more effective use of telemedicine in Slovenia (30-33).

2.5 Telehealth during and after the COVID-19 pandemic

Before the pandemic, the idea that telemedicine would ever replace personal patient care was considered very futuristic, but today it is already a reality practiced all over the world. Telemedicine has made it possible to protect patients and healthcare professionals during this crisis (7,34).

We are presenting a few cases from different specialist areas as examples of good practice.

Due to the increased need for the use of telemedicine during COVID-19, neurosurgeons conducted a systematic review of the literature between 1995 and 2020, analyzing the experiences of neurosurgeons with telemedicine. They found that 99.6% of all telemedicine interactions were successful. 162 cases were unsuccessful, in 81.5% this was due to a technical complication. These numbers are expected to decrease further as technology advances. 18.5% of failed remote examination cases triggered the need for an additional live examination. Based on all of the literature reviewed, and what COVID-19 has brought about, it is assumed that telemedicine is an acceptable tool for conducting triage examinations to help determine who does and who does not need a live examination (35).

In child and adolescent psychiatry, the COVID-19 pandemic has greatly changed the nature of work, making it more difficult and slowed down. Nevertheless, psychiatrists continued their work and looked for new ways and treatment options. In the case of young children/infants, it was found that it is practically impossible to assess them through a camera. Therefore, they asked parents to send videos of their children prior to the video consultation, recording them in their home environment: how they play, communicate, speak, etc.; 50–60% of the parents sent videos that proved useful in the clinical interpretation of the child. It was also found that teleconsultations were preferred by adolescents who do not like to go to school, who are bullied by their peers or who have agoraphobia. New topics for research were also offered, such as teletherapy for autistic and anxious patients (especially those who have problems with social contact), the life of people with ADHD in the home environment, and so on. Psychiatrists have suggested that new treatment methods that incorporate technology be

developed immediately to increase public awareness of child psychiatry and to continue research in this field (36).

During the COVID-19 pandemic, ophthalmologists had to divide their patients according to whether the hospital visit was urgent or not. They developed eight digital treatment models. These were divided into three groups: pre-hospital treatment, emergency cases, and remote monitoring of patients. One of the models of the first group is the hub-and-spoke treatment model that includes telesupport for patients according to their needs and triages patients to allow for the most efficient transition of patients between the primary, secondary, and tertiary sectors. It does this by recommending self-monitoring or by recommending additional consultation with a provider where people trained to give such advice are available. Such a treatment model has also been transferred to systems that use artificial intelligence to automatically classify eye diseases based on ophthalmic imaging examinations. This was used by ophthalmologists at Zhongshan Ophthalmic Center in China during the COVID-19 pandemic to achieve a quicker response of ophthalmologists and reduce the number of unnecessary outpatient visits. The different treatment models applied during the pandemic depend on various factors such as culture and financial support among many others (37).

The pandemic has also increased the problems faced by health professionals working to improve memory and other cognitive functions. A decline in cognitive functions, especially memory, has a prevalence of between 33% and 95% in the elderly population. Even before the pandemic, programs aimed at improving cognitive abilities faced problems such as poorer mobility of the elderly, limited means of transportation, accommodation in rural areas, and so on. All these factors had a strong influence on who was able to participate in the programs. Therefore, during the pandemic when there were even more obstacles, protocols were drawn up for a pilot study that will measure the feasibility, acceptability, and effectiveness of the OPTIMiSE (Online Personalized Training in Memory Strategies for Everyday) program. This is an online memory training program. This study will help to obtain important data on the effectiveness of online cognitive training because it could be an excellent solution to many current limitations (38).

Chronic patients need to return to the hospital regularly, which often leads to non-cooperation with the treatment plan, delays in outpatient examinations, and thus a worse treatment outcome and higher treatment costs. Here, telemedicine can offer a much more acceptable

way of treatment that increases patient attendance and participation. Telemedicine also enables home care, which can ensure that patients adhere to their treatment plan, which reduces the need for hospitalizations, costs, and the potential for hospital-acquired infections. We also hope that home care can be transferred to care for older people, reducing the stress on families who have to care for them alone. Telemedicine will encourage people to seek medical advice sooner. Thus, it will help with an earlier diagnosis and thus avoid complications (34).

3 Discussion

Telemedicine has become an important part of the healthcare system in a very short time. Although the COVID-19 pandemic has helped to move many of the boundaries that have inhibited the arrival of telemedicine, it has also pointed to important problems that must be solved before it can become part of everyday practice. It turns out that not only health professionals and programmers, but also patients, insurance systems, lawyers, and government departments must participate in the development of telemedicine (24). It is important to establish legal frameworks within which it can begin to operate safely for the patient and the healthcare professional. It is necessary to invest in the infrastructure of medical institutions so that they are able to renew and adapt to newer programs. It is also necessary to protect this infrastructure by developing security and detection systems against computer intrusions into the programs of the healthcare system. It is equally necessary to develop basic protocols for emergency action in the event of an intrusion into the health information system (11,20).

It is necessary to draw up guidelines and standardize treatment procedures via telemedicine at the national and global level. Programs must be introduced to educate the entire population about telemedicine, how to use it and everything that telemedicine has to offer. A common information system for safe data sharing needs to be developed, and research that will help guide the development of telemedicine in a safe and efficient direction needs to continue (11).

Patients and healthcare professionals are concerned that telemedicine bypasses the importance of the empathetic doctor-patient relationship that develops through personal contact. This can make health care very impersonal. For the further use of telemedicine, it will be crucial to define and categorize diseases according to when personal contact with the patient (first examination or follow-up examination) is necessary, which would optimize its use. Telemedicine has the potential to develop

and offer quality care at home, thus reducing treatment costs and enabling quality treatment even in remote locations (34).

Further large-scale prospective randomized studies, such as the OPTIMiSE pilot study, are also needed to assess whether live outpatient visits and virtual outpatient visits are complementary (35,38).

4 Conclusion

The COVID-19 pandemic allowed us to test telemedicine and its effectiveness on a global and, of course, national level. In Slovenia, during the pandemic, many new telemedicine-related procedures were introduced into clinical practice. Based on this, we have collected a lot of information from healthcare and from patients, which we can use to improve telemedicine and increase

and maintain its role in healthcare. We have experienced the issue of security when sharing data and found that the key strategic role in the introduction of telemedicine in healthcare is played by the Ministry of Health, the Health Insurance Institute of Slovenia and the National Institute of Public Health, who need to provide a clear strategy for the development of telemedicine, an appropriate legal basis, information security, long-term financing, as well as quality and safety standards of telemedicine. It is important to use the information obtained and continue the development of telemedicine in an ethical and responsible manner for the benefit of all participants.

Conflict of interest

None declared.

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