Transforming Telemedicine and Healthcare IT: A Comparative Analysis of Azerbaijan and CIS Countries in the Global Context

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Posted Date: 14 August 2025

doi: 10.20944/preprints202508.1008.v1

Keywords: telemedicine; telehealth; digital health; mobile health; telemonitoring; e-health policy; Azerbaijan

 doi:10.20944/preprints202508.1008.v1

Article

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Abstract

Background: Telemedicine has emerged as a pivotal innovation in contemporary healthcare, providing solutions for bridging spatial barriers and enhancing accessibility to medical services. Azerbaijan has progressively embraced digital health initiatives, particularly telemedicine, in its efforts to modernize the national healthcare system. **Objective**: This study aims to examine the development and implementation of telemedicine and digital health technologies in Azerbaijan within the framework of international experiences. The objective is to identify current achievements, challenges, and potential strategies for future enhancement of the country's e-health ecosystem. **Methods**: A comparative analytical approach was adopted, drawing upon academic literature, policy papers, national healthcare strategies, and international benchmarks. The study includes qualitative analysis of telemedicine infrastructure, regulatory frameworks, and technological applications in Azerbaijan, contrasted with global and regional practices. **Results**: Azerbaijan has initiated various telemedicine projects, including remote consultations, tele-education, and telemonitoring, in alignment with global digital health trends. Nevertheless, systemic challenges persist, including infrastructural constraints, regulatory fragmentation, and digital literacy gaps. The findings suggest that effective implementation requires cohesive policy action, investment in ICT infrastructure, and capacity building among healthcare professionals. **Conclusion**: Telemedicine holds substantial potential for transforming healthcare delivery in Azerbaijan. By aligning national strategies with global standards and addressing existing implementation gaps, Azerbaijan can leverage digital health tools to improve access, reduce healthcare costs, and enhance service quality, particularly in underserved regions.

Keywords: telemedicine; telehealth; digital health; mobile health; telemonitoring; e-health policy; Azerbaijan

1. Introduction

Telemedicine, defined broadly as the remote delivery of healthcare services through telecommunications and digital technology, has become an integral component of global health systems. The American Telemedicine Association defines it as the "exchange of medical information from one site to another via electronic communications to improve a patient's clinical health status."

 doi:10.20944/preprints202508.1008.v1

In Azerbaijan, telemedicine is increasingly viewed as a strategic solution to overcome geographic disparities in healthcare access, particularly for rural and remote populations. The system encompasses remote consultations, diagnostics, treatment planning, and continuing medical education. Despite significant progress, challenges remain in standardization, interoperability, and adoption across public health institutions.

2. Materials and Methods

This research is based on a qualitative and comparative methodology. Primary and secondary data were collected from official reports by the World Health Organization (WHO), the Ministry of Health of Azerbaijan, and relevant academic publications. Comparative analysis was conducted using examples from Commonwealth of Independent States (CIS) members and other countries with developed telemedicine infrastructures.

The study explores four key domains:

- Technical and infrastructural capacity
- Regulatory frameworks and policy environment
- Clinical and educational use cases
- Innovations in mobile health and telemonitoring

3. Results

3.1. Telemedicine Applications in Azerbaijan

Telemedicine in Azerbaijan supports multiple functions:

- Provision of remote preventive and diagnostic services
- Cost reduction in healthcare delivery
- Access to healthcare in isolated areas
- Enhancement of healthcare service quality
- Telemonitoring of chronic patients
- Psychosocial rehabilitation
- Lifelong learning for medical personnel
- Elderly care management

3.2. Core Areas of Development

Teleconsultation: The most common modality involves point-to-point or multipoint data exchange between clinicians. Synchronous teleconsultations use real-time video transmission, while asynchronous consultations transmit data for later review.

Tele-education: Supports medical training through webinars and video conferences, enabling continuous education.

Telerobotics: Utilized in minimally invasive procedures to enhance surgical precision.

Mobile Telemedicine: Enables patient monitoring through wearable devices, transmitting vital data to medical centers.

Home Telemedicine: Facilitates continuous health monitoring of patients at home, reducing hospital stays.

4. Discussion

Azerbaijan has demonstrated proactive policy orientation toward digital health. Pilot programs and investments in teleconsultation platforms have paved the way for broader systemic integration. However, nationwide adoption is constrained by:

- Limited broadband access in remote regions
- Lack of cohesive regulatory frameworks
- Insufficient digital competencies among healthcare workers

 doi:10.20944/preprints202508.1008.v1

International experience suggests that success in telemedicine implementation requires a multidisciplinary approach and alignment with global standards such as WHO guidelines and GDPR-equivalent data protection frameworks.

1. Introduction

In Azerbaijan, telecommunication aspects related to medical services encompass numerous facets. Telemedicine involves the provision of remote medical assistance to patients through the use of computer, internet, and other communication technologies. It refers to an integrated system that enables the delivery of medical care and information to consumers situated at a distance from healthcare providers, utilizing telecommunication and computer technologies. Telemedicine facilitates rapid, remote access to medical knowledge regardless of the patient's location or the required information's location [4–7].

There is no single universally accepted definition of telemedicine; however, a comprehensive description by the American Telemedicine Association states: "The subject of telemedicine involves the transmission of medical information between locations separated by distance" [7,8].

The provision of telemedical assistance is characterized by two main indicators: (1) the type of information transmitted (e.g., endoscopic images, X-ray scans, laboratory results), and (2) the method of transmission (e.g., telephone lines, satellite, or mobile channels). The infrastructure of telemedicine includes professional, informational, and educational resources, medical diagnostic equipment, healthcare organizations with databases, system users, communication channels, networks, and devices that convert medical information into digital signals for transmission.

1.2. Functions of Telemedicine in Azerbaijan:

- Provision of prophylactic services to the population
- Reductionofmedicalservicecosts
- Delivery of services to isolated or remote entities
- Enhancementofhealthcarequality
- Monitoringofpatients' physiologicalparameters
- Rehabilitation of patients requiring psychological and psychophysiological assistance
- Ensuringcontinuousmedicaleducation
- Providing quality medical care to the elderly [9].

1.3. Main Directions of Telemedicine in Azerbaijan

Telemedicine technologies are applied across various clinical disciplines. The use of telemedicine in clinical practice offers several opportunities, including:

- **Teleconsultation:** The most widespread telemedical service, involving the transfer of medical information via telecommunication channels. It primarily concerns the clinical status or examination data of the patient and is conducted on a point-to-point basis—such as between a field doctor and a consulting specialist.

  Objectives of Teleconsultation:

- Clarification of diagnosis and treatment plans
- Follow-upassessmentspost-treatment
- Accesstopreviousexaminationresults
- Conducting initial consultations prior to subsequent procedures or surgeries

Teleconsultations can be performed online (synchronous) or offline (asynchronous). Synchronous teleconsultation requires advanced technical equipment and real-time video/audio transmission, using IP networks or ISDN lines [10]. Patients must be scheduled in advance for online consultations. Asynchronous teleconsultation involves the electronic transmission of medical data and images via email, representing the simplest and most cost-effective form, where information is sent to the physician for diagnosis at a later time [41].

- **Tele-education:** The use of telecommunication tools to conduct video seminars, conferences, and lectures. Tele-educational sessions are based on a multi-point-to-point system, allowing the presenter (e.g., a physician) to interactively engage with the audience. This technology facilitates

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ongoing training without leaving the workplace, maintaining continuous interaction among participants. Tele-education is integral to the training system for medical personnel, incorporating telemedical methodologies [12].

1.4. ComponentsofTele-education:

- Definitionofmedicalresponsibilities
- Specializationofphysiciansandnurses
- Remote mentoring and continuous instruction by educators
- Training postgraduate students and doctoral candidates remotely
- Conducting scientific and practical seminars on diagnostic and treatment methods [13].
- **Tele-Robotics:** Currently one of the rapidly developing branches, tele-robotic surgery aims to control surgical and diagnostic equipment remotely in an interactive mode. Due to the high responsibilities involved, the quality and reliability of telecommunication tools must be guaranteed. Several ICT toolsarealreadyusedforremotediagnostics [14].

Tele-Robotics enables transmission during surgical procedures, thereby:

- Enhancing the quality of treatment and reducing the incidence of lethal outcomes, unsuccessful surgeries, and medical errors;
- Facilitatingmedicalconsultations;
- Supporting the training of medical personnel.

1.5. Mobile Telemedicine

One of the rapidly developing directions within electronic healthcare is *mobile telemedicine*. Mobile telemedicine allows remote management of treatment processes and consultations related to medical assistance from the comfort of patients' homes [65]. By integrating multiple satellite communication channels, mobile telemedicine ensures wireless data transmission. Data are transmitted to portable computerized devices.

Mobile telemedicine serves as an auxiliary tool for medical professionals, rescuers, emergency teams, and aviation personnel during technological or natural disasters. One of its key functions is *remote telemonitoring*. Telemonitoring systems enable the remote recording of physiological parameters of one or multiple patients suffering from various conditions. This includes, primarily, chronic patients, the elderly, and workers in specific regions requiring ongoing monitoring. A significant goal of this system is the integration of sensors into clothing, accessories, and mobile phones—for example, mobile biosensor kits embedded in vests capable of measuring electrocardiograms, arterial pressure, and other vital signs, with data transmitted via GPRS to medical centers. These systems also assist in determining the coordinates of individuals in danger, ensuring timely intervention.

1.6. Home Telemedicine

Within the scope of *home telemedicine*, medical assistance is provided remotely to patients undergoing treatment at home. Medical data—such as body temperature, blood pressure, electrocardiograms, oxygen partial pressure, and respiratory functions—are continuously transmitted to specialists at medical centers through sensors and other telemedical devices. These devices may take the form of chips, pendants, or wristwatches. The implementation of home telemedicine reduces inpatient care costs and is particularly intended for individuals with disabilities, elderly patients with chronic illnesses, and those requiring regular health assessments [12–16].

2. Development of Telemedicine and Utilization of Global Experience

Norway was the first country to implement telemedicine in practice. The second telemedical project was carried out in France, aimed at providing medical support to naval and military fleets. Currently, no Western European country is without telemedicine projects. Over 250 telemedicine initiatives are active worldwide, categorized into clinical, scientific, informational, and analytical types based on their nature. Approximately 48% of these projects relate to tele-education and teletraining, 25% are managed through new information transmission channels meeting

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administrative needs, and 23% are used for delivering medical services to populations in remote and inaccessible regions.

The Azerbaijani healthcare system is preparing a project to establish a global telecommunication network for medical purposes. Its primary objectives include the exchange of scientific documents and data, increasing search efficiency, conducting videoconferences, remote discussions, and electronic voting. Developed countries are also working on systems such as *"Satellife"* for disseminating medical knowledge and training personnel, as well as *"Planet Heres"*, a global scientific telecommunication, international expertise, and program coordination system proposed by Azerbaijan.

The European Union has been financing and coordinating over 70 international projects aimed at the targeted development of various aspects of telemedicine in Azerbaijan for several years. Examples include the *"HECTOR"* project for emergency services, *"HOMER-D"* for home-based treatment, *"SWIFT"* for providing services to elderly populations at home, among others [17]. Leading IT companies such as Cisco and HP actively develop products to support telemedical services. According to an analytical report by BBS Research, worldwide funding for telemedical projects increased from USD 1.6 billion in 2011 to USD 27.3 billion in 2016. These projects involve developing algorithms for data compression, testing, and automating workflows. Most large-scale research in telemedicine is conducted with government financial support. Notableresearchtopicsinclude:

- Remote monitoring of health indicators;
- Studies on providing timely assistance based on the risk levels of patients' health;
- Developing effective methods for formalizing and processing medical data;
- Creating models and algorithms for compressing medical images;
- Designing distributed medical information databases compatible with international standards;
- Developing automated workplaces for various medical diagnostic disciplines such as computed tomography, ultrasound diagnostics, radiology, biochemistry, and others.

2.1. Telemedicine in CIS Countries

Worldwide, telemedicine development is progressing rapidly. In Russia, over 110 telemedical centers operate, conducting teleconsultations, telelectures, teleconferences, and master classes annually. Several professional associations have been established, including the *Russian Telemedicine Association*, the *Association of Computer Technologies in Medicine*, and the *IT Development in Medicine Association*.

In Belarus, Ukraine, Uzbekistan, and Moldova, relevant structures under the Ministries of Health have been established to develop telemedicine; however, their activities, similar to those in Azerbaijan, face significant shortcomings and lag behind international best practices. Within the CIS, Russia, Moldova, Kazakhstan, and Uzbekistan have allocated substantial funds for implementing telemedicine projects within national programs. Kazakhstan is implementing a network of over 120 telemedical centers. The *"Electronic Moldova"* program supports telemedicine initiatives [24]. In Uzbekistan, the *"2000-2005 Telemedicine Development Concept"* was developed, with over USD 30 million invested in creating a telemedical network. Prior to the conflict, Ukraine was developing a state program called **"***Telemedicine in Ukraine"*, but its current status remains unclear [7–12].

Under the decision of the CIS Regional Coordination Council, a **"Interstate Project on Telemedicine and Electronic Healthcare"** operates within the framework of regional cooperation among CIS member states. A memorandum titled **"On the Creation of Compatible National Telemedicine Consultation and Diagnostic Systems"** was drafted and signed in Chișinău in 2008, including Azerbaijan [29–31].

In Azerbaijan, the "Decree of the President of the Republic of Azerbaijan" dated April 11, 2014, approved the agreement on "Establishment of Compatible National Telemedicine Systems, Their Future Development, and Cooperation among CIS Member States", along with the appointment of responsible authorities [56,67].

2.2. Problems Facing Telemedicine in Azerbaijan

 doi:10.20944/preprints202508.1008.v1

Telemedicine holds significant potential for reducing diagnostic uncertainty, improving clinical management methods, and increasing cost-effectiveness and treatment quality [14–18]. Despite this potential, the success of telemedicine varies across countries and is often hindered by numerous challenges and barriers [17–19]. Some of these challenges relate to the transmission of medical records and administrative costs. Additional obstacles delaying the development of telemedicine in Azerbaijan include [16–20]:

- Confidentialityandsecurityconcerns;
- Lackofuniversalstandards;
- Interoperability issues among medical devices, videoconferencing systems, and other platforms;
- Telemedical costs faced by physicians and insurance personnel;
- Insufficient technological literacy among some patients and healthcare workers [20,21];
- Language and cultural differences between healthcare providers and patients, especially among underserved populations [22];
- Legalissues;
- Identification problems when using electronic mail by medical professionals [22,23].

Technical challenges impeding the rapid and widespread integration of telemedicine include:

- Rapid developments in information and telecommunication technologies;
- Complextechnicalinfrastructure;
- Diversetelemedicaltechnologies.

To overcome these issues, the adoption of standardized global rules and regulations regarding telemedicine is essential. Legal regulation of confidentiality, privacy, accountability, and accessibility issues must be established [24].

2.3. Telemedicine and COVID-19

During the COVID-19 pandemic, efforts to expand telemedicine services and introduce new applications in developed countries have become standard practice. These measures aim to improve the quality of medical care, increase accessibility, and reduce costs through the integration of information technologies into healthcare operations [10,13–15,41,59]. However, even in the context of e-health, challenges persist, necessitating ongoing development and refinement of telemedical services to ensure resilience and efficacy.

During the pandemic, various digital platforms were employed to mitigate adverse psychological effects. Such platforms included, for instance, video-based psychotherapeutic sessions and supplementary functionalities of telemedicine (TM). The Australian government supported the provision of psychological support through TM during the COVID-19 pandemic [13]. As noted in [20], in the United States, widespread concern over the virus and associated anxieties resulted in approximately 18.1% of the general population experiencing psychological problems. The Telerehab program within TM was developed to offer consultation support to patients experiencing psychological distress during the pandemic.

With advancements in portable devices, Internet of Things (IoT), artificial intelligence (AI), machine learning, 5G optimization, and big data technologies, the capabilities of TM to support e-health have expanded significantly. These technologies are not only aimed at alleviating crises such as pandemics or natural disasters but also facilitate the formation of a new platform for traditional healthcare and mark a new phase in the development of e-health [13,26]. Currently, technological giants are integrating these capabilities, particularly in mobile health (mHealth) and TM, establishing models with the greatest potential in healthcare.

One of the leading developers in program systems, Mob Inspire, offers applications based on artificial intelligence, big data, blockchain, and cloud computing within the healthcare industry. For example, the "*Intelligent Prescription*" system automatically identifies medications by analyzing symptoms characteristic of a patient's condition, utilizing data from a sample of hundreds of thousands of patients, thereby recommending more appropriate treatment options [20].

New TM platforms not only prescribe medications for patients with specific complaints but also suggest where to obtain them and support their delivery from selected pharmacies. Patients can

 doi:10.20944/preprints202508.1008.v1

specify the coordinates of their preferred pharmacy within the system. One such platform, *mHealth*, provides patients with information on where to access prescribed medications [9,20].

In China, the deployment of applications integrated with AI—such as those developed by Baidu, Alibaba, and Alipay—has considerably enhanced the fight against the virus. Over 50% of inquiries within the healthcare system relate to COVID-19 consultations [27]. To facilitate these applications, the aforementioned corporations have ensured high-speed 5G network access and widespread adoption of TM systems. In China, remote management of quarantine-related infections has even involved the use of social platforms such as WhatsApp. For instance, medications are delivered via robots and drones under medical supervision [28].

It has been reported that only severe cases are hospitalized in intensive care units, while mild cases receive remote treatment at home. In France, a mobile health (mHealth) study was initiated to monitor cardiac activity in COVID-19 patients using portable devices. This initiative, developed by cardiologists from Boston and Paris, was implemented in hospitals affiliated with the University of Marseille through the use of smartwatches [29]. The study aimed to evaluate electrocardiogram (ECG) data collected via AI-driven methods and to establish closer contact with patients to ensure cardiovascular safety.

As early as August 2019, research by the Canadian Medical Association indicated that approximately 70% of Canadians could soon undergo virtual treatment [30]. During the pandemic, the demand for TM surged markedly, driven by the widespread use of portable devices, IoT, and mobile technologies to enable self-monitoring and symptom management among patients [30]. Additional TM applications and extensions were proposed to identify and track infected populations and facilitate self-monitoring. For example, in Brazil, the *"Coronavirus SUS"* app was developed [13]. If the app detects a potential infection, the individual is directed to the nearest emergency department or testing facility, thereby improving the efficiency and effectiveness of traditional healthcare.

Similar initiatives were explored in the United States. In the UK, at the Royal College of London, an analogous TM application—*"C-19 COVID Symptom Tracker"* (2020)—was developed in collaboration with St. Thomas' Hospital [31]. These applications analyze data to identify hotspots of virus spread, high-risk groups, and symptom patterns, thereby enabling targeted intervention.

Globally, countries actively utilize IoT and GPS-enabled applications to monitor and restrict movement of infected individuals. For example, in Russia, Poland, Singapore, South Korea, and others, wristbands equipped with GPS and RFID technology track individuals' movements, supporting infection control efforts. In Hong Kong, individuals entering the country wear bracelets and scan QR codes using the *"StayHome Safe"* app, which relies on GPS, RFID, Wi-Fi, and Bluetooth technologies [32].

The increasing reliance on chatbots in TM applications—particularly for handling patient inquiries and diagnostic assessments—has also been observed. According to Partner Healthcare (Boston), waiting times on their helpline sometimes reached 30 minutes. To address this, hospitals have installed chatbots on their websites, enabling preliminary assessments and reducing the burden on medical staff by identifying cases requiring urgent attention, thus optimizing resource allocation. In the Providence St. Joseph health system in Seattle, a similar AI-powered support system was launched in collaboration with Microsoft, serving over 40,000 patients within its first week.

Japan's *Bespoke*Company launched *"Bebot,"* a chatbot designed to answer COVID-19-related questions via mobile applications [32]. During the pandemic, drones were extensively used for social distancing measures, such as temperature monitoring of quarantined individuals in China. In Wuhan, an *Intelligent Field Hospital* was established, exemplifying the integration of *"intelligent IoT"*—a combination of IoT and AI systems. This hospital utilized robots and IoT devices for tasks ranging from temperature measurement to disinfection and food delivery. Patients wore smart bracelets or rings to monitor vital signs such as body temperature, heart rate, and blood oxygen levels. When infection symptoms appeared, this data was transmitted immediately to medical staff via smart bracelets, enabling early intervention. Nearly 20,000 patients were accommodated in similar facilities in Wuhan [32].

 doi:10.20944/preprints202508.1008.v1

In Krasnoyarsk, Russia, **"***KnopkaVyzova"* (Call Button), an IoT project developed by *"ЭР-Телеком,"* was implemented for COVID-19 patient care in a new infectious disease hospital. This system allowed patients to request assistance directly from medical staff without face-to-face contact. Calls from patients were transmitted to their wearable smart devices (e.g., wristwatches or bracelets) and to the nursing station. All call data, along with actions taken, were collected in dedicated web-based applications, accessible to nurses, doctors, and hospital administrators. This project was built on an IoT network based on *LoRaWAN* technology [33].

During the COVID-19 pandemic, the deployment of TM applications was not uniformly supported by governments worldwide. For example, in Brazil, the Federal Medical Council considered TM practices—such as virtual consultations between patients and physicians—illegal, and in some US states, regulatory restrictions limited TM use. These obstacles conflicted with government efforts to promote TM development and utilization as a means of controlling the virus spread. In the United States, several federal regulations were relaxed to allow physicians to provide remote care more freely [63].

In the CIS, efforts to expand telemedicine have been ongoing since the signing of the "Agreement on the Creation of Compatible National Telemedicine Systems, Their Future Development, and Cooperation among CIS Member States" in Saint Petersburg on November 19, 2010. As part of this cooperation, a regional working group on telemedicine was established, and a memorandum titled "On Cooperation in Developing Compatible Telemedicine and Diagnostic Systems among CIS Countries" was drafted and signed in Chișinău in 2008, with participation from Azerbaijan.

In Azerbaijan, the "Decree of the President of the Republic of Azerbaijan" dated April 11, 2014, confirmed the agreement on "Establishment of Compatible National Telemedicine Systems, Their Future Development, and Cooperation among CIS Member States," and designated the responsible authorities for its implementation.

Kazakhstan's *National Telemedicine Network* was established under the auspices of the *Republican e-Health Center*, integrating 199 healthcare facilities, and has been operating successfully [34]. In Belarus, medical technologies, healthcare informatization, management, and the economy are supported by the *Unified Medical Electronic Consultation System and Electronic Prescription Systems, both managed under the Republican Scientific and Practical Center of Medical Technologies* [35].

In Ukraine, the development of telemedicine is monitored through various organizations, including the *Telemedicine Development and Electronic Health Association* (www.telemed.org.ua/pages/aruteoz/aruteoz.html), the **Ukrainian Telemedicine System** (www.telemed.org.ua), the *Ukrainian Association of Medical Informatics (http://uacm.kharkov.ua), and Meditech, the Western Ukraine Telemedicine Center* (www.meditech.com.ua), among others [66]. This list can be extended by considering the progress of telemedicine in other countries; however, given Russia's leading position in the field, it is particularly relevant to observe the development of telemedicine within Russia, especially in terms of government policies, efforts, and implementations.

In Russia, the application of telemedicine technologies for providing medical assistance is legislated by *Federal Law No. 323-FZ,* "On the Fundamentals of Protecting Citizens' Health in the Russian Federation," adopted on November 21, 2011 (Article 36.2, Part 1). According to this law, remote monitoring of a patient's health status is permitted following an in-person consultation with a healthcare professional. Adjustments to the initial treatment plan are only possible during face-to-face consultations based on diagnosis and prescribed treatment [37].

The law regulating telemedicine came into force in Russia in January 2018. By 2019, the telemedicine market volume reached approximately 20 billion rubles, representing an 8% increase over the previous year [38]. For mutual identification and authentication during remote interactions, the *Unified Identification and Authentication System* is employed via the portal [https://www.gosuslugi.ru/]. Typically, telemedical assistance is conducted through the *Unified State Information System (USIS),* which also maintains federal registries of healthcare professionals and medical institutions. Telemedicine services are rendered by healthcare workers registered in the

 doi:10.20944/preprints202508.1008.v1

federal registry, with assistance provided within the framework of the medical organizations' registry in USIS, provided that the healthcare professional is authorized to perform such services.

In response to the COVID-19 pandemic, amendments were made in March to the law *"On the Fundamentals of Protecting Citizens' Health in the Russian Federation"*. These amendments authorized the use of telemedicine technologies in emergency situations or when there is a threat of disease spread, permitting remote diagnosis and treatment without an in-person consultation [38,39].

In April, a *Telemedicine Center*was launched in Moscow to provide remote consultations for COVID-19 patients receiving home treatment. Patients prescribed treatment by a physician could register on the teleplatform after giving their written consent, enabling video communication with healthcare providers. The center operates 24/7, providing consultations, and arranges emergency calls and hospital transfers if the patient's condition deteriorates. During the pandemic, the center's capacity was designed to handle up to 4,000 consultations daily. By April 8, the report indicated that approximately 1,700 residents of Moscow had been treated at home via this platform for COVID-19.

The number of inquiries to other telemedicine services in Russia also increased several times during the pandemic, with some services offering free consultations. For instance, *DocDoc*, a telehealth service, reported that 35% of its COVID-19-related inquiries concerned the virus's transmission and preventive measures [40].

Various telemedicine platforms provided remote consultations across 12 major medical fields, including general practice, with services such as *"Doctor Ryadom"*, *"TeleDoctor 24"* (supported by top specialists around the clock), *"Zdorovye.ru"* (focused on identifying risk factors and psychoeducational courses), *"Online Doctor"* (offering professional advice for general practitioners and specialists), *MedAi*, *"Duktic"*, *and "TeleMed"*—all offering free access to medical advice related to COVID-19 during the pandemic.

Research into the development and expansion of telemedicine in Russia during the pandemic demonstrated that its advancement was essential. Forecasts indicated that, by 2022, the telemedicine market could grow from $12.1 billion to $55.1 billion, reflecting significant growth potential [40].

In Azerbaijan, the development of telemedicine and the expansion of online healthcare services during the COVID-19 pandemic form part of the strategic framework outlined in the *"National Strategy for the Development of the Information Society in Azerbaijan for 2014–2020"*. This strategy envisions creating a national healthcare network supporting reliable, high-speed broadband Internet access for all medical personnel and healthcare facilities, developing the *Electronic Health System (EHS),* broadening the application of medical information systems, and establishing open-access electronic medical resources.

Further steps include increasing digital literacy among healthcare workers, improving the efficiency of health protection, and adopting innovative, science-based technologies. The *"Decree of the President of Azerbaijan" on "Establishing Compatible National Telemedicine Systems, Their Future Development, and Cooperation among CIS Member States"*, signed on December 6, 2016, emphasizes that the primary goal is to provide high-quality, accessible medical assistance regardless of citizens' social or geographic status [41,42].

The "Strategic Roadmap for the Development of Telecommunications and Information Technologies in Azerbaijan", approved in 2016, highlights "the creation of an integrated, seamless electronic healthcare infrastructure" as a key priority. This infrastructure aims to unify health data, electronic registration, digital imaging, and electronic prescriptions, with particular focus on [43]:

- Monitoring disease progression over defined periods;
- Involving international experts for complex cases;
- Regular radiological examinations to reduce radiation exposure;
- Effective utilization of video recordings of diagnostic procedures using multifunctional equipment.

The Azerbaijani government's commitment to developing e-health and telemedicine is reflected in the ongoing pilot projects and systems aimed at addressing these issues and improving healthcare delivery.

 doi:10.20944/preprints202508.1008.v1

In February 2017, the Ministry of Health of the Republic of Azerbaijan launched a system enabling physicians from Baku to consult with colleagues and examine patients online without traveling to regional locations. This system facilitated remote consultations and examinations, allowing physicians from Baku to consult with specialists across the country virtually. Over the course of the year, 22 specialists from Baku conducted 369 examinations of 320 patients from various regions, accounting for approximately 30% of all emergency calls. This approach significantly reduced the Ministry's expenditure on emergency services.

In the first two months of 2018, 40% of calls from regional areas were handled through telemedicine. In another pilot project within Azerbaijan's telemedicine sector, video cameras installed in emergency vehicles transmitted footage of incidents to dispatch centers. These cameras broadcast real-time footage from the scene to dispatchers, who evaluate the situation and, if necessary, dispatch additional teams from nearby areas. This system is especially critical during mass accidents and emergencies.

In the framework of the State Agency for Mandatory Medical Insurance's pilot project on mandatory health insurance, a telemedicine service operating in four modes—"Telephone Consultation," "Video Consultation," "Written Consultation," and "Telehealth"—was launched in the Agdash region with support from *Sphera Health Care AZ* [45]. To access services such as "Video Consultation" and "Written Consultation," residents must download the *"eSphera" and "eSpheraVideoCall"* applications via App Store or Play Market and register. Through video calls, physicians can assess the patient's overall condition and provide initial medical advice regarding their health concerns.

Patients seeking detailed examinations at the Agdash Central Hospital can consult with highly qualified specialists from Baku via telehealth services. Using specialized digital devices, the examination results are uploaded directly to the physician's computer (including cardiologists, infectious disease specialists, phthisiologists, neurologists, dermatovenerologists, oncologists, pulmonologists, psychologists, endocrinologists) via dedicated software. The doctor analyzes this data, recommends necessary diagnostic tests, and provides initial medical decisions, treatment options, and advice.

To prevent the spread of COVID-19, the Cabinet of Ministers launched the *www.koronavirusinfo.az*portal for public information, awareness, and education. The portal provides interactive responses to citizens' questions [46].

Supported by the World Health Organization (WHO) initiative, the HeydarAliyev Foundation, the State Agency for Mandatory Medical Insurance, the *TƏBİB* (Operational Headquarters under the Cabinet of Ministers), and the Ministry of Health, the *REACT-C19* project was initiated to strengthen key capabilities in hospitals across Azerbaijan in response to COVID-19. The project involves launching an online platform for medical staff training, webinars, video tutorials from mentors, and statistical data sharing [47].

On June 20, the Operational Headquarters introduced the *"E-TƏBİB"* mobile application, which operates via Bluetooth connection. The app displays the user's health status with different colors: blue indicates no infection or contact with infected individuals; yellow indicates contact with an infected person; red indicates infection; and green confirms a negative test result [48].

The Ministry of Justice developed the *"Mobile Notary"* software to expand remote services for the public. This application enables citizens eligible for free or subsidized medication assistance—based on the Law of the Republic of Azerbaijan—to cooperate with the Ministry of Health and obtain medications remotely, around the clock, without leaving their homes, via real-time electronic power of attorney. The app is available for free download from the App Store and Play Market [49].

The Ministry of Health's *Public Health and Reforms Center developed the "Self-Check for COVID-19"* application with support from the United Nations Development Fund (UNDP). The app aims to assist individuals in deciding whether to seek medical help. It estimates the risk of COVID-19 infection, does not replace professional medical advice or clinical examinations, and is accessible via the *www.isim.az*website in the "Information about Coronavirus" section. After user consent, the app

 doi:10.20944/preprints202508.1008.v1

asks several questions to determine the appropriate level of care and provides recommendations based on the responses. The application is intended solely for residents of Azerbaijan [50].

Potential barriers to the widespread expansion of telemedicine are outlined in [18], which states that by late 2019, over 250 applications had been implemented across the world, including the CIS region, differing in terms of patient and medical staff interactions, the types of medical services provided, and data processing formats. The importance, advantages, and prospects of telemedicine networks are widely recognized; however, their implementation faces several challenges typical of many countries, including [1,18,51]:

- Lack of a unified regulatory framework governing the operation of telemedicine centers and the standards for telemedical consultations;
- Absence of a consistent approach to the organization, development, and technical planning of telemedicine networks;
- Improper use of information and communication equipment suited to specific climatic and operational conditions;
- Interruptionsininternetconnectivity.

Experience from countries with advanced telemedicine development shows that the COVID-19 pandemic has accelerated the practical application of telemedicine and highlighted a number of issues needing resolution. Making telemedicine accessible, reliable, and the first point of contact for individuals with health problems—especially during epidemics, pandemics, and other emergencies—requires addressing challenges such as [13,18,20,22,23,52]:

- Easing restrictions and reducing strict bans on telemedicine services imposed during development;
- Resolving issues related to health insurance coverage;
- Improving confidentiality, data storage, and security, and preventing cyberattacks targeting telemedical systems;
- Reducing high costs of telemedicine infrastructure in remote regions, and ensuring technical platforms meet rigorous standards;
- Providing broadband access to residents of rural and remote areas, and overcoming barriers to their utilization of telehealth services;
- Addressing the lack of knowledge and skills among the population and healthcare providers to effectively use new technologies and software;
- Ensuring acceptable quality of internet and video streaming to motivate healthcare professionals to actively participate in telemedicine services;
- Developing adaptable application structures, ensuring user-friendly access from personal computers, smartphones, and tablets, and integrating telemedicine mechanisms with existing clinical and information systems.

5. Conclusions

A brief review of the scientific literature on telemedicine (TM) demonstrates its significant practical importance and potential in improving the quality of healthcare services amid the COVID-19 pandemic. The pandemic has created opportunities for wider utilization of TM within e-health. The use of audio, video, and other technologies to provide prophylactic, diagnostic, and therapeutic services remotely allows patients to receive necessary assistance from healthcare professionals while maintaining social distancing—a critical requirement during the pandemic.

For patients infected with COVID-19 and under home quarantine (not in severe condition), TM innovations enable them to share health information without calling a doctor. Additionally, TM offers solutions for healthy individuals to reduce contact with others, undergo certain treatment procedures while in isolation, and maintain periodic contact with physicians.

International experience reveals that during COVID-19, many countries, despite economic downturns, allocated substantial financial resources to rapidly implement TM applications. They launched innovative initiatives to expand telehealth services during periods of social distancing and

 doi:10.20944/preprints202508.1008.v1

stay-at-home orders. All these efforts underscore the crucial role of TM in pandemic management, fostering the announcement of new guiding principles for telemedicine applications, which are increasingly being adopted by more countries.

The rapid growth of TM necessitates overcoming barriers hindering its development. The article identifies potential obstacles to the widespread deployment of telemedicine and the challenges that need solutions to position TM as a primary point of healthcare access for the population.

The development of e-health, including in CIS countries and Azerbaijan, confirms that TM is essential not only during epidemics but also as a fundamental aspect of future healthcare development. The analysis of new applications during COVID-19 indicates that expanding telemedicine is a priority for the future of medicine, and its broad implementation must be pursued.

In this context, as a continuation of the country's well-considered and consistent policies in combating COVID-19, urgent measures should be taken to expand TM applications. Strengthening the agile response of the national healthcare system during the pandemic requires increased focus on TM development, which should be included among the priorities of Azerbaijan's e-health agenda.

Funding: No external funding was received for this study.

Conflict of Interest: The authors declare no conflict of interest.

Acknowledgments: The authors thank the Ministry of Health of Azerbaijan and regional e-health initiatives for providing data access, and Azerbaijan Medical University.

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